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STANFORD UNIVERSITY BULLETINS

Stanford University Bulletin (USPS 518500) Published by the University
Series 31, No. 79, September, 1987
Stanford, California 94305-3005

STANFORD UNIVERSITY BULLETINS—Second-class postage paid at Palo Alto, California. Acceptance for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917. Authorized on August 23, 1918. Issued once a month in February, March, May, and October, and twice a month in August and September. POSTMASTER: Send address changes to Stanford University, Office of the Registrar, 141 Old Union, Stanford, CA 94305-3005.

COURSES AND DEGREES SEPTEMBER
SCHOOL OF LAW SEPTEMBER
SCHOOL OF MEDICINE OCTOBER
SUMMER SESSION FEBRUARY
INFORMATION MARCH
APPROACHING STANFORD I MAY
APPROACHING STANFORD II AUGUST
STANFORD TODAY AUGUST

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Stanford, California 94305-3005

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Telephone number, all University departments: Area code: (415) 723-2300
UNIVERSITY CALENDAR

AUTUMN QUARTER, 1987

Sep 28-29 (Mon-Tue) Sign class lists; last days to arrange payment of University fees
Sep 30 (Wed) Instruction begins
Oct 1 (Thu) Conferral of degrees - Summer Quarter
Nov 26-29 (Thurs-Sun) Thanksgiving recess (no classes)
Dec 1 (Tue) Last day for filing A.B., B.S., and B.A.S. applications for January (Autumn Quarter) conferral
11 (Fri) Last day for filing candidacy applications for Educational Specialist and Engineer for April (Winter Quarter) conferral
11 (Fri) Last day for filing graduate "Notice of Intention," University theses, D.M.A. final projects, and Ph.D. dissertations for January (Autumn Quarter) conferral
14-18 (Mon-Fri) End-Quarter examinations

WINTER QUARTER, 1988

Jan 4 (Mon) Sign class lists; last day to arrange payment of University fees
5 (Tue) Instruction begins
7 (Thu) Conferral of degrees - Autumn Quarter
18 (Mon) Observance of Martin Luther King Day (holiday, no classes)
29 (Fri) Last day for filing graduate "Notice of Intention" and candidacy application for June commencement diploma
Jan 29 (Fri) Last day for filing A.B., B.S., and B.A.S. applications for April (Winter Quarter) and June (Spring Quarter) conferral
Feb 15 (Mon) Observance of Presidents' Day (holiday, no classes)
Mar 6 (Sun) Observance of Founders' Day
Mar 11 (Fri) Last day for filing candidacy applications for Educational Specialist and Engineer for June (Spring Quarter) conferral
11 (Fri) Last day for filing graduate "Notice of Intention," University theses, D.M.A. final projects, and Ph.D. dissertations, for April (Winter Quarter) conferral
14-18 (Mon-Fri) End-Quarter examinations

SPRING QUARTER, 1988

Apr 15 (Fri) Last day for filing undergraduate scholarship applications for matriculated undergraduates
May 30 (Mon) Memorial Day (holiday, no classes)
June 1 (Wed) Last day for filing candidacy applications for Educational Specialist and Engineer for September (Summer Quarter) conferral
1 (Wed) Last day for filing graduate "Notice of Intention," University theses, D.M.A. final projects, and Ph.D. dissertations for June (Spring Quarter) conferral
3-8 (Fri-Wed) End-Quarter examinations
11 (Sat) Baccalaureate Saturday and Senior Class Day
12 (Sun) Commencement

SUMMER QUARTER, 1988

Jun 20 (Mon) Sign class lists; last day to arrange payment of University fees
21 (Tue) Instruction begins
July 4 (Mon) Independence Day (holiday, no classes)
Aug 11 (Thu) Last day for filing candidacy application for Educational Specialist and Engineer for January (Autumn Quarter) conferral
12-13 (Fri-Sat) Eight-week term examinations
13 (Sat) Eight-week term closes
Aug 30 (Tue) Quarter closes
Sep 15 (Tue) Last day for filing graduate “Notice of Intention,” University theses, D.M.A. final projects, and Ph.D. dissertations for October (Summer Quarter) degree conferral

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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 sixteenth 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 western link of the first 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 1986 totaled 13,556, of whom 6,572 were undergraduates and 6,984 were graduate students. Blacks, Hispanics, Puerto Ricans and Native Americans numbered 1,826 undergraduates and 404 at the graduate level. Stanford awarded 4,159 degrees in 1985-86, of which 1,649 were baccalaureate and 2,510 were advanced degrees.

Among the 1,327 faculty members who make up the Academic Council there are 9 Nobel laureates, 77 members of the National Academy of Sciences, 124 members of the American Academy of Arts and Sciences, 44 members of the National Academy of Engineering, 10 members of the National Academy of Education, 11 winners of the National Medal of Science, 22 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 Office of the Registrar, Old Union Lobby. 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 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 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 conferred upon candidates who fulfill these requirements in the Schools of Earth Sciences or Engineering, or in the Departments of Biological Sciences, Chemistry, Mathematics, Physics, or 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 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 coterminal 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 coterminal 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 coterminal bachelor's/master's program are (1) 180 units for the bachelor's degree plus 36 (or 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.

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 coterminal degree program are available in the Graduate Program Office, or the Undergraduate Advising Office. 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.

UNDERGRADUATE STUDY AT STANFORD

A Liberal Education

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, must 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 4 ways:

1. English 1-2, a two-quarter sequence of composition courses (Note: A few students who demonstrate sufficient skill in the first quarter 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, not units.

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 carry a minimum of three 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, 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 may select a major at any time and must do so by the time they achieve junior status (85 units completed). All undergraduate major programs listed in Courses and Degrees are open to all students except for certain honors degree programs which require application and admission in advance. Students may change their 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.

Students electing the Bachelor of Arts and Science (B.A.S.) degree must fulfill the requirements of one A.B. and one B.S. major without overlapping courses.

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 the student in assuming maximum responsibility for his or her academic program. 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 the academic interest which they have indicated. Each residence where freshmen live offers them the services of a group of advisors representing the major academic disciplines. While freshmen are assigned to one specific advisor, they have easy access to all members of the advising group. Each freshman advisor works with advisees each quarter to plan academic programs; the advisor must sign study list cards for each quarter of the student’s freshman year.

Sophomores who are undecided about their major continue to work with the advisor with whom they were associated as freshmen, and that advisor continues to discuss and sign the
student's study list. Sophomores whose advisor does not continue to advise 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.

The UAC, located on the first floor of Sweet Hall, is where 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, there must be 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 any 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 procedures for obtaining advanced degrees, calculations of residency, and requirements for multiple degrees are available from the Graduate Program Office, Building 590, Room 104.

REGISTRATION REQUIREMENTS

Graduate students are expected to register at full tuition unless they fall into one of the following categories: graduate students with research and teaching assistantships, Stanford staff members, full-time teachers in the Bay Area, and Honors Cooperative students. Residency credit accrues more slowly for the number of units taken when students are registered for partial tuition (e.g. 11 or more units per quarter in the academic year = 1 quarter of residency; 9 units = .62 quarters of residency).

Graduate students are also eligible for one of the following registration categories to complete degree requirements:

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 3 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.

TGR students in all degree programs will enroll in a special TGR course in their department. The instructor for the course is the student's advisor, who will evaluate work on the thesis, departmental project, or dissertation as follows: N for satisfactory progress, N- for unsatisfactory progress. The Graduate Division will place a hold on the registration of a student who receives two consecutive N- grades.

A one quarter TGR authorization is available to graduate students who have completed all degree requirements, are return-
ing after a leave of absence or reinstatement, and who must register 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 Registration Requirement—Graduate students who have only a few remaining units to complete degree requirements or to qualify for AGP 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.

CONTINUOUS REGISTRATION

Graduate students must enroll for at least three quarters of every academic year until the degree is conferred. Registration is required for the quarter in which a student fulfills a University examination or departmental requirement or files an application for Admission to Candidacy. Students must be registered for the concurrent or immediately preceding quarter in which a degree is conferred and in which a thesis, dissertation, or Notice of Intention to Complete Advanced Degree Requirements is submitted to the Graduate Program Office.

Students who wish to interrupt their registration may request, in advance of departure, a leave of absence for up to one year that must be approved by the department and the graduate division. Students who wish to return to the University following an unauthorized leave must submit an Application for Reinstatement in Graduate Division (available from the Graduate Admissions Office). The department will review the Application for Reinstatement and previous academic history to determine whether readmission is recommended.

IN ABSENTIA REGISTRATION

Graduate students at Stanford are expected to do coursework and research on campus unless the department gives prior approval for study in absentia for one or more quarters. Students who wish to register while in absentia must sign the Registration Commitment (RC) form and have a current mailing address on file with the Registrar’s Office while away from campus. Students with fellowships must file a Petition for Receipt of Fellowship While In Absentia form with the Graduate Awards Office to receive their stipend checks by mail.

SATISFACTORY PROGRESS

Timetables for completion of degree requirements are established by departments and schools. The department chair or school dean is responsible for informing students of their failure to make satisfactory progress. Failure to correct deficiencies in a timely manner may be cause for dismissal. Guidelines for Dismissal of Graduate Students for Academic Reasons, approved by the Senate of the Academic Council in 1982, are described in the Information Bulletin.

CANDIDACY

Candidacy is required for the Ed.S., Engineer, D.M.A., Ed.D., and Ph.D. degrees. Candidacy for the A.M., M.S., M.A.T., and M.F.A. degrees was discontinued by the Faculty Senate on May 15, 1986, effective Autumn Quarter, 1986-87. Candidacy is approval of a student’s proposed program of study and acknowledgement of the student’s potential to complete successfully the requirements for the degree. Registration is required in the quarter in which students qualify for candidacy. Students who satisfy departmental requirements for obtaining candidacy submit an Application for Admission to Candidacy to the Graduate Program Office. Final admission to candidacy is granted by the Committee on Graduate Studies of the Senate of the Academic Council.

Candidacy is valid for five years from the date of graduate division approval unless a student is terminated for unsatisfactory progress. Students whose candidacy expires before completion of degree requirements must submit an Extension of Candidacy form. Renewal or extension of candidacy requires departmental and graduate division approval.

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 the Registrar’s Office or offices in the Graduate Administrative Center, must be submitted to the Associate Dean of Graduate Studies, Graduate Awards Office, 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 degree of Master of Arts (A.M.) and Master of Science (M.S.) is conferred on students who have satisfactorily completed at least three full-tuition quarters of residency as a graduate student in the University and 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 3 full-time 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 3 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 and 45 units of coursework at Stanford beyond a master's degree (or its equivalent). Field based projects are also required.

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 described in the "Art Department" section of this bulletin.

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 requirement 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 45 units of coursework at Stanford beyond a master's degree (or its equivalent). Field based projects are 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 satisfactorily completed six full-tuition quarters of residency as a graduate student (of which a minimum of three quarters and 36 quarter 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.

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

MASTER OF JURISPRUDENCE

The Master of Jurisprudence (J.M.) is a nonprofessional degree. Its requirements include successful completion of the first year of law school plus an additional academic year of full-time law study. The J.M. degree terminates a course of study at the Law School. Candidates may elect to take the degree in the early spring of their second year.

Holders of the J.M. degree who at a later date wish to apply for admission to complete the J.D. program may do so, but readmission is not automatic.

DOCTOR OF EDUCATION

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the Committee on Graduate Studies, the degree of Doctor of Education (Ed.D.) is conferred on candidates who have satisfied the academic requirements of the School of Education and the University residency requirement (see Doctor of Philosophy General Regulations).

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 full-tuition registration and graduate work is required of each candidate. A final project appropriate to the area of concentration is also required.

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 on 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
collection to knowledge. Such work and dis-
sertation shall conform to the rules of the Uni-
versity and the School of Law.

Candidacy is limited to students of excep-
tional 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 curricu-
lum 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 at-
tainment 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 satis-
factorily complete a three year program of study
and 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 must be taken with each of four Stanford
faculty members. A three year doctoral pro-
gram may include a master's or Engineer de-
gree. However, the minimum requirement for
a doctoral degree taken after another Stanford
advanced degree is 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 pro-
gram 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 grad-
uate 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 require-
ments 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 Can-
didacy specifies a departmentally approved
three year program of study to fulfill degree
requirements. If the program includes a minor,
approval by that department is also required.
Applications for Candidacy are reviewed by the
Graduate Program Office and then submitted to
the Committee on Graduate Studies for ap-
proval. Doctoral students are expected to com-
plete their degree requirements in a timely
manner. Therefore, candidacy is valid for five
years unless terminated by the department for
unsatisfactory progress. Extensions of candi-
dacy must be approved by the department and
the graduate division.

TEACHING REQUIREMENTS

A number of departments require their stu-
dents to teach for one to three quarters during
their doctoral program. Detailed information is
included in the departmental sections of this
bulletin.

FOREIGN LANGUAGE REQUIREMENT

Some departments require doctoral candi-
dates 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.

UNIVERSITY ORAL EXAMINATION

A University oral examination is a require-
ment of the Ph.D. program. The purpose of
the examination is to test the candidate's com-
mmand of the field of study and to confirm
fitness for scholarly pursuits. Departments
determine when during the doctoral program
the oral examination is taken. It may be a test
of knowledge of the field, a review of a disser-
tation proposal, or a defense of the disser-
tation.

The chair of the oral examination committee
is appointed by the Dean of Graduate Studies
through the Graduate Program Office. The
chair must not be from the student's depart-
ment or any department represented by a com-
mittee member. The oral examination commit-
tee is composed of at least four Stanford faculty
members representing the major and minor
departments. An examining committee may
include a member who is not on the Academic
The University Oral Examination Schedule must be submitted to the Graduate Program Office at least three weeks prior to the proposed examination date. The examination will not be held during the first two weeks or after the last day of classes of any quarter. It cannot exceed three hours.

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

Doctoral candidates must write a dissertation that demonstrates a capacity for independent advanced research that is satisfactory to their school or department. The dissertation is approved for the school or department by a reading committee consisting of the candidate's advisor and two other faculty members. The reading committee is endorsed by the chair of the major department on the Ph.D. Dissertation Reading Committee form which is submitted to the Graduate Program Office well in advance of completion of the dissertation. Each member of the reading committee signs the signature page of the final copy of the dissertation when they are ready to certify that the work is of acceptable scope and quality. One member of the committee will read the dissertation in its final submitted form and certify on the Certificate of Final Reading of the Dissertation that all requirements imposed by the reading committee have been met.

Dissertations must be in English. Exceptions require approval of the Graduate Dean prior to commencement of the work. They are granted only when the department can present in writing a convincing argument that circumstances in an individual case make it advisable for the dissertation to be written in a foreign language. The abstract of the dissertation must always be written in English. Furthermore, when permission has been granted for the particular dissertation to be written in a foreign language, an extended summary of the dissertation, written in English, roughly the length of a chapter, must also be filed with the dissertation and abstract to make the substance of the dissertation available to the intellectual community at large.

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. Some schools and departments do not permit nonmatriculated students to enroll in courses. Some programs also require full-time registration if nonmatriculated students are to take any courses. Details can be obtained from the Graduate Admissions Office. This status is granted for the current academic year only. Any extension of enrollment privileges into the next academic year requires approval in writing from the Graduate Admissions Office. Should a nonmatriculated student later apply for matriculated status, the normal application requirements must be completed at that time. Nonmatriculated students should not anticipate any special priority for admission to a degree program because of work completed in nonmatriculated status.

No more than one full tuition quarter of nonmatriculated study at Stanford may be counted toward completion of the residency requirement for the Master's Degree. No more than two full tuition quarters (or the equivalent) of nonmatriculated study at Stanford may be applied toward completion of the residency requirements for the Engineer or Ph.D. degrees.
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 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.
The Graduate School of Business, since its founding in 1925, has provided graduate education for careers in management, research, and teaching.

The two-year Master of Business Administration degree program is designed for the student who seeks preparation for a professional career in management. No specific undergraduate major or courses are required for admission, although prospective applicants are encouraged to include one year of college level mathematics in their undergraduate programs. Possible options within the M.B.A. Program are specialties in Health Services Management and in Public Management, as well as programs leading to the joint J.D./M.B.A. degrees, and to the M.B.A. degree and Doctorate in Educational Administration.

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

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

For detailed information on programs, curricula and faculty write to the Graduate School of Business, Stanford University, Stanford, California 94305 for the current bulletin.
The aims of the school are: (1) to prepare students for careers in the fields of geology, paleontology, geochemistry, geophysics, petroleum geology, petroleum engineering, geomechanics and engineering geology, hydrology, petroleum exploration, and environmental studies; (2) to conduct research in the earth sciences; and (3) to provide opportunities for Stanford undergraduates to learn about our planet’s history, to understand the natural resource base that underlies our economy, and to appreciate the geological and geophysical factors that contribute to the quality of our environment.

To accomplish these objectives the school offers a variety of programs adaptable to the needs of the individual student: a four-year undergraduate program leading to the degree of Bachelor of Science; a five-year program leading to the coterminal Bachelor of Science and Master of Science degrees in the social sciences, physical sciences, or engineering; a coterminal master’s degree in one of the Earth Sciences; and a graduate program offering the degrees of 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 help gain entry into the chosen career. The curriculum is quite broad, and aside from essential basic courses, the selection of individual courses is left to the student and the advisor. 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. Students are encouraged to discuss the coterminal program with their advisors during their junior year. Petitions for admission to the program are available in the Graduate Program Office and additional information is available in the individual departmental offices.

GRADUATE PROGRAM

Admission to the Graduate Program—A student who wishes to enroll for graduate work in the school must be qualified for graduate standing in the University and in addition must be accepted by the School of Earth Sciences. One requirement for admission is submittal of scores on the verbal and quantitative parts of the Graduate Record Exam. Admission to one department of the school does not guarantee admission to other departments.

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

Financial Aid—Scholarships, fellowships, and research grants are available to students in the School of Earth Sciences. Detailed informa-
tion 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*, Stephan A. Graham*
Affiliated Faculty: James O. Leckie** (Professor), John Bredehoef t, Steve Gorelick, 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
- Environmental Earth Sciences Management
- Land Resources Planning

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

- Applied Hydrogeology
- Geologic Remote Sensing
- Geomathematics in Petroleum Exploration and Resource Analysis
- Geomechanics
- Geostatistics for Natural Resources Evaluation
- Low Temperature Aqueous Geochemistry
- Ore Deposits and Exploration
- Petroleum Geology
- Special Applied Earth Sciences Program

Programs leading to the B.S., M.S., and Ph.D. degrees are available with the "special field" designation of the program on the 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. At the graduate level, the department welcomes applicants from any scientific or engineering discipline who are interested in using their training in Applied Earth Sciences.

UNDERGRADUATE PROGRAMS

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

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 190</td>
<td>Fundamentals of Geostatistics</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 192</td>
<td>Computing in Geology</td>
<td>W 3</td>
</tr>
<tr>
<td>A.E.S. 193</td>
<td>Introduction to Probability and Statistics</td>
<td>W 3</td>
</tr>
<tr>
<td>Math. 41, 42, 43</td>
<td>Calculus and Analytic Geometry</td>
<td>A,W,S 15</td>
</tr>
<tr>
<td>Op. Res. 50, 150, 152; A.E.S. 136 or Engr. Econ. Syst. 105</td>
<td></td>
<td>3</td>
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<tr>
<td>Total</td>
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</table>

Business and Economics

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
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<tbody>
<tr>
<td>Econ. 1</td>
<td>Elementary Economics</td>
<td>A,W,S 5</td>
</tr>
<tr>
<td>Engr. 60</td>
<td>Engineering Economics</td>
<td>A,W,S 3</td>
</tr>
<tr>
<td>Indust. Engr. 133</td>
<td>Industrial Accounting</td>
<td>A,S 3</td>
</tr>
<tr>
<td>Total</td>
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Chemistry and Earth Sciences

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31</td>
<td>Chemical Principles</td>
<td>A,W 4</td>
</tr>
<tr>
<td>Geol. 1</td>
<td>Interpreting the Earth</td>
<td>A,W,S 5</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>Sum 3</td>
</tr>
<tr>
<td>Geol. 110A</td>
<td>Structural Geology</td>
<td>W 3</td>
</tr>
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</table>

Earth Resources

<table>
<thead>
<tr>
<th>Course No.</th>
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<th>Qtr. &amp; Units</th>
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</thead>
<tbody>
<tr>
<td>A.E.S. 1</td>
<td>Introduction to Earth Sciences</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>Total</td>
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</table>

EARTH SCIENCES COMMODITIES

<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>
</tbody>
</table>
Course No. | Subject | Qtr. & Units
--- | --- | ---
Civ. Engr. 130. Introduction to Urban Planning | | W 3
Urban Studies 170. Introduction to Urban Design | | W 5
Total | | 26

Mineral Resources
A.E.S. 120. Introduction to Mineral Deposits | A 4
A.E.S. 124. Mineral Processing and Metal Extraction | A 2
Chem. 33. Structure and Reactivity or Chem. 135. Physical Chemical Principles | W,S 3-4
Geol. 170. Introduction to the Chemistry of the Earth | A 4
Total | | 13-14

Oil and Gas
A.E.S. 231. Oil Field Exploration and Development | S 3
A.E.S. 232. 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
A.E.S. 298. Decision Analysis in Petroleum Exploration | S 3
Geol. 151. Introduction to Sedimentary Facies | W 3
Geophys. 180. Geologic Interpretation of Reflection Seismograms | W 3
Total | | 23

Water
A.E.S. 127. Introduction to Groundwater Geochemistry | W 3
A.E.S. 135. Soil Science | A 4
A.E.S. 230. Hydrogeology | W 5
A.E.S. 258. Role of Fluids in Geologic Processes | W 2
Civ. Engr. 160. Water-Resources Engineering | A 4
Engr. 21. Mechanics of Fluids | A,S 4
Total | | 28

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

COMMON ENVIRONMENTAL CORE
Course No. | Subject | Qtr. & Units
--- | --- | ---
A.E.S. 1. Introduction to Earth Resources | S 3
A.E.S. 130, 131, 132. Environmental Earth Sciences | A, W, S, 15
A.E.S. 133. Measurement of the Environment-Remote Sensing | S 3

APPLIED EARTH SCIENCES
A.E.S. 192. Computing in Geology | W 3
A.E.S. 193. Introduction to Probability and Statistics in Geology | W 3
Chem. 31. Chemical Principles | A, W 4
Geol. 1. Interpreting the Earth | A, W, S, Sum 5
Geol. 80. Rocks and Minerals | S 5
Geol. 102. Introduction to Field Geology | Sum 3
Math 19, 20. Analytic Geometry and Calculus or Math. 41 | 6
Environmental Core Subtotal | | 50

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.

Course No. | Subject | Qtr. & Units
--- | --- | ---
Common Environmental Core | | 50
Geol. 110A. Structural Geology | W 3
One course from the following:
Geol. 2, Geol. 119, Geol. 150 or A.E.S. 135 | 3
Chem. 135. Physical Chemical Principles | S, W 3
Civ. Engr. 170. Environmental Science and Technology or
Civ. Engr. 171. Environmental Planning | A 3
Civ. Engr. 270. Movement, Fate, and Effects of Contaminants in Natural Waters | W 3
Math. 21, 22, 23. Analytic Geometry and Calculus or Math. 42, 43 | 9
(Students intending to enter graduate programs in science and engineering should substitute 2 courses from Phys. 51 series)
Urban Studies 131. Managing Local Government | W 4
Urban Studies 170. Introduction to Urban Design | W 5
Total | | 91

ENVIRONMENTAL EARTH SCIENCES MANAGEMENT
The Environmental Earth Sciences Management Program provides an understanding of environmental earth sciences as well as the tools for optimal environmental management. These tools are equally useful for management of earth sciences businesses, and institutions.

Course No. | Subject | Qtr. & Units
--- | --- | ---
Common Environmental Core | | 50
A.E.S. 136. Environmental Earth Sciences Management | S 3
A.E.S. 145. Mineral Economics | S 3
A.E.S. 251. Oil Field Exploration and Development or an alternate course in probability and statistics, to be discussed by advisor | S 3
A.E.S. 290. Geostatistics for Exploration and Development | W 5
### Course No. Subject Qtr. & Units

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 298</td>
<td>Decision Analysis in Petroleum Exploration</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Civ. Engr. 270</td>
<td>Movement, Fate, and Effects of Contaminants in Natural Waters</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 1. Elementary Economics</td>
<td></td>
<td>A, W, S</td>
<td>5</td>
</tr>
<tr>
<td>Engr. 60. Engineering Economics</td>
<td></td>
<td>A, W, S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 110A</td>
<td>Structural Geology</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Indust. Engr. 133</td>
<td>Industrial Accounting</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Math. 21, 22, 23</td>
<td>Analytic Geometry and Calculus or Math. 42, 43</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
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<td>99</td>
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</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.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Environmental Core</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>A.E.S. 145.</td>
<td>Mineral Economics</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 2. Earth History</td>
<td></td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 119. Geoarchaeology: The Evolution of Landscape and Civilization in the Aegean</td>
<td>S</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 150. The Oceans: An Introduction to the Marine Environment</td>
<td>W</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>One Course From:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anthro. 146.</td>
<td>Urban Problems in Anthropological Perspective</td>
<td>W</td>
<td>5</td>
</tr>
<tr>
<td>Soc. 150. Urban Sociology</td>
<td></td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>One Course From:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art 3. Introduction to the History of Architecture</td>
<td>S</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Art 175A.B. Modern Architecture I or II</td>
<td>W, S</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Art 176. American Architecture and Urbanism</td>
<td>W</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Civ. Engr. 130.</td>
<td>Introduction to Urban Planning</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Civ. Engr. 170.</td>
<td>Environmental Science and Technology</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Civ. Engr. 171.</td>
<td>Environmental Planning</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Econ. 1. Elementary Economics</td>
<td></td>
<td>A, W, S</td>
<td>5</td>
</tr>
<tr>
<td>Urban Studies 170.</td>
<td>Introduction to Urban Design</td>
<td>W</td>
<td>5</td>
</tr>
<tr>
<td>Urban Studies 131.</td>
<td>Managing Local Government</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>94</td>
</tr>
</tbody>
</table>

### 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 I
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

Course No. Subject Units
3-4 units: 1 course from:
A.E.S. 120. Introduction to Mineral Deposits 3-4
Geol. 110A.B. Structural Geology 3 each
Geophys. 180. Geologic Interpretation of Reflection Seismograms 3
Geophys. 190. General Geophysics 4
3 units: 1 course from:
Math. 103. Matrix Theory and its Applications 3
Math. 130. Ordinary Differential Equations 3
6-7 units: 2 courses from:
A.E.S. 190. Fundamentals of Geostatistics 3
A.E.S. 192. Computing in Geology II 3
A.E.S. 193. Introduction to Probability and Statistics in Earth Sciences 3-4
3-5 units: 1 course from:
A.E.S. 280. Rock Mechanics and Advanced Structural Geology 4
A.E.S. 291. Practice of Geostatistics on Simulated Deposits 3-5
A.E.S. 298. Decision Analysis in Petroleum Exploration 3
Civ. Engr. 201. The Creation and Solution of Environmental Models 3
Engr. 62. Introduction to Operations Research I 4
Engr. Eco. Syst. 208. The Art of Mathematical Modeling 3
18-24 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.

Course No. Subject Qtr & Units
A.E.S. 127. Introduction to Groundwater Geochemistry 3
A.E.S. 135. Soil Science alt. A 4
A.E.S. 193. Introduction to Probability and Statistics 3
A.E.S. 230. Hydrogeology 5
A.E.S. 255. Introduction to Solute Transport alt. A 2
A.E.S. 258. Role of Fluids in Geologic Processes 2
Civ. Engr. 160. Water Resources Engineering 4
Civ. Engr. 270. Movement, Fate, and Effects of Contaminants in Natural Waters 3
Civ. Engr. 361. Soil Moisture and Groundwater 4
Total ................................................. 37

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

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:
Course No. Subject Qtr & Units
A.E.S. 192. Computing in Geology W 3
A.E.S. 193. Introduction to Probability and Statistics 3
A.E.S. 280. Rock Mechanics and Advanced Structural Geology A 4
Geol. 110A. Structural Geology 3
Math. 103. Matrix Theory A,W,S 3
Total ................................................. 23-24
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. 296</td>
<td>Photogeology and Radar</td>
<td>alt. A 3-4</td>
</tr>
<tr>
<td>A.E.S. 297</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>
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OPTIONAL

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<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. Eco. Syst. 234. Artificial Intelligence for Decision Analysis</td>
<td>A 4</td>
</tr>
<tr>
<td>Math. 130. Differential Equations</td>
<td>A,W,S 3</td>
</tr>
<tr>
<td>Total</td>
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</tr>
</tbody>
</table>

GEOMETAMATHEMATICS IN PETROLEUM EXPLORATION AND 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 simulation 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.

<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 Geology</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>A.E.S. 292</td>
<td>Computing in Geology II: Simulation of Geologic Processes in Sedimentary Basins</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 298</td>
<td>Decision Analysis in Petroleum Exploration</td>
<td>S 3</td>
</tr>
<tr>
<td>Geophys. 180</td>
<td>Geologic Interpretations of Reflection Seismograms</td>
<td>W 3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

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 geology, geophysics, fluid mechanics, well-log analysis, petroleum reservoir analysis, statistics, geostatistics, computer science, decision analysis, operations research, and engineering-economic systems. 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 microcracks, 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 EVALUATION

All applicants to this program are expected to have an undergraduate background in Earth Sciences (Geology, Mining, Geophysics). The program is open to B.S. students in Math./Statistics provided that they make up for their Geology deficiency (Geol. 1-80).

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. 290</td>
<td>Geostatistics for Exploration and Development</td>
<td>W 5</td>
</tr>
<tr>
<td>A.E.S. 291</td>
<td>Practice of Geostatistics on Exhaustive Data Bases</td>
<td>W,S 5</td>
</tr>
<tr>
<td>A.E.S. 293</td>
<td>Topics in Advanced Geostatistics</td>
<td>A 3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>
OTHER RECOMMENDED COURSES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Sci. 135</td>
<td>Numerical Methods</td>
<td>W 3</td>
</tr>
<tr>
<td>Engr. 62</td>
<td>Introduction to Operations</td>
<td>Research A,W 4</td>
</tr>
<tr>
<td>Engr. 102W</td>
<td>Technical and Professional Writing</td>
<td>A,W,S 3</td>
</tr>
<tr>
<td>Stat. 201A,B</td>
<td>Data Analysis I-II</td>
<td>W,S 3-5</td>
</tr>
<tr>
<td>Total</td>
<td>13-15</td>
<td></td>
</tr>
</tbody>
</table>

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 geological or hydrogeological perspective. The Environmental Engineering Program in Civil Engineering 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 (Civil Engineering).

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 influence of surface energy on the thermodynamic and fracture properties of silicas, the atomic-scale structure and composition of both aqueous and adsorption complexes of transition metals and uranium, and computer algorithms for simulating the synergistic effects of inorganic water chemistry on adsorption and mobility of organic solutes in groundwaters.

ORE DEPOSITS AND EXPLORATION

This program is flexible, and students who wish to make substitutions for core require-ments 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>
<tr>
<td>Geol. 275</td>
<td>Solution-Mineral Equilibria</td>
<td>W 2-4</td>
</tr>
<tr>
<td>Geophys. 191</td>
<td>Geophysical Field Techniques</td>
<td>A 3</td>
</tr>
<tr>
<td>Total</td>
<td>13-15</td>
<td></td>
</tr>
</tbody>
</table>

SPECIALIZATION ELECTIVES

Choose at least 3 courses:

A.E.S. 224. Low Temperature Aqueous Geochemistry A 3
A.E.S. 252. Sedimentary Basins A 3
A.E.S. 258. Role of Fluids in Geologic Processes W 2
Geol. 185. Volcanology S 3
Geol. 186. Chemistry of Melts and Magma Systems S 4
Geol. 261. Rock Forming Minerals W 4

Total 19

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:

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

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.
REQUIRED COURSES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 251</td>
<td>Oil Field Exploration and Development</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 252</td>
<td>Sedimentary Basins</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 253</td>
<td>Petroleum Geology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 150A</td>
<td>Well Log Analysis I</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Pet. Engr. 150B</td>
<td>Well Log Analysis II</td>
<td>W</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 218</td>
<td>Seminar in Sedimentary Geology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 251</td>
<td>Continental Margins</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 254</td>
<td>Sedimentary Facies</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 278</td>
<td>Organic Geochemistry</td>
<td>W</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

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)

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).

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.

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.

127. Introduction to Groundwater Geochemistry—Compositions of natural waters and an introduction to chemical principles governing the compositional evolution of natural groundwaters and the fate of contaminants. Prerequisites: Chemistry 31, Math 41, Geology 80.

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)

131. Environmental Earth Sciences II—Topics: geologic constraints to development, stream and air pollution, environmental systems analysis, responses to landslides, environmental impact studies, general plan preparation, climatic water balance. Laboratories include computer storage of environmental data, optimization of planning decisions, use of multiple maps in regional planning, and stream pollution. Prerequisite: 130 or consent of instructor.

132. Environmental Earth Sciences III—(See course sequence description under 130, 131.) 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.

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.

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.

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

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


3 units, Aut (Journel) TTh 11

192. Computing in Geology I—Introduction to computing with stress on geological applications. Topics: FORTRAN programming, file handling, matrix algebra, surface fitting, contour mapping, numerical analysis, and simulation of dynamic systems. Wide variety of applications including petroleum geology, ore deposits, hydrology, and geomorphology.

3 units, Win (Harbaugh) MWF 10


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 designed to integrate field, theoretical, and laboratory 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, Spr (Lyon) TTh 1:15

plus lab 2:15-4:05

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. Pre-
requisites: Geology 110, 151. Recommended: Geology 154.
3 units, Aut (Graham) TTh 2:15-3:05

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

255. Introduction to 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: Freshman chemistry, and Geology 232 or Civil Engineering 201.
2 units, Aut (Rubin) Th 3:15-5:05 alternate years, given 1988-89

258. Role of Fluids in Geologic Processes—Principles which govern a number of 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; and transport of heat by groundwater. Prerequisites: Elementary calculus.
2 units, Win (Bredehoeft) Th 3:15

259. Seminar: Ground-Water Investigations—A ground-water investigation and analysis of an undeveloped ground water basin. Objective is to structure an investigation leading to description and analysis of the system. Each participant "bids the job" as if he or she is a consultant, designing a cost effective investigation to provide data to understand the system and design an optimal development.
2 units, Spr (Bredehoeft) by arrangement

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 will prepare the maps and produce a report suitable for presentation to management or for publication. Prerequisite: 120.
3 units, Spr vacation (Einaudi) register Spring Qtr.

280. Rock Mechanics and Advanced Structural Geology—Advanced concepts and theories of rock deformation with application to rock mechanics, structural geology, and tectonophysics. Methods of stress analysis. The governing equations of elastic plate theory are derived and applied to crustal flexure, multilayer bending, buckling, and viscoelastic flexure of rock. The governing equations of two-dimensional elastic theory are derived and applied to tectonic loading and mechanisms of stress concentration. Prerequisites: Elementary calculus, mechanics, and structural geology.
4 units, Aut (Pollard) MWF 10 alternate years, given 1988-89

281. Rock Physics—(Enroll in Geophysics 262.)

4 units, Spr (Pollard) MWF 10 alternate years, given 1988-89

283. Tectonophysics—(Enroll in Geophysics 290.)

5 units, Win (Journel) TTh 10-12 F 9

291B,C. Practice of Geostatistics on Exhaustive Data Bases—Based on a numerical model of a deposit/reservoir. Teams of students receive a budget for drillholes and the same geological information. The deposit is studied through maps, variograms, kriging. Economic feasibility is performed from the estimates of recoverable reserves. All results are checked against underlying reality. Prerequisites: 190 or 290. Fortran programming.
3-5 units, Win, Spr (Journel) TTh 9-11

292. Computing in Geology II—Focuses on utilization of detailed, three-dimensional dynamic computer models that simulate geolog-
 touted processes including erosion, transportation and deposition of elastic sediment, compaction, fluid migration, isostatic response of the crust, and progressive deformation by folding and faulting. Stress on interactive graphic display, using high resolution color facilities. Prerequisite: Previous programming experience.

3-5 units, Spr (Harbaugh) by arrangement

293A,C. Topics in Advanced Geostatistics—Topics from conditional expectations and non-linear kriging as projections in Hilbert spaces; parametric vs. non-parametric estimation of spatial distributions; conditional simulations of deposits and reservoirs. May be repeated for credit. Prerequisites: 290, advanced calculus.

3 units, Aut, Spr (Journel) 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) F 12-2

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 are evaluated. Includes laboratory analysis of imagery (satellite and aircraft) designed to extract the maximum of structural information from an area. Field analysis. Prerequisite: 133/233. A photogeologic course is essential. Term paper for 4 units.

3-4 units, Aut (Lyon) TTh 1:15 lab TTh 2:15-4:05 alternate years, not given 1988-89


3 units, Spr (Harbaugh) MTW 11

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

any quarter (Staff) by arrangement


any quarter (Staff) by arrangement

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 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 and current research in geostatistics. Topics selected on basis of interest and timeliness. May be repeated for credit.
1 unit, Aut, Win, Spr (Journel) by arrangement

Chairman: Gordon E. Brown, Jr.
Associate Chairman: Juhn G. Liou


Associate Professors: Simon Brassell, Stephan A. Graham**, Gail A. Mahood, Elizabeth L. Miller

Assistant Professors: Dennis K. Bird, Jonathan F. Stebbins

Acting Assistant Professor: Michael F. Hochella, Jr.

Consulting Professors: H. Edward Clifton, Gerard J. Demaison, Keith A. Kvenvolden, James O'Neil

Consulting Associate Professors: N. Timothy Hall, Joseph W. Ruetz

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

The program leading to the degree of Bachelor of Science in Geology provides a high degree of flexibility for each individual student because the required 37 units of chemistry, physics, and mathematics plus 75-78 units of geology leave ample room to satisfy University general requirements (distribution and language) and explore other subjects as well. The required courses for a student majoring in geology can be grouped into three categories: (1) courses offered within the Departments of Geology, Geophysics, and Applied Earth Sciences; (2) courses in chemistry, physics, and mathematics that are essential to the geology curriculum but are taught in departments other than the Department of Geology; and (3) the University’s requirements pertaining to courses in subjects other than science.

CORE COURSE SEQUENCE

The geology courses that are required from 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>Sophomore Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geol. 1. Interpreting the Earth</td>
<td>A,W,S,Su</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 2. Earth History</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 3. Earth History Lab</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Geol. 80. Rocks and Minerals</td>
<td>S</td>
<td>5</td>
</tr>
<tr>
<td>Geol. 102. Introduction to Field Geology</td>
<td>Su</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>17</strong></td>
</tr>
<tr>
<td>Junior Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geol. 100. Undergraduate Seminar (3 quarters @ 1 unit/qtr.)</td>
<td>A,W,S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 103. Advanced Field Geology</td>
<td>Sum</td>
<td>12</td>
</tr>
<tr>
<td>Geol. 110A. Structural Geology I</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 110B. Structural Geology II</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 151. Sedimentary Geology and Petrography</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 161. Crystal Chemistry, Mineralogy, and Mineral Optics</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>Geol. 170. Chemistry of the Earth</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>34</strong></td>
</tr>
<tr>
<td>Senior Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geol. 152. Stratigraphic Geology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 181. Igneous Petrology and Petrography or Geol. 182. Metamorphic Petrology, and Petrography</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 193. Introduction to Probability and Statistics in Earth Sciences</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 199. Senior Research Project</td>
<td>A,W,S</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

ELECTIVE COURSES

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>
<tr>
<td><strong>Total Required Elective Units</strong></td>
<td></td>
<td><strong>6-9</strong></td>
</tr>
<tr>
<td><strong>Total units required for the B.S. Degree in geology</strong></td>
<td></td>
<td><strong>112-115</strong></td>
</tr>
<tr>
<td><strong>Total Distribution, Language, Writing Requirements, Electives</strong></td>
<td></td>
<td><strong>65-68</strong></td>
</tr>
<tr>
<td><strong>Total Units Required for the B.S. Degree Program in Geology</strong></td>
<td></td>
<td><strong>180</strong></td>
</tr>
<tr>
<td><strong>Total Required Units in Geology Curriculum</strong></td>
<td></td>
<td><strong>75-78</strong></td>
</tr>
</tbody>
</table>
REQUIRED COURSES IN SUPPORTING SCIENCES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31</td>
<td>Chemical Principles</td>
<td>A,W</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 171</td>
<td>Physical Chemistry (may be replaced by Geol. 171.)</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Math 41, 42, 43, 44</td>
<td>Calculus and Analytical Geometry</td>
<td>A,W,S</td>
<td>18</td>
</tr>
<tr>
<td>Phys. 51</td>
<td>Mechanics</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Phys. 53</td>
<td>Electricity and Magnetism</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>Phys. 55</td>
<td>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 year should first consult their geology advisor regarding the proper schedule. If the student enters in his or her junior year, it is imperative that all requirements in mathematics, physics, and chemistry have been completed, as well as courses equivalent to Geology 1 and 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 analytical geometry in four quarters: Mathematics 41, 42, 43, 44

2. For students who wish to cover the same subjects in six quarters: Mathematics 19, 20, 21, 22, 23, 44

**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)

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)

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)

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

**ELECTIVES**

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.

**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 (LGI) of at least 3.5 in their earth science courses and an LGI 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 experiment.
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 Honors 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 University 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 3 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.

3. The student completes all the requirements for the baccalaureate degree and is recommended for the degree by the Subcommittee on Graduation.

4. The student completes all the requirements for the master's degree and is recommended for that degree by the University Committee on Graduate Studies.

GRADUATE PROGRAMS

Graduate studies in the Department of Geology involve academic coursework and independent research. A broad range of opportunity for research is offered by the varied interests of the faculty in the department and in other departments of the School of Earth Sciences. Stanford University is situated in a region that invites geologic field research during all seasons of the year. The California Coast Ranges, Sierra Nevada, Cascade Mountains, Colorado Plateau, Columbia Plateau, and the Basin and Range Province are all within easy reach, and their geology offers many unsolved problems in all branches of the science. Marine geological and geophysical research are pursued by several faculty and their students in a global context with special emphasis on the Pacific. One group is studying quaternary geology and geoarcheology. Laboratories and analytical facilities are available for research in various branches of geology, including mineralogy, mineral physics, metamorphic petrology, igneous petrology, volcanology, mineral deposits, geochemistry, geological archeology, groundwater geology, marine geology, paleontology and micropaleontology, palynology, petroleum geology, photo-geology, rock mechanics, sedimentology, stratigraphy, and structural geology.

Course programs in the areas of faculty interest are tailored to the student's needs and interests with the aid of his or her research advisor. Students are encouraged to include in their program courses offered in other departments of the School of Earth Sciences as well as in other parts of the University. Graduate programs in the areas of engineering geology, environmental earth science, mineral deposits, and petroleum exploration are listed in this bulletin under the Department of Applied Earth Sciences and involve courses and faculty in both Applied Earth Sciences and Geology. The three broad areas of faculty research include (1) geochemistry, mineralogy, and petrology, (2) sedimentary geology and paleontology, and (3) structural, tectonic, and regional geology. These are summarized as follows:

Geochemistry, Mineralogy, and Petrology—The research and teaching interests of a number of the faculty in the Geology Department involve geochemistry and its applications to problems 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 palaeogeographic 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, Remson, and van Andel with a number of overlapping research interests shared with other faculty in 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 course work 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 section "Advanced Degrees" 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 residence) 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:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plan coursework for first year with academic advisor.</td>
</tr>
<tr>
<td>2-3</td>
<td>Planned coursework; selection of thesis advisor and thesis topic; submit short research proposal to thesis advisor; begin thesis research.</td>
</tr>
<tr>
<td>3-5</td>
<td>Select second reader and apply for M.S. degree candidacy to Graduate Studies Office.</td>
</tr>
<tr>
<td>5-6</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 section 'Advanced Degrees' 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 three 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:

<table>
<thead>
<tr>
<th>Quarter Procedure</th>
<th>1</th>
<th>Plan coursework for first year with advisor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-6</td>
<td>Preparation of research proposal; Research Examination, certification and petitions for Ph.D. Candidacy; admission to candidacy for the Ph.D.</td>
<td></td>
</tr>
<tr>
<td>2-12</td>
<td>Ph.D. research; University Oral examination; complete dissertation.</td>
<td></td>
</tr>
</tbody>
</table>

**COURSES**

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

The student is urged to examine the course offerings by other departments. Of particular importance are those in Applied Earth Sciences, Chemistry, Geophysics, Petroleum Engineering, Physics, Materials Science, 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 land forms, produce the minerals and rocks that comprise the earth’s crust, create the soils, deform the earth’s crust, and move the continent. Ways in which man interacts with the earth, both constructively and destructively. Surficial processes involving water, water’s role in erosion, and in the production of rocks called sediment. Processes acting with the earth’s interior with emphasis on 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 (Staff) MWF 8
Spr (Mahood) MWF 8
Sum (Staff) MWF 9
lab and field trips by arrangement

2. **Earth History**—The earth never ceases to change. Its every-varying climate with warm states and Ice Ages, the rise and fall of the sea, the growth and drift of continents, the evolution of life produced our present world and produce that of tomorrow. Geology is history, a concept of eternal time, of gentle, sometimes catastrophic change. Our view of our planet, modified by a revolution in geological thinking continues to bring new and surprising insights. This course traces the history of the earth by following its principal themes, the evolution of land, sea, atmosphere, and life, beginning with the easily understood present time and its climate. Designed for non-majors and prospective geology majors. Students intending to major in geology must take 3 either concurrently or in a subsequent year. (DR:7)

3 units, Aut (van Andel) MWF 11

3. **Earth History Laboratory**—An introduction in the methods and materials of historical geology essential for those planning to major in geology. Laboratory sessions deal with the interpretation of the rock record, with the analysis of geological maps and cross sections, with the stratigraphic and facies (environmental) interpretation of rocks and rock sequences, and provide a brief introduction in the nature and uses of 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 (van Andel) 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 a hand lens in making observations, and field trips demonstrate rock structures and genetic associations.
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. The schedule each year is given in the bulletin, Summer Session. Prerequisites: 1 and 80, or consent of instructor.

3 units, Sum (Ruetz) Sept. 10-24

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 of field 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 geologic report; conducted from a tent camp at one or more localities in the western states and involves a coordinated field study of mapping, descriptions, and interpretation of a relatively unknown field area. Emphasis in the field 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. Graduate students must obtain the permission of the instructor(s) to enroll. Prerequisites: 1, 2, 80, 102, 110, and 151; or consent of instructor(s).

103A. Introduction to advanced field techniques; detailed stratigraphic and structural mapping; description and interpretation of lithologic features; conducted from a field camp in California or Nevada. Credit for 103A requires completion of 103B.

8 units (Miller) June 16-Sept. 1

103B. Preparation of comprehensive geologic report on field areas studied during 103A; work done in the field or on campus.

Credit for 103B requires completion of 103A.

4 units (Miller) June 16-Sept. 1

110. 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. The geometric and mechanical principles that are useful for understanding the deformation of rock in the earth's crust. Elementary concepts of stress and strain analysis, physical properties of rock, brittle fracture, friction, buckling, flexure, and heat and mass transport are used in field and laboratory exercises emphasizing the techniques of data collection and interpretation. Exercises include measurement of small and large strains in rock, stereonet analysis of folded rock, determination of fault slip directions and magnitudes, and the construction of realistic geologic cross sections. Joints, sheet intrusions, faults, and folds are described, idealized, and analyzed using computer models based on continuum mechanics. Also, the roles of these structures in the evolution of the earth's crust, in natural resource recovery, and in the assessment of earthquake and volcanic hazards. Prerequisites: 1 and Calculus.

3 units, Win (Pollard, Miller) MWF 11

labs and field trips by arrangement

110B. Structural Geology II—Second of a two part series emphasizes the use of structural geology in understanding earth history in the formation of mountain belts and continental margins. The nature and processes of deformation in the earth's crust, the tectonic styles of deformation formed by crustal shortening, extension and strike-slip faulting, and an in-depth treatment of advanced techniques used for structural analysis of deformed rocks. Techniques include the study and interpretation of folds, multiple episodes of folding, deformational fabrics in metamorphic rocks, and the mechanisms of ductile flow at the grain and atomic scale. Major mountain belts, the western North America Cordillera and the European Alps expose the ultimate products of these deformational processes; their case histories synthesize this course and place deformational processes in an appropriate space-time framework. 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.

\[ 5 \text{ units, Win (Evitt) MWF 10; lab T1: 15-4:05} \]
\[ \text{plus one lab by arrangement} \]

150. The Oceans: An Introduction to the Marine Environment—The series of oceanography: the nature of sea water, the interplay between circulation of the oceans and atmosphere, the tides, waves, sea floor topography, and history of the major ocean basins. The interface between continents and ocean basins; beaches, estuaries, and the continental shelves. A broad view of the biology of the oceans emphasizing the sympathetic interaction between the distribution of inorganic constituents, oceanic circulation, and biologic productivity. Real and potential marine resources together with attendant legal conflicts. Lectures, occasional demonstrations, and one coastline field trip required. (DR:7)

\[ 3 \text{ units, Win (Ingle) MWF 11; demonstrations and field trips by arrangement} \]

151. Sedimentary Geology and Petrography—Depositional systems. Topics: grain size analysis, origin of bedding and sedimentary structures, origin of sedimentary facies. Siliciclastic depositional systems studied include alluvial, fluvial, eolian, deltaic, nearshore, shelf, deep-sea. Summary of carbonate deposition: reef models, tidal flats and shelves, evaporites and deep-sea. Three field trips, one with write-up. Lecture combined with lab concentrates on sedimentary particles, introduction to point counting, tectonics and sandstone composition, cementation and diagenesis, thermal maturation. Prerequisites: 1, 2.

\[ 4 \text{ units, Win (Staff) MWF 9} \]
\[ \text{lab and field trips by arrangement} \]

152. Stratigraphic Geology—Rudiments of interpreting sedimentary rocks, emphasizing the utility of integrating paleontologic and sedimentologic evidence to reconstruct depositional environments. Characteristic variations of modern and ancient biofacies and lithofacies are traced in time and space. Concepts of biostratigraphy, stratigraphic techniques and correlation are interwoven with discussions of the dynamics of the marine ecosystem, basin analysis, and paleoceanography. A stratigraphic problem serves as a basis for a required term paper. Lectures and discussions are supplemented by reading from classic and current scientific literature. Prerequisites: 1, 2, 102, and 151.

\[ 4 \text{ units, Spr (Ingle) MWF 10; two required field trips; research conferences by arrangement} \]

161. Crystal Chemistry, Mineralogy, and Mineral Optics—Introduction to the crystallographic groups and the theory of x-ray diffraction. Principles of crystal chemistry. Factors affecting the stability of minerals and the solid contaminants of our environment. Systematic examination of the structures, chemistry, physical properties and paragenesis of the major rock-forming minerals emphasizing silicates. Introduction to 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).

\[ 5 \text{ units, Aut (Brown) MWF 10} \]
\[ \text{lab MW 1:15-4:05} \]

170. Introduction to the Chemistry of the Earth—How chemical elements are distributed in the earth, ocean, and atmosphere, processes which cause this distribution, and conceptual and analytical tools needed to explore these questions. Lectures supplemented by a series of 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.

\[ 4 \text{ units, Aut (Stebbins) MWF 11} \]
\[ \text{lab by arrangement} \]

171. Geochemical Thermodynamics—Introduction to the application of chemical principles and concepts to geologic systems. Concentrating on developing an understanding of the chemical behavior of fluids, minerals, and gases, and 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. Prerequisites: 102, 161, and Chemistry 171.

\[ 4 \text{ units, Aut (Bird) MWF 9} \]

176. Stable Isotope Geochemistry—A survey of the natural variations in stable isotope ratios of H, C, N, O and S of rocks and minerals, and of the fractionation of these ratios among co-genetic minerals and fluids. Conditions of both formational and post-formational geologic processes, and origin of source materials. Topics: the theory of isotopic fractionation, the carbonate ocean paleotemperature scale, isotopic hydrol-
ogy, geothermometry, experimental systems, and a spectrum of applications to sedimentary, metamorphic and igneous petrology. Emphasis depends on student interest.

2 units, Spr (O'Neil) ThF 3
alternate years, given 1988-89

181. Igneous Petrology—Origin of igneous rocks, emphasizing magmatic differentiation processes displayed in the chemistry of volcanic rocks. Topics: the physical properties of magmas, role 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, Aut (Mahood) MWF 10
lab T 1:15-4:05

182. Metamorphic Petrology—Genesis of metamorphic rocks and the imposed physiochemical 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; classification of volcanic landforms and their relation to the composition and physical properties of the magma; characteristics of magma chambers; volcanic gases; eruptive histories of volcanic centers. One four-day field trip required. Prerequisite: 80 or its equivalent.

3 units, Spr (Mahood) MWF 11
alternate years, given 1988-89

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, Spr (Mahood) W 1:15-4:05
alternate years, given 1988-89


3-4 units, Win (Switzer) MTh 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 comparative 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

223. Geological-Geochemical Methods in Petroleum Exploration—The origin and fate of organic matter in sedimentary rocks. Emphasizes the analytical methods by which sedimentary organic matter is characterized and the incorporation of such data into petroleum exploration.

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

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 with emphasis on foraminifera. The principles of classification, evo-


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) TTh 9

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 emphasized: 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—Provides an understanding of 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: Concurrent enrollment in 265 and consent of the instructor.

2 units, Aut (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


2 units, Win (Brassell) TTh 4:15

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, given 1988-89

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, Aut (Hochella) MW 10 lab by arrangement

317. Advanced Field Mapping—10-14 days mapping in a structurally complex region. Emphasis is on collected detailed microscopic structural data as well as 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

351. Seminar in Ocean Science—Advanced discussion of current research problems in the tectonics, sedimentation, climate and paleoclimate, and history of the ocean basins and margins. Topic announced in Winter Quarter.

2 units, Spr (van Andel) 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

381. Seminar in Geochemistry.

1 unit, Aut (Staff) 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.

2 units, Aut (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.
339. Problems in Environmental Earth Sciences and Hydrogeology.
349. Problems in Paleontology, Palynology, and Paleoecology.
355. Problems in Oceanography.
359. Problems in Sedimentary Geology.
369. Problems in Mineralogy.
379. Problems in Geochemistry.
389. Problems in Petrology 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.
439. Research in Environmental Earth Sciences and Hydrogeology.
449. Research in Paleontology, Palynology, and Paleoecology.
455. Research in Oceanography.
469. Research in Mineralogy.
479. Research in Geochemistry.
489. Research in Petrology 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 Professor: Michael O. McWilliams
Assistant Professor: Kiyoshi Yomogida
Courtesy Professors: Steve Graham, David Pollard
Acting Assistant Professors: Jill McCarthy, Richard Ottolini
Consulting Professors: Cecil Green, Walter Mooney, Francis Muir, William Ostrander, Carl Wentworth
Visiting Professor: Fabio Rocca

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, N, P) 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>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31.</td>
<td>Chemical Principles</td>
</tr>
<tr>
<td>Chem. 135.</td>
<td>Physical Chemical Principles, or Physics</td>
</tr>
<tr>
<td>170, 171.</td>
<td>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. 50.</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, N, P</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>
</table>

9 units of Geophysics chosen from the list below.

The following Geophysics electives 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, Geology 103A and B, Geology 181, Physics 57, 59, 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, N, P).
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 103B.
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.

**MASTER OF SCIENCE 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**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elect. Engr. 261. Fourier Transform</td>
<td>3</td>
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<tr>
<td>and its Application</td>
<td></td>
</tr>
<tr>
<td>Geophys. 174. Seismology</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 380A. Seminar: Exploration Geophysics</td>
<td>1</td>
</tr>
<tr>
<td>Geophys. 397. Contemporary Geophysics Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Pet. Engr. 150A. Introductory Well</td>
<td></td>
</tr>
<tr>
<td>Log Analysis</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
</tr>
</tbody>
</table>

**Winter Quarter**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 151. Sedimentary Geology</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 180. Geologic Interpretation of</td>
<td>3</td>
</tr>
<tr>
<td>Reflection Seisograms</td>
<td></td>
</tr>
<tr>
<td>Geophys. 180A. Seismic Data Processing Lab</td>
<td>1</td>
</tr>
<tr>
<td>Geophys. 262. Rock Physics</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 397. Contemporary Geophysics Seminar</td>
<td>1</td>
</tr>
<tr>
<td><strong>One of the following 3 courses:</strong></td>
<td></td>
</tr>
<tr>
<td>App. Ear. Sci. 298. Decision Analysis in</td>
<td>3</td>
</tr>
<tr>
<td>Petroleum Exploration</td>
<td></td>
</tr>
<tr>
<td>Elect. Engr. 263. Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>FORTRAN Short Course</td>
<td>0</td>
</tr>
<tr>
<td>Geophys. 150. Plate Tectonics</td>
<td>3</td>
</tr>
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<td><strong>Total</strong></td>
<td>14</td>
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**Spring Quarter**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>Geol. 80. Rocks and Minerals</td>
<td>5</td>
</tr>
<tr>
<td>Geol. 110. Structural Geology</td>
<td>5</td>
</tr>
<tr>
<td>Geophys. 284. Reflection Seismology I</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
</tr>
</tbody>
</table>

Second Year

**Autumn Quarter**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophys. 191A. Geophysical Field Techniques</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 285. Reflection Seismology II</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 380B. Seminar: Exploration Geophysics</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>13</td>
</tr>
</tbody>
</table>

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 (nine quarters) of university graduate study must be satisfactorily completed. At least two of these years, ordinarily the 1st, 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, N, P). 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, 284, or 290. 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**

1. **Natural Hazards and Risk Assessment**—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.

   3 units, Spr (Kovach) MWF 10

3. **Paelomagnetism**—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. Prerequisites: Geology 1 or 2. Recommended: 150, Geology 110, Physics 53.

   3 units, Spr (McWilliams) by arrangement not given 1987-88

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 (Staff) TTh 12

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, Sleep) MWF 11


   3 units, Aut (Kovach) MWF 9

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, H, J, K, L, M, N, P. **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) not given 1987-88

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 data including COCORP data.

   2 units, Aut, Win, Spr (Thompson) 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

185N. Research Seminar: Plate Tectonics—Current research in paleomagnetism and plate tectonics.

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


2 units, Aut, Win, Spr (Rocca)  
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) MWF 10

276X. Advanced Seismology—Review of modern techniques in earthquake seismology. Elastodynamic 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, Win (Yomogida) TTh 1:15
276Y. Advanced Seismology—Body waves in vertically heterogenous media (generalized ray theory, reflective method, WKBJ method, full-wave theory), kinematics of seismic source processes. Introduction to dynamics of seismic source processes. Prerequisite: 276X.
3 units, Spr (Yomogida) TTh 1:15 alternate years, given 1988-89

276Z. Advanced Seismology—Surface waves and free oscillations in vertically heterogenous media. Introduction to surface waves and free oscillations in laterally heterogeneous media. Prerequisite: 276X.
3 units, Spr (Yomogida) TTh 1:15 alternate years, not given 1988-89


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

283. Geophysical Inverse Problems—Lectures on fundamental concepts in inverse theory and application of inverse theory. Generalized inverse theory, stochastic inverse, resolving kernels, and error analysis. Students must complete a term project applying inverse theory to actual geophysical data.
3 units, Aut (Yomogida) TTh 1:15

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 (Rocca) MWF 10

3 units, Aut (Rocca) MWF 10

3 units, Spr (Zoback, Nur) MWF 11 alternate years, not given 1988-89

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,N,P. Research Seminars—Provides 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) not given 1987-88

385C. Research Seminar: Seismology—Current research in seismology, seismicity, 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 data including COCORP data.
2 units, Aut, Win (Thompson) by arrangement

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

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

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

385M. 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

385N. Research Seminar: Plate Tectonics—Current research in paleomagnetism and plate tectonics.
   2 units, Aut, Win, Spr (Ottolini) by arrangement

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

397. Introduction to Contemporary Geophysics—Seminar on current topics of interest in geophysics emphasizing active research within the department and at other institutions. Required of all first year graduate students.
   1 unit, Aut, Win, Spr (Yomogida) F 3:15

398. Seminar in Ocean Science—See Geology 351 for details.
   2 units, Aut (van Andel) by arrangement

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

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

PETROLEUM ENGINEERING

Emeriti: (Professor) Frank G. Miller, (Consulting Professor) Marshall B. Standing
Chairman: Khalid Aziz
Associate Chairman: William E. Brigham
Professors: Khalid Aziz, William E. Brigham, George M. Homsy (by courtesy), Sullivan S. Marsden, Jr., Henry J. Ramey, Jr.
Associate Professor: Roland N. Horne
Associate Professor (Research): Franklin M. Orr, Jr.

OFFERINGS

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 facilities, selection and implementation of schemes for enhancing recovery, monitoring of reservoirs, and transportation of oil and gas to processing facilities and to markets. Because of the complex and changing nature of the problems involved, the Petroleum Engineering Department curriculum attempts to develop a sound background in relevant basic sciences and their application to practical problems. This includes fundamentals of physics, chemistry, mathematics, geology, geophysics, computer science, and engineering. Applied courses in the department cover virtually all aspects of petroleum engineering and some related fields like geothermal 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 department 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 encouraged to participate in research projects. Graduate programs lead to the degrees of Master of Science, Engineer, Engineer with Management Option, and Doctor of Philosophy.

**FACILITIES**

The department occupies the Lloyd Noble Laboratory of Petroleum Engineering and portions of the Ruth Wattis Mitchell Earth Sciences Building and the Henry Salvatori Laboratory 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 (22 1/2 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 (min)</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 [ ].

**Course No.**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 41. Calculus and Analytical Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Math. 42. Calculus and Analytical Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
</tr>
</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 19. Calculus and Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Math. 20. Calculus and Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Math. 21. Calculus and Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
</tr>
</tbody>
</table>

In addition, the following courses are also required:

**Course No.**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 43. Calculus and Analytical Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Math. 44. Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Math. 130. Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
</tr>
</tbody>
</table>

**SCIENCE**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31. Chemical Principles</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 33. Structure and Reactivity</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 135. Physical Chemical Principles</td>
<td>3</td>
</tr>
</tbody>
</table>

or Chem. 171. Physical Chemistry
Geology 1. Interpreting the Earth
Physics 51. Mechanics
Physics 53. Electricity and Magnetism
Physics 54. Electricity and Magnetism
Total

ENGINEERING FUNDAMENTALS

Course No. | Subject | Units
---|---|---
Engr. 10. | Applied Mechanics | 3
Engr. 11. | Mechanics of Materials I | 4
Engr. 21. | Mechanics of Fluids or Mechan. Engr. 33. Introduction to Fluids Engineering | 4
Pet. Engr. 167. | Engineering Valuation of Oil and Gas Wells or Engr. 60. Engineering Economics | 3
Engr. 70. | Introduction to Software Engineering (same as Comp. Sci. 106A.) or Engr. 70X. Introduction to Software Engineering (Accelerated) (same as Comp. Sci. 106X.) | 5

Total

* 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.

PETROLEUM ENGINEERING DEPTH

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

Course No. | Subject | Units
---|---|---
Geol. 110A. | Introduction to Earth Structures [1] | 3
Geol. 151. | Introduction to Sedimentary Facies [1] | 3
Pet. Engr. 151D. | Reservoir Fluids Laboratory [0] | 2

Total

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.

**Course No. | Subject | Units**
---|---|---
App. Earth Sci. 192. | Computing in Geology | 3
Geophys. 190. | General Geophysics [1] | 4

Total

Note: Courses taken to satisfy requirements for engineering fundamentals, petroleum engineering depth and technical electives must include a total of 22.5 design units (minimum).

Courses recommended as electives (in addition to technical electives):

**Course No. | Subject | Units**
---|---|---
App. Earth Sci. 190. | Geostatistics | 3
Chem. Engr. 140. | Fluid Mechanics | 3
Comp. Sci. 135. | Numerical Methods | 3
Engr. 102W. | Technical Writing | 3
Engr. 103. | Public Speaking | 3
Geol. 2,3. | Earth History, Earth History Lab | 3,2

Geophys. 180. | Reflection Seismograms | 3
Math. 113. | Linear Algebra | 3
Math. 114. | Linear Algebra | 3
Math. 131. | Partial Differential Equations | 3
Math 132. | Partial Differential Equations | 3
Pet. Engr. 173. | Special Topics | 3
Pet. Engr. 190. | Undergraduate Research | 1-3
Stat. 110. | Statistical Methods in Engineering | 4

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 (22\% credits) of engineering design. The latter requirement will normally be met on completion of engineering fundamentals and petroleum engineering depth requirements.

**HONORS PROGRAMS**

A limited number of undergraduates may be admitted to the Petroleum Engineering 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 six units of advanced petroleum engineering courses and complete at least three 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.
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 student's 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 in-
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 student interest or prior background.

MATH SEQUENCE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pet. Engr. 251</td>
<td>Applied Mathematics in Petroleum Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9</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>Total</td>
<td></td>
<td>9</td>
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</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>
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<td></td>
<td>9</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>Total</td>
<td></td>
<td>6</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
Total                   | 6

RESEARCH

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

Total units required for Master’s Degree                   | 45

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 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 credit for research (Petroleum Engineering 360), and including all the course requirements of the department’s master’s degree except the research. If the candidate has received unit credit for such research, this credit ordinarily would be transferable to the Engineer degree. No more than 10 of the required 90 units may be applied to overcoming deficiencies in undergraduate training. 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):

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus. 200-201</td>
<td>Economic Analysis and Policy I and II</td>
<td>4 ca.</td>
</tr>
<tr>
<td>Bus. 210-211</td>
<td>Accounting I and II</td>
<td>4 ca.</td>
</tr>
<tr>
<td>Bus. 220</td>
<td>Business Finance I</td>
<td>4</td>
</tr>
</tbody>
</table>
Bus. 261. Decision Making under Uncertainty 4
Bus. 270. Organizational Behavior 4
Bus. 290. Strategic Management 4
Bus. 321. Investment Management 4
Bus. 351. Negotiation and Intervention 4
Bus. 352. Small Business Management 4
Bus. 354. Energy-Business Issues 4
Indust. Engr. 270. Managing Technical Companies 4

Additional units needed to make up the required 90 may be electives. The student must secure at least “Pass” grades in Graduate School of Business courses. In all other courses the student must maintain a letter grade indicator 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

Course No. Subject Units
Aero. & Astro. 192. Vector Analysis and Cartesian Tensors 3
Aero. & Astro. 291A and B. Linear Transforms and Their Applications to Engineering Problems I and II 3 ea.
Comp. Sci. 106. Introduction to Structured Programming 3
Comp. Sci. 135. Numerical Methods 3
Comp. Sci. 234. Numerical Methods of Optimization 3
Math. 106. Introduction to Theory of Functions of a Complex Variable 3
Math. 113. Linear Algebra and its Applications 3
Math. 114 Linear Algebra and Matrix Theory 3
Math 115. Fundamental Concepts of Analysis 3
Math. 131. Partial Differential Equations—I 3
Math 132. Partial Differential Equations—II 3

PETROLEUM ENGINEERING

Mech. Engr. 201. Applications of Complex Variables 3
Stat. 110. Statistical Methods in Engineering and Physical Sciences 4

SCIENCE

App. Earth Sci. 225. Surfaces and Interfaces 3
App. Earth Sci. 251. Oil Field Geology and Exploration 3
App. Earth Sci. 255. Introduction to Solute Transport 2
Geol. 232. Numerical Methods in Hydrology 2
Geol. 278. Organic Geochemistry 2
Geophys. 180. Geologic Interpretation of Reflection Seismograms 3
Geophys. 190. General Geophysics 4
Geophys. 262. Rock Physics 3

ENGINEERING

Chem. Engr. 140. Fluid Mechanics 3
Engr. 257. Methods and Experiences in Engineering Education 3
Engr. 298. Seminar in Fluid Mechanics 1
Mech. Engr. 250. Introduction to Heat Transfer 4
Mech. Engr. 252A. Convective Heat and Mass Transfer 3

The Ph.D. program is normally a 4-year program. Except in unusual circumstances, the first year is consumed in fulfilling the requirements for the M.S. degree. During the second and third years, the student acquires 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. 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 then-
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. Engineering calculations of fluid contents of reservoirs, and predicted recoveries of geothermal, oil, water, and natural gas reservoirs. Design of reservoir development. Prerequisites: 151A and B.

3 units, Spr (Staff) MWF 1:15

171. Reservoir Simulation Fundamentals—
Lectures and problems. Development of reservoir simulation equations and their solution by finite-difference methods. Standard black-oil models and their applications to predicting reservoir behavior. Prerequisites: Knowledge of Fortran, 151A, B, and 170.

3 units, Aut (Horne) Th 2:30-4


3 units, Aut (Aziz) 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

251. Thermodynamics of Phase Equilibria—

3 units, Aut (Orr) Th 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, Spr (Ramey) MWF 11

alternate years, not given 1988-89

270A. Advanced Reservoir Engineering—

3 units, Aut (Staff) MWF 9

270B. Advanced Reservoir Engineering—

3 units, Win (Staff) MWF 10

3-4 units, Win (Aziz) MWF 11

273. Special Topics in Petroleum Engineering—Lectures, problems. Any quarter (Staff) by arrangement


3 units, Aut (Marsden) MWF 10


3 units, Win (Staff) by arrangement


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


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


3 units, Spr (Horne)

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

3 units, Win (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 will prepare and present several lectures, problem sets, grade problems, and prepare 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 (Aziz, Brigham, Castanier, Dykstra, Homsy, Horn, Horne, Marsden, Orr, Ramey) by arrangement

Dean: Marshall Smith

Associate Deans: Larry Cuban (Academic Affairs), Anne Gaddy (Administration), Ralph Keller (Alumni Affairs)

Director of Student Services: Deborah Sutherland

Professors: Arthur Applebee, J. Myron Atkin (on leave, Spring), Michael Bratman (by courtesy), Paul Brest (by courtesy), Edwin M. Bridges, Robert C. Calfee, Martin Carnoy, Elizabeth C. Cohen, Arthur Coladarci, Larry Cuban, Sanford M. Dornbusch (by courtesy), Elliot W. Eisner (on leave, 1987-88), Richard E. Gross, Shirley Heath (by courtesy), Alex Inkeles (by courtesy), Herant Katchadourian (by courtesy), Michael W. Kirst (on leave, Winter), John D. Krumholz, Henry M. Levin, James G. March (by courtesy), John W. Meyer (by courtesy), Nel Noddings, Ingram Olkin, Denis C. Phillips, W. Richard Scott (by courtesy), Lee S. Shulman, Albert E. Siegel (by courtesy), Richard E. Snow, Herbert Solomon (by courtesy), George D. Spindler, Patrick C. Suppes (by courtesy), Carl E. Thoresen, David B. Tyack, Hans N. Weiler

Associate Professors: Martin Ford (on leave, Autumn), Milbrey McLaughlin, Francisco O. Ramirez, David Rogosa (on leave, Autumn, Spring), Joel Samoff, Pamela L. Straitharn (by courtesy), Myra H. Strober (on leave, Spring), Decker F. Walker

Assistant Professors: M. Beatriz Arias (on leave, Autumn), Michael Garet, Edward Haertel (on leave Winter), Thomas G. Huebner, Teresa D. LaFromboise

Associate Professor (Research): Judith Langer

Lecturers: Raymond F. Bacchetti, David Bettmer, David Grossman, Ronald B. Herring, Larry V. Hull, Louise Spindler

Acting Assistant Professor: Rachel Lotan

Visiting Professors: Isidoro Cheresky, Jeremy Finn, Judith Torney-Purta

OFFERINGS

The School of Education is responsible for the preparation of scholars investigating educational processes, and of teachers, supervisors, guidance workers, administrators, and other educational specialists. Five degrees with specialization in education are granted by the University: Master of Arts, Master of Arts in Teaching, Educational Specialist, Doctor of Education, and Doctor of Philosophy. For experienced teachers the Master of Arts in Teaching degree is offered jointly with several academic departments. Teaching and educational service credentials are issued by state departments of education upon verification by the School of Education that properly accredited work has been completed by the student. The school recommends to the California Commission on Teacher Credentialing that credentials be granted to those students completing one of the Commission-approved credential programs.

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 state requirement in one of the University’s degree programs. Students requiring this University recommendation must contact the Degree Program Office in the School of Education during their first quarter of study.

The School of Education offers no correspondence or extension courses.

SUMMER SESSION

The full Summer Session in the School of Education is eight weeks in length. In addition, several one-, two-, three-, and four-week workshops and institutes are offered which make it possible for students to earn credit in shorter periods of time. However, those who pursue a full program of study (15 units) for eight weeks may earn a full quarter of residence toward the requirement for a degree. The number of units for which a student may register in the Summer Session may not exceed 16, unless part of the registration is for thesis or dissertation.

The Summer Session Bulletin, issued each year in February, contains more detailed and definite information about summer offerings.

UNDERGRADUATE PROGRAM

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.
SS SCHOOL OF EDUCATION

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 under-
graduate department and of the School of Edu-
cation 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 number is 36.

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

In addition to the coterminal program, the
school offers a variety of opportunities to under-
graduates interested in education under the
auspices of the Undergraduate Program in the
School of Education (UPSE).

GRADUATE PROGRAMS

The information about programs of study
reported below is related to degrees and
credentials. Many students entering the School
of Education are seeking both degrees and cre-
dentials. In that case, both applicable sections
should be consulted. Below are listed degrees
offered by the School of Education with which
credentials may be associated. (There is no
necessary association between degrees and cre-
dentials. Requirements for degrees and cre-
dentials may differ.)

Students who wish to be candidates for grad-
uate degrees are urged to write to the Admis-
sions Office, School of Education, Stanford Uni-
versity, Stanford, CA 94305 for full information
and application forms. The sections below sum-
marize the requirements for the degrees but do
not describe the programs in detail. The details
are supplied upon request by the School of
Education. The Graduate Record Examination
(General Test) is required for all graduate
admissions.

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

Students working toward graduate degrees
should follow the suggestions outlined for each
degree. Students applying for the master’s or
doctoral degree will present a preliminary pro-
gram of study which represents the work to be
completed in earning the degree. They should
consult their advisors with regard to organizing
their graduate programs.

Students who are candidates for a master’s or
doctoral degree should also consult the Univer-
sity’s general requirements described in the
“Degrees” section in this bulletin, noting in
particular, registration and residence require-
ments.

MASTER OF ARTS

The degree of Master of Arts (A.M.) in Educa-
tion is offered in the following fields:

Administration and Policy Analysis
Curriculum and Teacher Education (with
specialization in any of the following
fields):
Art Education
Design and Evaluation of Educational Pro-
nets (General Curriculum, Curricu-
lum Evaluation, Elementary Education,
Mathematics Education, Secondary
Education, Teacher Education)
Language, Literacy and Culture (Bilin-
gual/Bicultural Education; Second Lan-
guage Education; Writing, Reading, and
Language-English)
Dance Education
Social Studies Education
International Development Education
(SIDEC)
International Educational Administration
and Policy Analysis (APA, SIDEC)
Mathematical Methods in Educational Re-
search
Social Sciences in Education
Gender Studies
Stanford Teacher Education Program*

Ordinarily candidates for the master’s degree
in the Curriculum and Teacher Education area
will have completed student teaching or an-
other practicum, or have one year or more of
teaching experience before entering the
master’s program.

More detailed information about the Master
of Arts programs and requirements in specific
areas may be obtained from the Degree Pro-
gram Office, School of Education.

* A program for candidates who are seeking initial
preparation for the Single Subject Teaching Cre-
dential (secondary) as well as for the master’s degree.
See “Credentials for Public School Service” for perti-
nent information.
A minimum of 36 quarter units of graduate work is required, although some A.M. programs in the School of Education have course and residence requirements which exceed the minimum requirements. In a 36-unit program at least 30 units must be completed at Stanford. A minimum of 12 units must be taken for a letter grade and the candidate must achieve at least a "B" letter grade indicator. 18 units of the program must be in the School of Education. University residence requirements must be met. The minimum residence requirement for the master's degree is registration at Stanford as a graduate for three full-tuition quarters. Only one quarter of nonmatriculated study may be counted toward the residence requirement for this degree.

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

Master's students must file a program proposal for the degree with the Graduate Division by the last day of class in their first quarter of residence.

Information on program requirements and the necessary forms should be obtained from the Degree Program Office, School of Education, during registration in the first quarter of residence.

MASTER OF ARTS, TEACHING (SUBJECT)*

The degree of Master of Arts, Teaching (Subject) 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

* 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. Candidates seeking their initial preparation for teaching by way of a teaching internship may prepare for the degree of Master of Arts in Education as well as for a credential. See "Credentials for Public School Service" for pertinent details.
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, described below.

General Requirements—The Educational Specialist degree can be completed with a minimum of three quarters of coursework beyond the master's (or its equivalent) and an accumulation of 45 quarter units; in addition, field-based projects are required. The minimum residence requirement for the degree is registration at Stanford as a graduate student for three full-tuition quarters.

EVALUATION TRAINING PROGRAM

Evaluation of educational and social programs is a relatively new specialization. Evaluators are, in effect, doing educational work; they attempt to help society to learn in its programmatic attempt to solve pressing problems. To carry out this function, evaluators need to be conversant with a variety of disciplines, and to have expertise in at least one that is pertinent. In addition, in order to be effective, evaluators need to understand the political, social, and organizational settings in which programs are carried out and in which decisions about progress are made.

There are three general ways in which the Ed.S. degree in Evaluation can be earned:

1. By applicants with professional experience who hold an A.M. degree and whose professional advancement would be enhanced by the Ed.S. degree as a terminal qualification.
2. By applicants who are taking another course of study within Stanford (e.g., a doctorate in Education or Communication) and who wish to take the Ed.S. degree concurrently.
3. By applicants who hold a doctorate but who wish to qualify themselves in evaluation by taking the Ed.S. degree in a post-doctoral year.

Students in the Evaluation Training Program (ETP) will be required to take courses examining evaluation problems from both "technical" and "practical" perspectives, and courses which place evaluation in political and social contexts. Participation in practicum activities is also required. However, within this framework, students will be able to meet the program requirements by tailoring their courses to satisfy their individual interests.

Further information about the Evaluation Training Program and the Educational Specialist degree can be obtained from the School of Education Degree Program Office.

Note—Application for candidacy for the Ed.S. degree must be filed with the Degree Program Office, School of Education, by the end of the first quarter in the program.

DOCTORAL DEGREES

Students admitted to study for advanced degrees in education should plan to specialize in the field of their professional interest, preparing for some line of professional activity and at the same time securing mastery of an organized body of knowledge. The choice should be made in light of the professional objectives of the student. The course of study for the various program areas is somewhat flexible, allowing a student, in consultation with the advisor, to emphasize certain aspects of the work, depending on particular interests and objectives. A faculty advisor from the student's program area will assist in planning a program of study and in projecting research plans for the dissertation. Other members of the faculty of the School of Education may also be consulted with regard to the particular area chosen by the student.

The program areas for the doctorate are listed below:

Administration Policy Analysis
Curriculum and Teacher Education with specialization in any of the following fields:
Art Education
Design and Evaluation of Educational Programs (General Curriculum, Curriculum Evaluation, Elementary Education, Secondary Education, Mathematics Education, Teacher Education)
Language, Literacy, and Culture (Bilingual/Bicultural Education; Second Language Education; Writing, Reading, and Language — English)
Social Studies Education
  *International Development Education (SIDECC)
  *Mathematical Methods in Educational Research
  *Psychological Studies in Education, with specializations in:
    Child Development and Early Education
    Counseling Health and Psychology
    Educational Psychology
  *Social Sciences in Education, with specializations in:
    Anthropology of Education
    Economics of Education
    History of Education

* Ph.D. degree only.
The degree of Doctor of Education (Ed. D.) is a professional degree conferred by the University upon recommendation by the faculty of the School of Education and the University Committee on Graduate Studies. This degree is intended to meet the needs of (1) those who seek a comprehensive professional understanding of and competence in dealing with educational problems met by administrators, supervisors, guidance workers, and curriculum specialists; or (2) those who aspire to a scholarly preparation for teaching Education in colleges or universities.

Residence—Nine full tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the candidate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. In such cases, candidates for the degree will be expected to register at Stanford for a minimum of two academic years (six full quarters or the equivalent in partial registrations). A minimum of two of these quarters must be in consecutive full-time residence. Only two quarters of non-matriculated study may be counted toward the residence requirement for this degree. Application for formal admission to candidacy for the Ed.D. degree must be made by the end of the second year of graduate study at Stanford. Admission to candidacy is granted by the University Committee on Graduate Studies and expires five years from the end of the quarter in which the candidacy is established.

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

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

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

Information about requirements in specific program areas may be obtained from the relevant Area Committee in the School of Education.

The degree of Doctor of Philosophy (Ph.D.) is conferred by the University upon recommendation by the faculty of the School of Education and the University Committee on Graduate Studies. Students working toward this degree in the School of Education are ordinarily preparing to direct research work in public school systems or in specialized institutions, or to conduct research as faculty members of colleges or universities.

Residence—Nine full tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the candidate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. In such cases, candidates for the degree will be expected to register at Stanford for a minimum of two academic years (six full quarters or the equivalent in partial registrations). A minimum of two of these quarters must be in consecutive full-time residence. Only two quarters of non-matriculated study may be counted toward the residency requirement for this degree. Application for formal admission to candidacy for the Ph.D. degree must be made by the end of the second year of graduate study at Stanford. Admission to candidacy is granted by the University Committee on Graduate Studies and expires five years from the end of the quarter in which the candidacy is established.
Units — A minimum of 108 quarter units must be completed. A minor field of study must be included if the candidate does not hold an acceptable master's degree outside the field of education. Unit requirements are evaluated on the basis of graduate units taken beyond the baccalaureate degree, including a maximum of 36 quarter units of relevant and acceptable graduate work taken elsewhere. Graduate course work taken seven or more years ago ordinarily will not be included in the doctoral program.

Organization of Program — Considerable flexibility is allowed in projecting a program for the Ph.D. degree. The candidate will be expected to organize a program of work for the degree in conference with advisors relevant to the field of concentration. All programs require the approval of the relevant School of Education Area Committee, the Associate Dean for Academic and Student Affairs, and the University Committee on Graduate Studies. Information about requirements in specific program areas may be obtained from the relevant Area Committee in the School of Education.

Ph.D. MINOR
Candidates for the Ph.D. degree in other departments or schools of the University who elect a minor in Education will be expected to choose a field of concentration, and to take a minimum of 30 units of graduate courses in education. In the organization of the program, the student who applies for a minor in the School of Education will consult with the School's Associate Dean for Academic and Student Affairs.

CREDENTIALS FOR PUBLIC SCHOOL SERVICE
The Stanford School of Education is authorized to recommend the granting of certain credentials for service in the public schools of California. The course work and teaching experience required for California credentials will in many instances meet the credential requirements of other states.

PRELIMINARY ADMINISTRATIVE SERVICES CREDENTIAL
California recently initiated a two-stage credential program for administrators. The first stage leads to the Preliminary Services Credential with a Specialization in Administrative Services, authorizing service for five years. It is designed for those who seek entry level positions in educational administration. The second stage, the Professional Administrative Services Credential, has not yet been designed but will require prior work experience as an administrator in California school settings. At the present time, Stanford's credential preparation in educational administration is limited to the Preliminary Administrative Services Credential.

The Stanford School of Education is authorized by the Commission on Teacher Credentialing to recommend candidates for the Preliminary Services Credential with a Specialization in Administrative Services. Persons seeking this credential at Stanford must be admitted to a degree program in the School of Education as well as to the Preliminary Administrative Services Credential Program. Applications for the Credential Program are available from the Degree Program Office in the School of Education and should be filed by the second quarter of study. Before completing the application, students should consult with the director of the program to insure that they possess the appropriate qualifications. Students seeking the Preliminary Administrative Services Credential must hold a valid California teaching credential, or designated subjects credential, or a pupil personnel services credential; have three years of successful full-time experience either in teaching or pupil personnel services; and be enrolled in a degree program in the School of Education. To be recommended for the credential, a candidate must complete all the requirements of the Stanford program, which consist of a prescribed set of courses and an internship. Most of the courses in Stanford's APA core program for the M.A. or Ph.D. degrees count also toward the credential requirement. In some cases, prior experience and/or course work can satisfy some of the requirements of the Preliminary Administrative Services Credential Program.

TEACHING CREDENTIALS*

The School of Education is authorized to recommend for the California Single Subject (secondary) Teaching Credential those students who complete the Stanford Teacher Education Program. This program is described below.

STANFORD TEACHER EDUCATION PROGRAM (INTERNSHIP)

The Stanford Teacher Education Program (STEP) is a 12-month, fifth-year program which leads to a California Single Subject (secondary) Teaching Credential and the Master of Arts degree in Education. It begins in June with a Summer Quarter of intensive preparation in the process of teaching and experiences in summer programs in high school classrooms. During the

* Stanford does not offer training for a teaching credential at the elementary level (Multiple Subject Credential) at this time.
academic year, students take courses in their academic fields and in professional education; they also teach part time in local schools. Stanford offers training for the credential in the following areas: English, Foreign Language (French, German, Spanish), Mathematics, Science (Biology, Chemistry, Physics), and Social Science.

Eligibility—Graduates in the humanities and sciences from college and universities of recognized standing are eligible to be considered as candidates for admission to the Stanford Teacher Education Program if they have maintained at least a "B-" letter grade indicator in undergraduate and graduate courses. Applicants must have acceptable preparation in one of the teaching majors listed above. As a general rule, previous course work in professional education at the graduate level will not be counted toward the master's degree. Persons who have been out of college for some time who now seek to prepare to teach, as well as recent graduates, are encouraged to apply. The number of candidates that can be admitted to prepare in a particular subject area is limited by the facilities of the University and by the number of school assignments available in that subject field.

Closing date for filing applications—Completed applications should be filed no later than February 15. The application form is available from the Admissions Office, School of Education.

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

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

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

Requirements—To qualify for the California Single Subject Teaching Credential, the candidate must satisfy the following requirements:

1. A baccalaureate or higher degree from an approved institution (except in professional education).
2. A teaching major consisting of a minimum of 36 quarter units (24 semester units) of upper division or graduate courses.
3. The approved fifth year of study program of professional preparation which includes work in the academic area, in professional education, and in practical teaching experiences. A minimum of 45 units of graduate study is required, and at least 36 of these units must be completed at Stanford.
4. Fulfillment of the U.S. Constitution requirement either by taking satisfactory course work or by passing an examination.
5. The course in reading instruction.
6. The course in health and special education.
7. Verification of subject-matter knowledge in the student's area of admission in order to obtain a teaching authorization. This must be done by one of the following two methods:
   a) Passage of an examination on the subject matter (currently one of the Specialty Area tests of the National Teacher Examinations) or,
   b) Completion of a Commission-approved subject matter waiver program in a California institution.
8. Passing score on California Basic Education Skills Test (CBEST), prior to matriculation for California residents, and by September for all others.

Both interns and student teachers must verify their subject matter knowledge by one of the methods stated above before starting their September assignments.

In light of continuing program development these requirements are subject to revision.

ORGANIZATION OF PROGRAM

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

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

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-level Courses primarily for A.M. and first-year doctoral students (undergraduates may enroll with instructor's permission).

300-level Courses primarily for 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.

100. UPSE Practicum in Education — For undergraduates who want to teach, tutor, or coach in local schools and educational programs. Opportunities for first-hand experience exist at all age levels and in a wide variety of subjects. Special opportunities for students who desire to serve minority students or who want to work in their home communities. Placement and supervision through the Undergraduate Program in the School of Education. May be repeated for credit.

2-3 units, Aut, Win, Spr, Sum

(Staff) by arrangement

101. UPSE Seminar—For undergraduates who had or are having first-hand experience as teachers, tutors, or coaches. Emphasizes contemporary educational issues and the common concerns of beginning teachers. Focus of seminar may vary by quarter. Sponsored by Undergraduate Program in the School of Education. May be repeated for credit.

1-2 units, Win (Staff) T 7-9 p.m.

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 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. (APA, SSE)

3 units, Aut (Kirst, Tyack) MW 2:15 and by arrangement

125X. 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, Aut (Gross) T 2:15-4:05

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, Win (LamFromboise, Krumboltz) M 3:15-5:05 alternate years, not given 1988-89

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, Spr (Haertel) MW 1:15-2:45

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

3 units, Spr (Herring) by arrangement

170. Gender and Education—(Same as Feminist Studies 130, 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. Primary disciplines in the course 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, Win (Strober, Cohen) MW 3:15-5:05

175X. Women and Development in Africa—(Same as Africa and Afro-American Studies 175X, Anthropology 109, Feminist Studies
A survey of women's roles and experiences in formal and informal development activities in Africa. Major topics: women in African history, women and decolonization/liberation, development and dependence, crisis in production and productivity, education and work, women and development planning, women, politics, and power, and feminism in the U.S. and Africa. Reviews relevant theoretical orientations and empirical research, drawing on concrete case studies. Recommended: Prior or concurrent work on Africa and/or women in the Third World. (IDE, SSE)

4 units, Spr (Samoff) TTh 4:15-6:05

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

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, Auts (Ramirez) MWF 10

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. (CTE, SSE) (DR:5)

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

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)

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)

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

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. Required for all first-year students in SIDE; others by consent of instructor. (IDE)

2-3 units, Aut (Weiler) M 1:15-3:05

and by arrangement

206B. Project Workshop in International Development Education—This course concludes the 4-quarter A.M. program in SIDE, and is 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)

2-5 units, Sum (Carnoy) M 3:15-5:05

207X. International Cooperation in Education Development — (Same as Political Science 248.) Critical review of current policies, priorities, and practices in international cooperation in education, with attention to the role of international organizations (World Bank, Unesco, OECD), and of national development assistance agencies. (IDE, SSE)

5 units, Spr, alternate years, given 1988-89

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 (Noddings) MW 1:15-3:05

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 (Walker) TTh 4:15-6:05

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 3:15-5:05

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. Features short written assignments and individual feedback. 210/310 meet together. (SSE)

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

211. Introduction to Philosophy of Social Science—(Same as Philosophy 166.) For upper division undergraduates majoring in one of the social sciences, and for beginning graduate students in related areas such as education. Focuses on the differences writers have noted between the natural and social sciences, and moves on to topics of importance in the social sciences: explaining human action, the functional explanation of social phenomena, and holistic versus reductionist orientations. Examples from contemporary social science research literature. (SSE)

3 units, Win (Phillips) Th 7-10 p.m.

212A. Practicum in Ethnographic Futures Research I—(Same as Anthropology 269A.) Instruction in the rationale and guidance in the practice of Ethnographic Futures Research (EFR), loosely structured, open-ended, interactive, non-directive method for eliciting from a sample of interviewees their middle-range perceived and preferred sociocultural scenarios for their society or organization. EFR (1) is an auxiliary method for research on cultural values and change; (2) augments conventional policy-making and planning approaches; and (3) provides an educational experience for interviewer and interviewee. Students work alone or join a team working on Stanford Futures or Biotechnical Futures. (SSE)

3-5 units, Aut (Textor) W 7-10 p.m.

212B. Practicum in Ethnographic Futures Research II—(Same as Anthropology 269B.) Continuation of 212A for those who require additional time and guidance, especially in writing up research results for publication. (SSE)

3-5 units, Win (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

215. Psychological Foundations of Education—(Same as Psychology 145.) Introductory application of psychological principles to educational practices. (CTE, PSE)

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

217X. Teaching a Global Perspective: Cross-Cultural Approaches—Current research and practice in the field of global education emphasizing Stanford Program on International and Cross-Cultural Education (SPICE). Includes selected global and cross-cultural issues in some depth, with reference to the problems and prospects of teaching such issues in American classrooms. Exposure to various experiential approaches to global education, including simulations and computer-assisted instruction. (CTE, IDE)

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

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, Win (Eisner) MW 3:15-5:05

220A,B,C. The Social Sciences and Educational Analysis—Relationships among economics, political science, and sociology and their applications to education in the United States. Required of students in APA and open to all students. 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 10-11:50

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—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. Application to policy analysis, implementation, and politics of reform emphasized. (SSE)

4 units, Sun (Kirst) MW 10-12

220C. Education and Society—(Same as Sociology 143.) Effects of schools and schooling on individuals, the stratification system, and society. Education as socializing indi-
222C. Decision Analysis in Education III—Application of simple quantitative models to administrative problems through structured computer-based simulations of educational processes, procedures, and institutions. Introduces Markov models, queuing theory, and elementary difference equations. Participants work briefly with existing simulation models and then spend the quarter constructing programming, and testing small-scale computer simulators. Prerequisites: 222A and 222B, or their equivalents. (APA, SSE)

5 units, Spr (Garet) MWF 10:30-12
and by arrangement

224X. Microcomputers, Databases, and Data Management in Educational Policy—For students planning to use a microcomputer for data analysis. Alternative ways of using computers to manage and analyze both quantitative and qualitative data. Data entry and coding, data management, strategies for coping with messy data, and for displaying data. Prerequisite: An introductory course in statistics. (APA)

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

225S. Democracy, Human Rights, and Educational Change—Recent developments in democratic theory and questions about its explanatory capacity, particularly the definition of the social function of education. Neo-contractualist theory, the potential of democratic values and new social movements, and the obstacles created by social domination and institutional stagnation. (IDE, SSE)

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

227. Educational Assessment of Linguistic and Culturally Diverse Populations—The major assessment issues in bilingual education including language proficiency testing program entry 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, IDE)

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

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, Win (Calfee) MWF 8:20-9:50

229. The Development of Social Competence: Theory, Research, and Practice—Critically
examines theory and research on social competence from a developmental perspective. Emphasizes socialization influences and the psychological attributes of socially competent children and adolescents. Analyzes selected educational approaches and projects designed to enhance social competence. (PSE)

4 units, Aut (Ford) TTh 12:15-2:05
alternate years, given 1988-89

230S. Socialization: An International Perspective—One can understand socialization processes which underlie education most effectively by studying cultural commonalities and variations. Attention to socialization of values (especially civic education, political values, and moral education) and the interaction of family and school with other institutions. Stress on critiquing empirical research and implications for policy and practice. (IDE, SSE)

3 units, Spr (Torney-Purta) W 3:15-6:05

231. Social Structure of World Society—(Same as Sociology 152; Values, Technology, Science, and Society 155.) Sociological analysis of society on a world-wide basis, i.e., all the people inhabiting the earth and the institutions through which their lives are organized are treated as participants in one global social system. Competing models of the emerging world order are reviewed and compared. Topics: the worldwide population dynamics, the nature of the world economy, communication of persons on a global scale, socio-economic stratification of the world population and education, science and technology as global systems. Mixed lecture-discussion format, with Thursdays from 10-11 set aside for discussion only. (IDE, SSE)
(DR:5)

5 units, Win (Inkles) TTh 10-12

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

4 units, Aut (Thoresen) MW 9-11

233. Seminar in Cross-Cultural Counseling—(Same as Psychology 235.) How the New World experience has affected the adaptive strategies, acculturation patterns, family structure, predominant stresses, and support systems of Afro-Americans, American Indians, Asian/Pacific Islanders, and Hispanic Americans. Intensive analysis of the theory and practice of cross-cultural counseling, the cultural appropriateness of present mental health service delivery models, alternatives to individual counseling interviews, and the process of culturally adapting counseling interventions. Emphasis on multicultural and clinical competence with diverse ethnic minority groups. (PSE)

3 units, Spr (LaFromboise) M 1:15-3:05

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

3 units, Aut (J. Krumboltz) M 3:15-5:05
alternate years, given 1988-89

235X. Counseling and Therapy in Groups—Introduction to using small groups in counseling and therapy. Different theoretical models are examined (psychodynamic, 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, Spr (Krumboltz, Thoresen)
TTh 2:15-4:05
alternate years, not given 1988-89

235A. 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 9-10:50

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 (Thoresen) Th 10-12
and by arrangement
(Krumboltz) M 8-10 and by arrangement
(LaFromboise) by arrangement

238C. 4 units, Spr (Thoresen) Th 10-12
and by arrangement
(Krumboltz) M 8-10 and by arrangement
(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)

3 units, Win (Staff) TTh 2:15-4:05
243S. Education about the World: The U.S. in a Comparative Context—Assumption that during middle childhood and adolescence individuals build a representation of the world which has spatial, temporal, and power dimensions and usually includes their own country at the center. Includes: what is known about the characteristics of these representations in American students (some attention to those in other countries); how these representations are acquired and changed; the acquisition of skills associated with understanding world problems and foreign policy; implications for public opinion. Emphasis on existing approaches to global education in the U.S. and Europe, evaluation of their successes, critiquing existing empirical research, and deriving implications. (IDE, SSE, CTE) 3 units, Win (Torney-Purta) W 3:15-6:05

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. (IDE, SSE) 4 units, Win (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 (Staff) by arrangement
246B. 1-13 units, Aut (Staff) by arrangement
246C. 1-13 units, Win (Staff) by arrangement
246D. 1-13 units, Spr (Staff) by arrangement

247. Affective Education—Treats affect and emotion and looks clearly at social, ethical, and intellectual aspects of affect and their relation to cognition. (SSE, CTE) 3 units, Sum (Noddings) MW 3:15-5:05

250A,B. Statistical Analysis in Educational Research I—Two-quarter sequence for graduate students who expect to use statistical methods in their research. Covers 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 (Finn) MWF 11-12:30
250B. 4 units, Spr (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).

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 (telemicroelectronic, 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 1988-89

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 1988-89

255. Human Abilities—(Same as Psychology 155.) The nature, development, and measurement of intellectual abilities. Prerequisites: Psychology 1 and Statistics 60 or Psychology 60, or equivalent. (PSE) 3 units, Win (Snow) MWF 10

260X. Investing in Education of the Disadvantaged—The educationally disadvantaged...
represent a large rising portion of students in the American public schools. Failure to address their needs 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 M.A. students and undergraduates. (APA, SSE)

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

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

2-3 units, Aut (Applebee) T 4:15-6:05

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

263A. 3 units, Sum (Staff) TTh 3:15-5:05

263B. 2-3 units, Aut (Staff) 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 (Huebner) TTh 3:15-5:05

264B. 2-3 units, Aut (Huebner) M 3:15-5:05

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 (Hull) MW 3:15-5:05

267B. 2-3 units, Aut (Hull) 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 (Gross) 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

272. Literacy: Social and Historical Perspectives—Historical examination of writing systems, the impact of print, and links between social mobility and literacy are used 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, Aut (Langer) 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. The students meet with faculty members of the Area Committee. Provides orientation to the wide range of intellectual and research strategies represented by the social science faculty. Opportunity to interview faculty and to plan with them the topic of discussion for the evening of their course session. Each session is planned with relevant readings. This course 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

275X. Contemporary European Psychology—Introduces the broad range of contemporary European psychological theory and research and its contrasts and complementarities with U.S. work. Cognitive, instructional, and differential psychology emphasized but also research on human perception, motivation, volition, personality, life-span development, and social behavior. (PSE)

3 units, Aut (Snow) TTh 4:15-6:05

276. Feminist Perspectives on Ethics and Education—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, Spr (Noddings) TTh 2:15-4:05

277X. Education and Work—The action of traditional models of socio-economic structure and educational changes, concentrating on the rela-
relationship between education and work. Emphasis on functionalist and dialectical models. Literature includes work done in the U.S., Europe, and the Third World. Case studies illustrate the models. Open to students from all areas. (IDE)

5 units, Win (Carnoy) M 7-10 p.m.

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)

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

279. Leadership: Research, Policy, and Practice—A conception of leadership that includes the classroom, school, district office, and state capitol. Deals with the role complexity of teachers through superintendents, past and present, and how that complexity permitted leadership to arise. Case studies and theory covering over a century of schooling is introduced and discussed. (APA)

3-4 units, Win (Cuban) MW 9-10:50

280. Training Seminar: Ethnography of Schooling—(Same as Anthropology 214.) 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. (SSE)

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

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

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

4-5 units, Aut (Huebner) MW 10-11:50

283. Introduction to Educational Theories—Introduces theories relating schools to society, concepts of curriculum and teaching, and key normative issues facing educators including the relation of human diversity, of race, ethnicity, gender, and class, to equality in education. Aim is to sharpen students' analytical understanding of alternative conceptions of the purposes of education. (CTE, SSE)

284. 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 (Applebee) M 3:15-6:05 and by arrangement, alternate years, not given 1988-89

285. Language and Literacy in Secondary Schools—General survey of elementary school reading instruction, including phonics as an approach to word identification. Introduction to reading in secondary school subjects and to remedial reading. (CTE)

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

286. Adulthood—(Same as Human Biology 172X.) Explores 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 rela-
tionships, patterns of vocational choice, physiological changes, menopause, psychological stress, and aging. (PSE)
4 units, Win (Katchadourian) TTh 3:15-5:05

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

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

306B. Education and Political Change—(Same as Political Science 221.) Introduction to the analysis of the relations between education and politics from a comparative perspective. Attention to: 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 (Samoff) TTh 2:15-4:05

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) TTh 2:15-4:05

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, Spr (Weiler) M 3:15-5:05 and by arrangement, alternate years, not given 1988-89

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, Aut (Cohen) 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 evaluation 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, Spr (Cohen) MW 1:15-3:05
alternate years, 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, Win (Gross) Th 4:15-6:05

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 educa-
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)

T 7-10 p.m.

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

4 units, Win (Spindler, L. Spindler)

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: Students must be at least in the second year of their 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

325A, B. 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 so that students learn to conceptualize and critically review research designs and proposals. (APA)

325A. 1 unit, Aut (Strober) M 12–1:05

325B. 1 unit, Win (Strober) M 12–1:05

342A, B. Curriculum Construction—A practicum in design of curriculum materials. Each year an interdisciplinary area is chosen and materials developed for teaching it. The topic and age level change each year. All phases of curriculum planning and evaluation are covered. Prerequisites: 208A, B., consent of instructor. (CTE)

342A. 3 units, Win (Walker) W 6–9 p.m.

342B. 3 units, Spr (Walker) W 6–9 p.m.

343. Motivational Processes in Education—Primarily for psychological studies students interested in problems of motivation and perception in achievement-related situations. Content includes the study of traditional theories of motivation and related research, an in-depth examination of recent reconceptualizations of traditional theories of motivation in information processing terms, motivational development in children, including home and school influences, and educational outcomes. Attention to implications for classroom instruction, teacher training, and curriculum development. (PSE)

4 units, Spr (Ford) TTh 12:15–2:05

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 (Shulman) MW 3:15-5:05
alternate years, not given 1988-89

348. Educational Connoisseurship and Educational Criticism—Introduces literature dealing with forms of educational evaluation that employ artistic and qualitative rather than scientific and quantitative procedures. Provides opportunities to develop high levels of educational connoisseurship and fosters the development of writing skills in a critical mode. Students write, present, and compare educational criticism. (CTE)
4 units, Spr (Eisner) MW 9-11
alternate years, given 1988-89

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 (Haertel, Snow) T 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, Aut (Rogosa) MW 3:15-5:05
alternate years, given 1988-89

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, Win (Calfee) MW 1:15-3:05

353. Problems in Measurement—(Same as Psychology 249.) Survey of alternative mathematical models used in test construction, analysis, and equating emphasizing applications of item response theory (latent trait theory) to measurement problems, including estimation of item parameters and person abilities, test construction and scoring, tailored testing, mastery testing, vertical and horizontal test equating, and detection of item bias. Prerequisites: 250B and 252 or Psychology 152 and 248, or equivalent. (MME, PSE)
3 units, Aut (Atkin) MW 10-11:30

355X. Policy Issues in Science Education—Issues in science education at all educational levels and sites, emphasizing public primary and secondary schools. Oriented toward questions of science education policy: What science should be taught at different educational levels? For what purpose? To whom? By whom? Where? By what methods? How is effectiveness of science education programs to be assessed? (CTE)
4 units, Aut (Atkin) MW 3:15-5:05

358X. Research Seminar in Science Education—Researchable issues in science and technological education. Seminar offers an opportunity for students to identify and develop their research plans. (CTE)
4 units, Win (Atkin) MW 1:15-3:05

360X. Research Seminar on Education of the Disadvantaged—For students planning research on any aspect of the education of at-risk students. Will work with a qualified faculty member in their specialization in conjunction with the seminar. (APA, SSE)
4-5 units, Win (Levin) MW 3:15-5:05

369. Personnel Administration — Covers a range of personnel matters including selection and appraisal of personnel, collective bargaining, work-related stress, and dismissal. Treats the legal, social science, and educational aspects of these topics. (APA)
3 units, Sum (Bridges) TTh 10:30-12

376. Education and the Theories of the State—Explores the assumption that the basis for public education is the public good by reviewing theories of the state and their implications for the provision of public education. (IDE)
4 units, Spr (Cheresky) M 7-10

377. Organization and Style in Research Reports—Some major considerations in preparing formal reports of scholarship and inquiry, including theses and dissertations. Attention to organization; the achievement of clarity, technical, ethical and legal considerations; alternative conventions; general stylistic practices. (All Areas)
3-5 units, Aut, Spr (Coladarci) Th 10-12 and by arrangement
378X. Current Issues in Reading, Writing, and Language: A Socio-Communicative View of Literacy Instruction—Critical reviews of recent trends in reading research. Focus may be on reading/writing relationships, comprehension analysis, text analysis, or domain specificity and ways of understanding. Topics decided in class based on student interests. (CTE)

4 units, Spr (Langer) M 1:15-4:05
and by arrangement

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, Spr (Eisner) given 1989-90

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 (Arias) not given 1987-88

383. Recent Developments in Foreign Language Education—Second language teaching in the context of bilingual education and cultural pluralism. Student variables and problems of individualization of instruction. Description and evaluation of linguistic and cultural objectives. (CTE)

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

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, Spr (Arias) Th 3:15-6:05
and by arrangement

395. Education and Radical Change: African Experiences—(Same as Political Science 221S.) Education and radical change: schools as the targets of protest; education as a core element in development strategy. The education system in South Africa, the efforts of South African students, and the educational system as a mechanism for organizing broader changes. Also, efforts of educators in those African states that have achieved majority rule. (IDE)

5 units, Spr (Samoff) TTh 12:15-2:05 and by arrangement, alternate years, not given 1988-89

398X. Oral and Written Learning—The cultural and psychological factors that affect approaches to language use and literacy learning within home and school settings based on the belief that literacy learning is socially based, and that this foundation affects cognitive behaviors, communicative interactions, and interpretations of instructional events. Readings and discussions broaden understandings of sociocultural issues as they intersect with literacy and schooling. (CTE)

4 units, Spr (Langer) W 12:15-3:05
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 SEDC and SSE. (IDE, SSE)

408A. Research Workshop in IDE I.

2-5 units, Aut (Weiler) TTh 4:15-6:05

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 (Ramirez) TTh 4:15-6:05

415. Seminar in the Psychology of Reading—Topics for advanced students. Admission by consent of instructor. (PSE)

2-4 units, Win (Calfee) by arrangement alternate years, not given 1988-89

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,B,C,D. Internship in Educational Administration—A seminar for students in a 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. Research on Educational Administration and Policy Analysis: The Dissertation Proposal—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 1:15-3:05
426. Theory and Practice in Criterion-Reference Test 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 3:15-4:35 alternate years, given 1988-89

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 5:15-7:05 p.m., biweekly

453. Doctoral Dissertation—any quarter (Staff) by arrangement

455X. Advanced Seminar in Language, Literacy, and Culture: Current Issues in Reading Research—Critical review of recent trends in reading research. Focus on reading/writing relationships, emergent literacy, and domain specificity. (CTE)

4 units, Sum (Langer) T 1:15-4:05

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, Win (McLaughlin, Rogossa) TTh 2:15-3:30

461. Seminar in Art Education for Doctoral Students—An opportunity for doctoral students in art education to examine and critique specific research studies, reports, and theoretical materials published in the field and to present for group critique ideas and proposals that are being considered for doctoral dissertations. Students assume a major responsibility in the selection of the content for the seminar and for the ways in which the content is examined. Open to doctoral students in the School of Education who have a serious interest in understanding the role of the arts in education. Prerequisite: Consent of the instructor. (CTE)

2-3 units, Aut (Eisner) T 4:15-6:05 alternate years, given 1988-89

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 both 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. (CTE)

4 units, Aut (Applebee) M 3:15-5:05 and by arrangement, alternate years, not given 1988-89

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. Upon completing the seminar, students should be acquainted with the major problems in this field and ways these are addressed by current investigators. (CTE)

1-5 units, Win (Walker) T 7-9 p.m. and by arrangement

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

by arrangement

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

Aut, Win, Spr (Staff) by arrangement

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

by arrangement

490. Directed Research—For advanced graduate students. (All areas)

by arrangement

493A,B,C. 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) T 12-2 Win (Olkin, Rogossa) T 12-2 Spr (Finn) T 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
221. Issues in Policy Analysis
222A. Decision Analysis in Education I
222B. Decision Analysis in Education II
222C. Decision Analysis in Education III
224X. Microcomputers, Data Bases, and Data Management in Educational Policy
226X. Investing in Education of the Disadvantaged
229. Leadership: Research, Policy, and Practice
325A,B. Administration and Policy Analysis Research Seminar
360X. Research Seminar on Education of the Disadvantaged
369. Personnel Administration
377. Organization and Style in Research Reports
422A,B,C. Internship in Educational Administration
423. Research on Educational Administration and Policy Analysis

CURRICULUM AND TEACHER EDUCATION (CTE)

125X. Issues in Education
200. History of Education
208A,B. Introduction to Curriculum
209X. Introduction to Curriculum: Policy Focus
213. Aesthetic Foundations of Education
215. Psychological Foundations of Education (Same as Psychology 145.)
217X. Teaching a Global Perspective: Cross-Cultural Approaches
218. Perspectives in Dance (Same as Dance 268.)
219. Artistic Development of the Child
227. Educational Assessment of Linguistic and Culturally Diverse Populations
228. Psychology of Literacy
240. Adolescence: Health and Special Needs
243S. Education About the World: The U.S. in a Comparative Context
246A,B,C,D. Secondary School Teaching Practicum
247. Affective Education
262A. Curriculum and Instruction in English: Introduction
262B. Curriculum and Instruction in English: The Teaching of Literature
263A,B. Curriculum and Instruction in Mathematics
264A,B. Curriculum and Instruction in Foreign Languages
267A,B. Curriculum and Instruction in Science
268A,B. Curriculum and Instruction in Social Studies
269. Foundations of Learning for Teaching
272. Literacy: Social and Historical Perspectives
276X. 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
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
304. The Philosophical and Educational Thought of John Dewey
314. Seminar in Citizenship Education
321A,B,C. 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
355X. Policy Issues in Science Education
358X. Research Seminar in Science Education
377. Organization and Style in Research Reports
378X. Current Issues in Reading, Writing, and Language: A Socio-Communicative View of Literacy Instruction
380. Curriculum Development in the Visual Arts
382. Practicum in Cultural Pluralism
383. Recent Developments in Foreign Language Education
388. Recent Research in Bilingual Education: A Critical Appraisal
398X. Oral and Written Language Learning
455X. 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) (SIDE)C

161. Introduction to Teaching and Learning in Asia
175X. Women and Development in Africa—(Same as African and Afro-American Studies 175X, Anthropology 109, Feminist Studies 138.)
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.)
202. Social Science: Teachers and Schools
207X. International Cooperation in Education Development (Same as Political Science 248.)
210. Sociology of Education (Same as Sociology 210.)
211. Introduction to Philosophy of Social Science (Same as Philosophy 166.)

212A. Practicum in Ethnographic Futures Research I (Same as Anthropology 269A.)
212B. Practicum in Ethnographic Futures Research II (Same as Anthropology 269B.)
220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education
220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education
220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education (Same as Sociology 143.)
222A. Decision Analysis in Education I
222B. Decision Analysis in Education II
222C. Decision Analysis in Education III
225S. Democracy, Human Rights, and Educational Change
230S. Socialization: An International Perspective
231. Social Structure of World Society (Same as Sociology 152; Values, Technology, Science and Society 155.)
243S. Education About the World: The U.S. in a Comparative Context
245X. Origin and Diffusion of Mass Education
247. Affective Education
254A. Ethnographic Monitoring of Rapid Change II (Same as Anthropology 192A.)
254B. Ethnographic Monitoring of Rapid Change I (Same as Anthropology 192B.)
260X. Investing in the Education of the Disadvantaged
272. Literacy: Social and Historical Perspectives
276X. Feminist Perspectives on Ethics and Education
278. Introduction to Issues in Evaluation
280. Training Seminar: The Ethnography of Schooling (Same as Anthropology 214.)
288. Introduction to Educational Theories

304. The Philosophical and Educational Thought of John Dewey
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 398.)
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
360X. Research Seminar on the Education of the Disadvantaged
377. Organization and Style in Research Reports
405A,B,C. Research Workshop in International Development Education
460. Advanced Seminar in Evaluation Design

DIRECTED READING AND RESEARCH, DISSERTATION AND PRACTICA

180. Directed Reading in Education—Master's degree students. by arrangement
190. Directed Research in Education—Master's degree students. by arrangement
453. Doctoral Dissertation. by arrangement
470. Practicum—For advanced graduate students. Not for STEP students. by arrangement
470E. Practicum in Evaluation—For Evaluation Consortium members. by arrangement
490. Directed Reading—For advanced graduate students. by arrangement
490. Directed Research—For advanced graduate students. by arrangement
Dean: James F. Gibbons  
Associate Deans: Kenneth S. Down (Business Affairs), Robert H. Eustis (Academic Affairs), Dwain N. Fullerton (Development), Gordon Kino (Space Planning), Elliott Levinthal (Research)  
Assistant Deans: Mary Lou Allen, Linda Wells  
Consulting Professor of Engineering: Jeffrey Wadsworth  
Associate Professors: Gerald Fuller, Lambertus Hesselink, Bruce Lusignan, M. Elisabeth Paté-Cornell, Robert Sinclair  
Assistant Professors: Jeffrey R. Koseff, Sheri Sheppard  
Lecturers: David Lougee, Gerd 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), Gijo Wiederhold (Computer Science), Felix Zajac (Mechanical Engineering)  
OFFERINGS  
The School of Engineering offers four-year undergraduate programs leading to the degree of Bachelor of Science; five-year programs leading to both Bachelor of Science and Master of Science degrees; others leading to a Bachelor of Science with a Bachelor of Arts in a field of humanities or social science; dual degree programs with certain other colleges; and graduate curricula leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy.  
The school includes ten 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 there are 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 Aeroacoustics, 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 intending 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 Pro
grams." In addition, students would be well advised to 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 for departmental majors and School of Engineering majors must be taken for a letter grade.

For Chemical, Civil, Computer Science, Electrical, Industrial, Materials, and Mechanical Engineering majors, the average grade for all courses taken in fulfillment of the Engineer-
Fundamentals and Engineering Depth components of the major must be at least 2.0 letter grade indicator (LGI). In addition, for Electrical Engineering (E.E.), majors must receive at least a "C" LGI in the courses in the E.E. depth sequence.

For School of Engineering majors, the average LGI must be 2.0 or above on all engineering courses taken for the major.

DEPARTMENTAL MAJORS
Curricula for majors offered by the Departments of Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering have the following components: Mathematics (21 units minimum); Science (20 units minimum); Engineering Fundamentals (five courses); Values, Technology, Science, and Society (VTSS) (one course); Engineering Depth (45 units). Included within the courses taken to fulfill these curricular components is a requirement for eight units of experimentation. Further details are included in Notes 1, 2, 3, and 4 below. Lists of approved courses meeting the above requirements can be found in the Undergraduate Handbook available from the office of the Dean of Engineering, Terman 202.

Curricula offered by the School of Engineering and by the Department of Computer Science have their own structures 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 Undergraduate Handbook which can be obtained from the office of the Dean of Engineering.

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

* Science courses should include Chem. 31, 33, and 35.
** Chem. 171 may be substituted for Engr. 30 in Engineering Fundamentals.

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 3
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

* The additional units must be C.E. courses selected with the approval of the student's advisor.

The additional units must be C.E. courses selected with the approval of the student's advisor.

Specialty areas in C.E. available at Stanford include: Construction Engineering and Management, Environmental Engineering, Geotechnical Engineering, Resources Planning, Structural Engineering, and Water Resources Engineering. A list of recommended courses for students interested in any of these areas is available in the School of Engineering Undergraduate Handbook or from the Department of Civil Engineering Office.

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 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:** (26 units)
- Math 41, 42, 43. Calculus and Analytic Geometry 15
- Math 103 or 113. Linear Algebra 3
- C.S. 157. Logical Basis for Computer Programming or Phil./Math 160A. First-order Logic 4
  or
- C.S. 151.* Proof Techniques in Discrete Mathematics 1
- 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. Introduction to Software Engineering or
  C.S. 106A and 106B
- Engr. 40. Basic Electronics 5

**Computer Science Courses:** (42 units)
- C.S. 108A, B, C. Fundamentals of Computer Science 10
- C.S. 110. Introduction to Computer Systems and Assembly Language 4
- C.S. 140 Introduction to Concurrency 4
- C.S. 140L. Systems Programming Lab 1
- 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. 223. Logical Foundations of Artificial Intelligence or C.S. 224. Introduction to Artificial Intelligence 3
- C.S. 240. Operating Systems 3

**Project Courses††** 6

* Students with sufficient mathematical background will be exempted from this requirement with the approval of their advisor.

**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. 143B (3-6 units), C.S. 191 (3-6 units), C.S. 225A and 225B (6 units), C.S. 246 (3-6 units), C.S. 247 (3 units). Further details can be found in the School of Engineering Undergraduate Handbook.

Since this is the second year that a Computer Science major is being offered, some students who are currently Seniors may have transitional problems as they adapt to the new curriculum. Such students may petition the Computer Science Department for possible modifications to these requirements.

**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:**
- E.E. 101, 102. Circuits 6
- E.E. 131, 122. Digital, Analog Laboratory 6
- Engr. 102E. Writing for Electrical Engineering 1
- Comp. Sci. 106B. Software Engineering 5
- E.E. 141. Electromagnetic Fundamentals 3

**Specialty Courses** 9
- Electrical Engineering Electives 6

* Engineering Fundamentals should include Engr. 40 and 70A.

** Three courses from one of the specialty areas shown below (consultation with an advisor in the selection of these courses is especially important):**
- Controls: Engr. 105, 206, 207, 208, 209, 211, 212, 213, 216, 221, 238
- Fields and Waves: E.E. 142, 241, 242, 245, 246, 249, 252, 254, 256, 265
- Signal Processing: E.E. 104, 261, 263, 264, 279, 281

**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 3
- I.E. 125. Work Design and Measurement 4
- I.E. 133. Industrial Accounting 3
- I.E. 144. Simulation 4
- I.E. 235. Introduction to Financial Decisions 3
- I.E. 260. Analysis of Production Systems 3
- 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

Restricted Electives* 6


COMPUTER SYSTEMS ENGINEERING (C.S.E.)

Mathematics: (21 units)
Math. 41, 42, 43, 44. Calculus
Math. 103 or 113. Linear Algebra

Science: (12 units)
Phys. 51. Mechanics
Phys. 53. Electricity and Magnetism
Phys. 55. Light and Heat

Basic Engineering: (10 units)
Engr. 40. Electronics
Engr. 70X. Software Engineering

Depth: (48-49 units)
Comp. Sci. 108A,B,C. Fundamentals of Computer Science
Comp. Sci. 140. Introduction to Systems Programming
Comp. Sci. 140L. Systems Programming Lab
Comp. Sci. 143A. Compilers (4 units)
Comp. Sci. 240A. Operating Systems (3 units)
Elect. Engr. 101. Circuits
Elect. Engr. 111, 112. Electronics
Elect. Engr. 121. Digital Laboratory
Elect. Engr. 182. Digital Computer Organization

SCHOOL OF ENGINEERING MAJORS

The School of Engineering offers the degree of Bachelor of Science in Engineering. School of Engineering programs must be approved by the Undergraduate Council of the school. There are two types of programs: majors which have been proposed by cognizant faculty groups and have been pre-approved by the Council, and Individually Designed Majors. At present, there are three pre-approved majors, Aeronautics and Astronautics, Computer Systems Engineering, and Product Design. Total units required for these majors must be at least 90 and not more than 107.

AERONAUTICS 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
Math. 103 or 113. Linear Algebra

Science: (12 units)
Phys. 51. Mechanics
Phys. 53. Electricity and Magnetism
Phys. 55. Light and Heat

Basic Engineering: (10 units)
Engr. 40. Electronics
Engr. 70X. Software Engineering

Depth: (48-49 units)
Comp. Sci. 108A,B,C. Fundamentals of Computer Science
Comp. Sci. 140. Introduction to Systems Programming
Comp. Sci. 140L. Systems Programming Lab
Comp. Sci. 143A. Compilers (4 units)
Comp. Sci. 240A. Operating Systems (3 units)
Elect. Engr. 101. Circuits
Elect. Engr. 111, 112. Electronics
Elect. Engr. 121. Digital Laboratory
Elect. Engr. 182. Digital Computer Organization

SCHOOL OF ENGINEERING MAJORS

The School of Engineering offers the degree of Bachelor of Science in Engineering. School of Engineering programs must be approved by the Undergraduate Council of the school. There are two types of programs: majors which have been proposed by cognizant faculty groups and have been pre-approved by the Council, and Individually Designed Majors. At present, there are three pre-approved majors, Aeronautics and Astronautics, Computer Systems Engineering, and Product Design. Total units required for these majors must be at least 90 and not more than 107.
Elect. Engr. 183. Digital Logic Laboratory 3
Elect. Engr. 271. Introduction to VLSI Systems 3
Senior Project* 6

Total Units: 91-92

* Senior projects can be either course-based or independent study. The courses Elect. Engr. 272A and B satisfy the requirement as do Comp. Sci. 143B and/or Comp. Sci. 240B. 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** (See Note 3)
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. 103. 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.


INDIVIDUALLY DESIGNED MAJORS
Individually Designed Majors 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). It should be understood that the 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. 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 Individually Designed Majors 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 Office of the Dean of the School of Engineering, Terman room 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 on probability theory. The minimum preparation should normally include work to the level of Mathematics 43. Knowledge of ordinary differential equations and matrices is important in many areas of engineering, and students are encouraged to select additional courses in these topics.

Courses which satisfy the mathematics requirement are as follows: Math. 19, 20, 21, 22, 23, 41, 42, 43, 44, 43H, 44H, 45H, 103, 104, 106, 109, 113, 114, 120, 123, 130, 131, 132, 132, 139, or more advanced mathematics courses; Statistics 110, 116, or more advanced courses; Comp. Sci. 1, 60, 135, 237A,B,C,
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; Chem. 31, 33, 35, 36 (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 students with a breadth of knowledge concerning the major fields of endeavor within engineering. Second, it allows the incoming engineering student an opportunity to explore a number of courses before embarking 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. Basic Electronics
Engr. 50. Introductory Science of Materials

Note 4 (Val. Tech., Sci., & 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 engineering majors require one course on the interaction of technology with values and beliefs, social institutions, or behavior.


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

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

COTERMINAL DEGREE PROGRAMS

A Stanford undergraduate may work simultaneously toward bachelor's and master's degrees, i.e., A.B. and B.S., A.B. and M.S., A.B. and A.M., B.S. and M.S., or B.S. and A.M. The degrees may be granted simultaneously or at the conclusion of different quarters. Usually five years will be needed for a combined program.

Coterminal A.B. and B.S. Degree Program—To qualify for both degrees, a student must: (1) complete the stated University requirements and departmental requirements for each degree, (2) complete 15 full-time quarters or 3 full-time quarters after completing 180 units and (3) complete a total of 225 units (180 units for the first bachelor's degree plus 45 units for the second bachelor's degree.)

Coterminal Bachelor/Master Program — A Stanford undergraduate may be admitted to the University Division for the purpose of working simultaneously toward a bachelor's degree and a master's degree. To qualify for both degrees, a student must (1) complete 15 full-time quarters (or the equivalent) or 3 full-time quarters (or the equivalent) after completing 180 units; (2) complete, in addition to the 180 units required for the bachelor's degree, the number of units required by his or her graduate department for the master's degree (not fewer than the University minimum of 36 units); (3) complete the requirements for the bachelor's degree (department, school, and University) and apply for the degree at the appropriate time at the Office of the Registrar, and (4) complete the department and University requirements for the master's degree.

Admission to the coterminal program requires admission to graduate status by the pertinent department. Admission criteria vary from department to department.

Procedure for Applying for Admission to the Coterminal Degree Programs—A Stanford undergraduate may apply (using the University coterminal petition form) for admission to the coterminal bachelor/master program after the beginning of the eighth quarter of undergraduate 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 University; applications are reviewed by the appropriate department of the school before admission is authorized. Inquiries may be addressed to the Dean of Engineering or to the Chairman of the Department. While most graduate students have undergraduate preparation in an engineering curriculum, it is feasible to enter from other programs including chemistry, physics, or mathematics.
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

Flight 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

Artificial Intelligence and Expert Systems
Computational Mechanics
Construction Engineering and Management
Environmental Engineering and Science
Water Resources Engineering (including elements of hydraulics, hydrology, hydromechanics, and nuclear environmental engineering)
Resources Planning
Energy and Environmental Planning
Land Use Planning
Water Resources Planning
Structural Engineering
Earthquake Engineering
Reliability and Risk Analysis
Structural Analysis and Design
Structural Mechanics

ELECTRICAL ENGINEERING

Communications and Information Theory
Computer Applications and Systems
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
Orthopedic Biomechanics
Neuromuscular Biomechanics
Rehabilitative Engineering
Transport Phenomena in Biological Systems

ENGINEERING-ECONOMIC SYSTEMS
Decision Analysis
Energy Modeling and Analysis
Information Policy
Mathematical System Analysis
Social Analysis
System Economics

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. 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 the Electrical Engineering Department a superb integrated circuits facility is used in research on advanced medical instrumentation, such as ultrasonic imaging systems, Dopplershift blood flowmeters, and micropower implantable electronics for neural prostheses and biological microsensors. Also in Electrical Engineering advanced analysis techniques are applied to signal processing EKG, EEG, and X-ray image. Most research projects are carried out in collaboration with faculty of the Medical School or members of the local medical community.

A major new opportunity for bioengineering experience is now available in the 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 interdepartmental 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.

**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 ASSISTANTSHIPS

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, Aut (Sinclair) W 1:15-3:05

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 (Sinclair) 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)
and vector algebra are introduced and used. Prerequisite: Physics 51. (DR:8) 3 units, Aut (Barnett) MWF 9 Win (Springer) MWF 9 Spr (Ashley) 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 (Sheppard) MWF 9 Spr (Gere) 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; gyroscopes; balancing rotating machinery; vibrations, and dynamic response of simple mechanical systems. Writing dynamic system equations of motion, their solution and interpretation. Prerequisites: Math 23 or 43, and Physics 51. (DR:8) 4 units, Aut (Powell) MWF 9 Spr (Baganoff) 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: pollution control, biotechnology, energy production, and semiconductor processing. Prerequisite: Chemistry 31. 3 units, Spr (Frank, Fuller) 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: Engineering 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 (Johnston) MWF 10

35. Automotive Technology—An engineering description of today’s automobile, how it works and why it’s 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 (Powell) 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 elementary microprocessor. Basic function of electronic components including ideal diodes and transistors; tuned circuits. Laboratory assignments complement the lecture content. 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, Spr (Manning) MWF 11-12:15 one 3-hour lab weekly by arrangement

50. Introductory Science of Materials—Crystalline structure and of the microstructures that determine the important physical properties of engineering materials. Introduction to phase diagrams and their use in predicting phase changes in materials. Elementary treatment of diffusion and of the kinetics of reactions in solids. Discussion of methods for controlling the properties of engineering materials by controlling internal structure. (DR:8) 3 units, Win (Sherby) MWF 11 Spr (Sinclair) MWF 11

51. Materials Technology for Structural Applications—Metals, alloys, ceramics, glass, materials used primarily for their mechanical properties. Description of materials processing techniques, e.g., heat treatment used to develop optimum properties. Materials selection and processing for engineering applications. Prerequisite: 50. 3 units, Win (Wadsworth) 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 (Paté-Cornell) MWF 11
   (Staff) MWF 2:15
   Win (Sweeney) TTh 9:30-10:50
   Sum (Staff) MWF 10

62. Introduction to Operations Research I—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 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. Introduction to Software Engineering—(Enroll in Computer Science 106A.)

70X. Introduction to Software Engineering (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 this course may become paid speech instructors in the Technical Communications Program. Admission by consent of instructor.

3 units, Spr (Staff) M 7:30-10 p.m. Th 12:15

102E. Writing for Electrical Engineers—A writing course required of Electrical Engineering majors. Examines process of writing technical/ professional documents. Lectures, writing assignments, individual conferences. Co-requisite: Electrical Engineering 121. 1 unit, Win, Spr (Lougee, Staff) W 1:15

102S. Writing: Special Projects—Structured writing and instruction for students working on non-course-related materials (theses, dissertations, journal articles). Neither a course in remedial English nor an editing service, 102S aims to make students self-sufficient writers. 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 work as professionals.

3 units, Aut, Win, Spr (Lougee)

103. Public Speaking—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 (Staff) TTh 11-12:15
Win (Cannon) MW 11-12:15


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

176. Nuclear Energy—Theory, design, and applications of nuclear energy systems; radioisotope heat sources, fission chain reactors and concepts of fusion reactors. The information developed is applied to topics of current interest: nuclear waste disposal, health effects of nuclear radiation, fusion reactor development, laser separation isotopes.

3 units, Spr (Connolly) MWF 1:15

190. Problem Solving—(Same as VTTSS 181, Industrial Engineering 201.) 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 undergraduates and graduates in any field.

3 units, Spr (Adams) given 1988-89

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 (DeBra) TTh 11-12:15
Win (Franklin) TTh 11-12:15
Spr (Parkinson) TTh 8-9:15
lab by arrangement


3 units, Aut (Staff) TTh 1:15-2:30
Spr (Powell) TTh 11-12:15


3 units, Spr (Staff) MW 8-9:15


3 units, Sum (Wallenstein)

220A. Methods of Mathematical Physics—(Enroll in Mathematics 220A.) An exposition of characteristic and Green's function, integral trans-
form, variational, perturbation, and distribution theoretic methods for the analysis of differential, difference, and integral equations, with illustrative examples. Prerequisite: Some familiarity with differential equations and functions of a complex variable.

3 units, Aut (Keller)

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

3 units, Win (Keller)

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 suggest 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, given 1988-89

235A,B. Space Systems Engineering — 40-50 students, mostly from engineering, but also from business, political science, law, and education, 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.

235A. 3 units, Win (Banks, Lusignan)

TTh 1:15-3:05 and two hours by arrangement

235B. 3 units, Spr (Banks, 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 — 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; three additional units for optional workshops treating selected issues in more depth and writing a term paper. (Sequential registration is not required.)

1 unit, section 1 (lecture only) or 4 units, section 2 (lecture plus workshop) Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel, Textor) 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 one 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

AERONAUTICS

AND ASTRONAUTICS

Emeriti: (Professors) Nicholas J. Hoff, John V. Breakwell, Chi-Chang Chao, Krishnamurty Karamcheti, Erastus H. Lee, Jean Mayers Richard S. Shevell, Walter G. Vincenti
Chairman: Robert H. Cannon, Jr.
Associate Chairman: Daniel Bershad

Professors (Research): Dean R. Chapman, Bradford W. Parkinson, Leonard Roberts
Professor (Teaching): Richard S. Shevell
Associate Professors: Brian J. Cantwell, Lambertus Hesselink
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
- 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
- Aerelastic 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

AERONAUTICS AND ASTRONAUTICS

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

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); spacecraft thrustor 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.

Stanford's new Center for Automation and Manufacturing is located in the Guidance and Control Laboratories. It includes facilities for building and testing new control designs for flexible robots, with application to industrial automation and to free-flying space robots for which air-cushion-vehicle simulators are available. 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 emphasizes modern optical methods, including resonant interferometry and holography. There is also a specially designed laboratory for studies of aerodynamic noise. Other laboratories recently outfitted include dealing 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, gyroscopic behavior, vibration modes of a simulated wing, blunt-body flow with ballistic freeflight 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.

For the development and evaluation of new techniques, excellent facilities exist in the Fourier Optics and Optical Diagnostics Laboratory, including stable continuous wave and pulsed laser sources, extensive optical and electronic equipment, as well as a complete stand-alone digital image processing computer, linked to a VAX 11/780.

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 of prepreg tape. 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, 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 CSAA.

At the master’s level a program in Computational Fluid Mechanics (C.F.D.) is an option within the general structure of the master’s requirements. At this level, students interested in a still greater emphasis on C.F.D. 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 C.F.D. should prepare for the post master’s series in C.F.D. (A.A. 214A-C and A.A. 215A-B) by planning an M.S. program strong in mathematics and numerical analysis (Mechanical Engineering 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 C.F.D. program should be selected in consultation with the student’s advisor. Research topics in C.F.D. are supervised by a number of faculty members in both the Department of Mechanical Engineering and of Aeronautics and Astronautics. Students undertaking theses in C.F.D. 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. In addition to acoustics, specializations encompassed by the institute include: aerodynamics, fluid mechanics, flight dynamics, systems analysis, guidance and navigation. The Stanford University faculty and staff interfaces 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; a rotor noise lab to investigate the aerodynamics and noise of surfaces in motion at speeds ranging from 30 m/s to Mach 1 with special application to rotor noise, 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 JIIAA’s faculty, staff, and students.

**GENERAL INFORMATION**

The department sponsors a very active student branch of the American Institute of Aeronautics and Astronautics which holds weekly technical meetings and comprehensive faculty research-area seminars. It also conducts visits to nearby research, 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 (LCI) 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 LCI 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 LCI’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 substituted for credit toward the M.S. degree requirements only in Category D (Other Electives).

A. Basic Courses—Candidates will select eight courses as indicated.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Description</th>
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<tr>
<td>A.A. 200A1</td>
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<tr>
<td>A.A. 210A1 or A.A. 206A (Mech. Engr. 258A)</td>
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<td>A.A. 240A1 and (A.A. 240B or A.A. 246, A.A. 247 or A.A. 256)</td>
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<td>or A.A. 245A1 and (A.A. 245B or A.A. 246 or A.A. 247 or A.A. 249A)</td>
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<td>A.A. 242</td>
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<td>A.A. 271A1 or A.A. 279A</td>
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<td>A.A. 280 or A.A. 283A1</td>
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<td>A.A. 131</td>
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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...
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 9 units of graduate level work in the Department of Aeronautics and Astronautics. The petition must be accompanied by a statement explaining the objectives of the program, how it is coherent, contains depth, and fulfills a well-defined career objective. The grade and unit requirements are the same as for the Master of Science in Aeronautical and Astronautical Engineering.

**ENGINEER**

The University's basic requirements for the Engineer degree are outlined in the "Degrees" section in this bulletin. The following are department requirements. The candidate's study program must fulfill the department's requirements for the master's degree or their substantial equivalent. Beyond the master's degree, a total of 45 units of work is required, including a minimum of 30 units of courses. The 30 units beyond the master's degree are chosen as follows:

1. 24 units of approved electives, of which 9 shall be in mathematics and the remainder usually selected from one of the following fields: (a) Acoustics, (b) Aerelasticity, (c) Aerophysics, (d) Aerospace Structures, (e) Computational Fluid Mechanics, (f) Flight Mechanics, (g) Gas Kinetics, (h) Guidance and Control, (i) Physical Gas Dynamics, (m) Propulsion, and (n) Waves and Vibrations.

2. 6 units of free electives.

A list of courses currently accepted as approved electives can be obtained upon request to the department. Candidates for the degree of Engineer will be expected to have a minimum 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 three units of a directed research problem (course 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 dissertation draft in writing) but before final approval of his or her dissertation. The examination consists of a public seminar presentation of dissertation research, followed by substantive private 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.

**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 demonstrated research capability are eligible for halftime 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. Pre-requisites: Math 41, 42, elementary physics, or consent of instructor.

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, Lawless, 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, Spr (Hesselink, 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.)

135. Introductory Acoustics—The basic concepts of acoustics and their applications, on the basis of one-dimensional acoustic motion. Lectures with experimental demonstrations: one-dimensional acoustic motion of a homogeneous inviscid fluid; wave equation and its general solution; travelling plane sound waves; speed of sound in gases and liquids; sound energy density, flux, and intensity; intensity and pressure levels and the decibel scale; one-dimensional sound propagation in an elastic solid; mono- chromatic waves; frequency, wave length, wave number and phase speed; reflection and transmission of sound between different media; mass law of transmission through walls; acoustic impedance of surfaces and sound absorption; spherical and cylindrical waves; acoustic source and dipole radiators; analysis of acoustical systems—electrical and mechanical analogies; acoustic resistance, inductance, capacitance and impedance; combinations of various acoustic elements; filters and transformers; measurement of impedance and absorption coefficients; propagation through a rigid duct of varying cross section; introduction to acoustical measurements; remarks on the effects of friction and heat-flow, and of motion of the medium and sound propagation.

3 units, Aut (Staff) MWF 10


3 units, Aut (Bershader, 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; sound energy density, flux, intensity, and power; r.m.s. pressure; plane, spherical, and cylindrical waves; harmonic (monochromatic) waves; simple sound radiators; reflection and transmission of sound at interfaces between different media; multiple analysis of sound radiation—monopole, dipole, and quadrupole distributions; inhomogeneous wave equation; Kirchhoff integral representation; scattering and diffraction of sound, propagation through ducts—dispersion, attenuation, group velocity; sound in enclosed regions—reverberation; elements of sound propagation in an elastic solid. Prerequisite: First year graduate standing in engineering, mathematics, sciences, or consent of instructor.

3 units, Win (Staff) MWF 10
not given 1987-88

201B. Fundamentals of Acoustics—Continuation of 201A emphasizing the acoustics of moving and inhomogeneous fields. Effects of friction and heat flow on sound propagation in a homogeneous fluid initially at rest—equations, and boundary conditions; energy considerations; simple examples of plane wave propagation—longitudinal and transversal waves; general considerations introducing the notions of dilatational and rotational waves; effects on propagation in ducts; comments on sound absorption and dispersion owing to relaxation
processes; radiation from moving sources and dipoles; Doppler effect; propagation through a uniformly moving fluid—equations and energy relations; plane wave propagation in such a fluid; reflection and transmission at the interface of two differently moving fluids; radiation from a source in a uniformly moving fluid in a duct; acoustics of an inhomogeneous nonuniformly moving fluid; geometrical or ray acoustics; propagation in the atmosphere and the ocean. Prerequisite: 210A or equivalent or consent of instructor.

3 units, Spr (Staff) MWF 10
not given 1987-88

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 wings), supersonic flow, oblique flow, swept wings, thin airfoils, inverse methods for the linearized potential equation of similarity parameters. Review of solution techniques. Hands-on experience with aerodynamic design problems using back-of-the-envelope analyses, micro-computer based programs, and super-computer results. Prerequisites: 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, Spr (I. Chang) TTh 9:30-10:45
alternate years, not given 1988-89

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. Prerequisite: 192 (may be taken concurrently) and Mechanical Engineering 131A or equivalent.

3 units, Aut (Baganoff) MWF 1:15
Spr (Bershader) MWF 1:15

210B. Fundamentals of Compressible Flow — Continuation of 210A with emphasis on more general flow geometry. Use of exact solutions to explore the hypersonic limit and 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 nonsentropic flow. Real gas effects in compressible flow. Flows in various gas-dynamic testing facilities. Prerequisite: 210A.

3 units, Win (Baganoff) MWF 1:15

211. Physical Gas Dynamics—(Enroll in Mechanical Engineering 262A.)
212. Introductory Hypersonic Aerophysics—Dynamic and thermal fluid flow features of the hypersonic vehicle environment over a wide range of velocities and altitudes. Emphasis on thermochemical equilibrium behavior under hypervelocity conditions, with additional introductory material on nonequilibrium flows. The thermostatistical basis for the calculation of energies, specific heats, and shock strengths in dissociated and ionized gases. Effects of viscosity and heat conductivity to study drag, heat transfer, and overall flow field environment around high-velocity flight vehicles. Limitations of continuous gasdynamic analysis in the context of planetary atmospheric configurations. Recommended: Familiarity with the elementary concepts of compressible flow.

3 units, Win (Bershadler) TTh 8-9:15

213A. Atmospheric Entry—High-speed atmospheric entry subjecting vehicles to intense heating, decelerations, and structural loads. These phenomena are 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 are studied and their effectiveness compared. Example applications include 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 (Warming) TTh 9:30-10:45

215B. Advanced Topics in Computational Fluid Dynamics—Topics from recent developments in the field of computational fluid dynamics. Material related to the latest advances in algorithms producing high convergence rates, accuracy and robustness. 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 1988-89

221. Hypervelocity Flight—Flowfields about advanced aeromaneuvering vehicles at moderate to very high altitudes (around 100 km). The Navier-Stokes equations and the macroscopic gradient vector applied to real gas flowfields including the transport of mass, momentum, energy, chemical species, and
surplus 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 very high altitude).

3 units, Aut (Howe) MWF 1:15

222. Modern Developments in Reacting Flows—An introduction to the principles of chemical kinetics at high temperatures and low densities pertinent to the flight regimes of futuristic hypervelocity vehicles and objects. Collision processes leading to vibrational or electronic excitation; master equation; quasi-steady-state approximation to master equation; equations governing vibrational, electronic, and electronic excitation energies; mathematical formulation of chemical reaction rates (Bates-Kingston-McWhirter-Keck hierarchy); molecular dynamics approach to reaction rates; variational and diffusion approximations; vibration-dissociation coupling; electron-vibration coupling; and impact of these processes on overall reaction rates and radiation as applied to one-dimensional flows.

3 units, Win (Park) MW 8-9:15

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 microcomputers are part of homework assignments.

3 units, Spr (Baganoff) MWF 1:15 alternate years, given 1988-89

226. Modern Photodiagnosics 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 including laser-induced fluorescence, coherent Raman processes, and multi-photon processes. Emphasis is on the fundamental physical principles associated with the use of these processes for gasdynamic measurements. Recommended: 211 and 212.

3 units, Spr (McKenzie) TTh 2:45-4:05 alternate years, not given 1988-89

227. Atmospheric and Space Physics—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 corona of the Sun, and the solar wind in interplanetary space. Theory of Motion of a charged particle in electric and magnetic fields with application to Van Allen particles and cosmic rays. 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


3 units, Spr (I. Chang) TTh 9:30-10:45 alternate years, given 1988-89

230. Basic Aerodynamics of Rotary Wing Aircraft and Power Generators—Recent advances in rotary wing technology as applied to helicopter and VTOL aircraft, and the windmill. Fundamental aerodynamics of rotors, including general momentum theory, blade element theory, and an introduction to vortex theory. Aerodynamic and mission performance of the modern helicopter and other VTOL aircraft using simple preliminary design methods.

3 units, Aut (Schmitz) MWF 3:15 alternate years, not given 1988-89

231. Basic Rotor Control, Trim, and an Introduction to the Dynamic Stability of Rotary Wing Aircraft—The known methods of controlling the modern helicopter and other VTOL aircraft (tilt-rotor, tilt-wing, jet) and questions of control uniqueness and redundancy. The equations governing flapping and feathering of "rigid" and "soft" rotor systems including rigid blade response to control and body motion
inputs. The 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, Win (Schmitz, Lebacqz) MWF 3:15 alternate years, not given 1988-89

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, Spr (Hodges) MWF 3:15 alternate years, not given 1988-89

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.

3 units, Spr (Schmitz, Staff) MWF 3:15 alternate years, given 1988-89

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 include influence of mission requirements on pilot control strategy and examples of analytical models of the pilot for use in closed-loop control analysis and synthesis. Also, 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, given 1988-89

235A,B. Space Systems Engineering—(Enroll in Engineering 235A,B.)

236. Spacecraft Design—Design of unmanned spacecraft and spacecraft subsystems with concentration on identification of design drivers and current design methods. Topics: spacecraft configuration design, mechanical design, structure and thermal subsystem design, attitude control, electric power, command and telemetry, and design integration and operations. Prerequisites: 104, 240A, 242 or equivalents.

3 units, Win (Reeves) WF 11-12:15

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 are used to 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, given 1988-89

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 (Springer) 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 system; 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 (Reeves) WF 2:15-3:30

243A. Spacecraft Attitude Dynamics I—(Enroll in Mechanical Engineering 232A.)
243B. Spacecraft Attitude Dynamics II—(Enroll in Mechanical Engineering 232B.)
244A. Free and Forced Motion of Structures—Vibrations and forced response of linear systems with a finite number of degrees of freedom. Vibrations and forced response of continuous structures, developed in a framework of analytical dynamics; rods, beams, membranes and other elastic systems. Approximate methods for analyzing nonuniform and built-up structures. Finite-element methods in a dynamic context. Introduction to random responses and to nonlinear systems, with emphasis on stability. Prerequisites: 240A, 242.

3 units, Aut (Ashley) MWF 8

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, given 1988-89

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 of current interest: 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, given 1988-89

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, Spr (F. Chang) TTh 9:30-10:45

253A. Waves and Vibrations—(Enroll in Mechanical Engineering 236A.)
253B. Wave Propagation — (Enroll in Mechanical Engineering 236B.)


3 units, Spr (Springer) MWF 9


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 are given and 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. Stability and Control of Flight Vehicles—Stability and control of longitudinal and lateral modes of motion of aircraft and of orbiting spacecraft. Introduction to automatic flight control true systems. Prerequisites: 200A, 242, Engineering 105, or equivalents.

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


3 units, Spr (Bryson) MWF 8 alternate years, not given 1988-89


3 units, Win (DeBra) TTh 8-9:15 alternate years, not given 1988-89


3 units, Spr (Staff) TTh 8-9:15 alternate years, not given 1988-89

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 Logic—(Enroll in Engineering 209.)


3 units, Win (Bryson) TTh 2:45-4

presence of uncertainty. Prerequisites: 278A and Statistics 116E (or equivalent).
3 units, Spr (Staff) TTh 2:45-4

3 units, Win (Breakwell) MWF 11

alternate years, given 1988-89

279A. Space Mechanics—Orbits of near-earth satellites and interplanetary probes; transfer and rendezvous; decay of satellite orbits; influence of earth’s oblateness; sun and moon effects on earth satellites.
3 units, Win (Powell) TTh 9:30-10:45

279B. Advanced Space Mechanics—Effects of several centers of attractions; restricted three-body problem; libration points; Encke’s method for accurate orbit computation; expansion matching for lunar and interplanetary orbits. Hamilton’s principle and elements of the calculus of variations; canonical perturbation theory; application to nonlinear oscillations and orbital analysis; nonlinear resonances. Prerequisite: 279A.
3 units, Spr (Breakwell) MWF 10

alternate years, given 1988-89

279C. Optimal Space Trajectories—Optimal interception and rendezvous in free space; optimal transfer in a central field, for either high-thrust or low-thrust propulsion; the power-limited case; optimal orbit corrections, interplanetary guidance. Prerequisites: 278A, 279A, or equivalent.
3 units, Spr (Breakwell) TTh 9:30-10:45

alternate years, not given 1988-89

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 1:15-2:30

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

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, Win (Cantwell) TTh 1:15-2:30

alternate years, not given 1988-89

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, given 1988-89

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, Aut (Chang) TTh 2:15-3:30

alternate years, given 1988-89

297. Seminar in Mechanics and Control of Flight—Problems in all branches of vehicle control, guidance, and instrumentation pre-
sented 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: (Professor) David M. Mason
Chairman: George M. Homsy
Professors: Andreas Acrivos, 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. Gast
Senior Lecturer: Robert H. Schwart
Lecturers: Shari B. Libicki, James C. Schlatter
Consulting Professors: A. John Appleby, C. Richard Brundle, Ralph Dalla Betta, 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.

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

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.

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 Engi-
neering 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 insure that an appropriately balanced program is being taken by all M.S. candidates, the student’s program must be approved by the departmentally appointed graduate advisor, and a 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 six 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. The remaining courses, to total 60 units, may be chosen from the basic sciences and engineering, including up to six units of Chemical Engineering 270 through 278. A few selected students may participate in a research project during their first year. Following consultation with their advisor and approval by the Graduate Committee, they may register for up to six units of Chemical Engineering Research. This research need not be the same as the student’s ultimate Ph.D. research. These 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 Department of 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 examined on the Engineer’s research work for the purpose of qualifying for the Ph.D. If the request is granted, the student’s thesis must be available in its final form for inspection by the faculty and must have been approved by the Reading Committee at least two weeks prior to the scheduled date of the examination.

DOCTOR OF PHILOSOPHY

The Ph.D. degree is awarded 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 six units of Chemical Engineering 270 through 278. A few selected students may participate in a research project during their first year. Following consultation with their advisor and approval by the Graduate Committee, they may register for up to six units of Chemical Engineering Research. This research need not be the same as the student’s ultimate Ph.D. research. These 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 Department of Chemical Engineering.

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 examined on the Engineer’s research work for the purpose of qualifying for the Ph.D. If the request is granted, the student’s thesis must be available in its final form for inspection by the faculty and must have been approved by the
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 requirements 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 (Frank, Fuller)

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 (Homsy) 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 (Acrivos) MWF 9

3 units, Aut (Staff) MWF 11

160. Chemical Engineering Plant Design—Application of chemical engineering principles to design of practical plants for manufacture of chemicals and related materials. Topics: equip-
ment 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 (Schwaar) 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 (Staff) 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 (Fuller, Homsy) TTh 9:30-10:45


3 units, Win (Acrivos, 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, Acrivos) 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, Spr (Fuller) TTh 11-12:15


3 units, Aut (Fuller) MWF 2:15-3:30 alternate years, given 1988-89

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, Gast) TTh 1:15-2:30

231. Catalysis and Surface Science—Fundamental concepts and definitions of reaction kinetics; structure of metal surfaces. Kinetics of overall reactions; elementary steps; adsorption, desorption and surface reaction. Kinetics of two-step reactions on nonuniform surfaces. Sur-

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


3 units, Spr (Frank) MWF 2:15-3:30

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

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 enrolled in this course should 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: James M. Gere, Paul V. Roberts


Associate Professors: Anne S. Kiremidjian, Peter K. Kitanidis, Raymond E. Levitt, Clyde B. Tatum

Assistant Professors: David L. Freyberg, Dunja Grbić-Galic', H. Craig Howard, Jeffrey R. Koseff, Stephen G. Monismith, Peter M. Pinsky, Lyna L. Wiggins

Professor (Research): C. Allin Cornell

Associate Professor (Research): Martin Reinhard

Professor (Teaching): Gilbert M. Masters

Courteous Professors: Thomas J. Hughes, George S. Springer

Acting Assistant Professor: Ronaldo I. Borja

OFFERINGS AND FACILITIES

The undergraduate Civil Engineering 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 coterminal 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 programs with particular strength in:

- Artificial Intelligence and Expert Systems
- Computational Mechanics
- Construction Engineering and Management
- Computer Applications
- Human Resource Management
- Legal and Contractual Administration
- Operations Analysis and Design
- Project Planning, Estimating and Control
- Environmental and Water Studies
- Environmental Engineering and Science
- Water Resources
- Resources Planning
- Energy and Environmental Planning
- Land Use Planning

Water Resources Planning
Structural Engineering
Earthquake Engineering
Reliability and Risk Analysis
Structural Analysis and Design
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 is being formed in collaboration with the Department of Computer Science. The major thrust of the new Center for Integrated Facilities Engineering (CIFE) will be to employ advanced CAD database, artificial intelligence, and communications concepts to integrate the presently fragmented participants in the facility development process. CIFE will be launched in the Autumn Quarter of 1987 and will stimulate significant new research and educational activities in the two departments.

PROGRAMS OF STUDY

COMPUTATIONAL MECHANICS, ARTIFICIAL INTELLIGENCE, AND EXPERT SYSTEMS

These interdisciplinary fields are having an important effect on civil engineering primarily because of the availability of fast and efficient computers and new kinds of programming languages. Programs in these fields are made up of courses from civil engineering, applied mechanics, numerical analysis, computer science, mechanical engineering, and electrical engineering.

Strong teaching and research ties exist between the structures program in civil engineering and the applied mechanics program in mechanical engineering, especially in computational mechanics.

We offer two programs in Artificial Intelligence and Expert Systems. At the master's level, students will take a three course sequence in Computer Science (C.S. 22, 157, and 224), a three course sequence in Civil Engineering (C.E. 210, 212, 214) and develop an approved program of depth in one of the application areas in Civil Engineering (i.e., Structures, Construction, Water Resources/Environmental Engineering, or Resources Planning). At the Ph.D. level, students will take approximately one year of course work in Computer Science (possibly leading to a master's in Computer Science or Artificial Intelligence) in addition to a year of course work in a traditional civil engineering area, and will complete a dissertation involving advanced applications of Artificial Intelligence/Expert Systems to civil engineering problems.

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 will be active participants in the new Center for Integrated Facilities Engineering (CIFE) to be 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 environ-
ment. 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 specialty 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 ENGINEERING

Instructional programs and research opportunities are provided in several areas of structural engineering. Particular emphasis is given to earthquake engineering, risk and reliability analysis, computer aided structural analysis and design, computational mechanics, structural dynamics, and finite-element methods. Flexible programs enable students to prepare for careers as consulting engineers or as engineers in industry, government, and universities. The John A. Blume Earthquake Engineering Center provides support and facilities for instruction and research in earthquake engineering and structural dynamics.

Related coursework is available from other departments such as geology, geophysics, computer science, and mechanical engineering. The computer facilities and library of the Blume Center are available to graduate students. In addition, weekly seminars provide the opportunity for discussions with practicing engineers.

Structural Engineering faculty and students from the program will be active participants in the new "Center for Integrated Facilities Engineering" to be launched in 1987. Several post-M.S. students are currently working on problems at the interfaces between financial planning, analysis design, construction, facility operation, maintenance, and rehabilitation, and are taking advanced coursework in computer science and artificial intelligence to support this research.

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.

UNDERGRADUATE HONORS PROGRAM

This program leads to a Bachelor of Science with Honors in Civil Engineering. The program
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.

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 a "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 $19,500. A generous student loan program is available. Applications for financial aid and assistantships should be filed by January 15; it is important that GRE scores be available at that time.

Teaching assistantships (normally awarded only to Engineer and Ph.D. candidates) carry stipends for as much as one-half time work as teaching aides during the academic year. Research assistantships are also available. Engineer and Ph.D. candidates may be able to use research results as a basis for 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.

ADMISSION

Admission as a graduate student in Civil Engineering is obtained by applying to the Office of Graduate Admissions. Applications normally require submission of the application form, statement of purpose, letters of recommendation, results of 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.

COURSES

UNDERGRADUATE


3 units, Spr (Lepore) 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 with priority given to seniors in civil engineering. Prerequisite: Computer Science 106A or equivalent.

4 units, Spr (Howard) MW 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 (Wiggins) MWF 10


3 units, Spr (Staff) MW 3:15-4:30
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 (Staff) 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 structures; markets for key construction resources and products; and techniques used in estimating, planning, coordinating and controlling time, cost, quality, and scope. Limited to juniors, seniors, and graduate students. This is an appropriate course 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

150. Legal and Professional Aspects of Civil Engineering—Fundamental concepts of contract law. Types and selection of construction contracts. Procedures for advertising, awarding, and administering construction contracts. Specifications and their cost impacts. Liability of engineers. Engaging professional services. 3 units, Aut, Win (Fondahl) TTh 11-12:15

160. Water Resources—The role and movement of water in the environment. Introduction to hydrologic processes, including precipitation, infiltration, water use by vegetation, water movement in soils, and runoff. Water resources analysis and development. Flood and drought hazard analysis. Water supply and use. Water law and institutions. Prerequisite: Engineering 21. 4 units, Aut (Kitanidis) 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) MWF 10 plus one hour by arrangement

162. Transport and Mixing Processes in Surface Water Flows—(Graduate students enroll in 262.) Application of fluid mechanics to problems of pollutant transport and mixing in the water environment. Mathematical and numerical models of advection, diffusion, dispersion, dilution, and attenuation. Prerequisite: Engineering 21. Recommended Co-requisite: 161. 3 units, Aut (Koseff) MWF 10

170. Environmental Science and Technology—(Same as VTIS 182.) An introduction to the causes, effects, and methods of controlling 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 non-science majors. (DR:8) 3 units, Aut (Masters) MWF 8

171. Environmental Planning—(Same as 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 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, given 1988-89

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

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 suitable for a single dwelling or small cluster of buildings. Emphasis on solar water heating and passive and active solar space heating. Photovoltaics and wind-electric systems are considered. 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) MF 1:15 plus one 3-hour lab weekly by arrangement; not given 1986-87

180. Elementary Structural Analysis — Analysis of beams, trusses, frames; influence lines for beams, girders, trusses; 3-dimensional
trusses, deflections by virtual work, moment area, elastic loads; indeterminate analysis by superposition equations, slope-deflection, moment distribution. Introduction to matrix methods and computer methods of structural analysis. Prerequisites: Engineering 11 and a year of calculus.

4 units, Aut (Kiremidjian) MWF 10 and W 1:15-3:05

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 (Krawinkler) 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 and 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 (Borja) MWF 11 laboratory 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 engineer-
edge 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.

3 units, Spr (Lecitt) MW 10

plus one hour to be arranged

220. Seminar in Resources Planning—Discussion by faculty and students on aspects of land planning and use, energy, and water resources planning. Introduction to planning theory: the alternative roles of the civil engineer/planner. Students will complete a short computer assignment using LOTS. Restricted to students in the graduate program in Resources Planning or by special permission.

1 unit, Aut (Staff) TTh 1:15-2:30

221. Economics and Infrastructure Planning—Applications of microeconomics in the planning and management of physical infrastructure. A survey of basic elements from theories of demand, production, input-output analysis, and welfare economics. Role of economics in environmental equality management and in benefit-cost analysis. Planning and evaluation in the face of multiple-objectives. Prerequisite: Math 43. Students with no prior exposure to economics, matrix algebra and Lagrange's method of undetermined multipliers should co-register in 221A.

3 units, Aut (Staff) TTh 1:15-2:30

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

1 unit, Aut (Staff) W 10-12

first five weeks of quarter only.

222. Planning and Management Methods—Role of research and analysis in infrastructure planning; research design and problem formulation; theory construction and hypothesis formulation. Role of forecasting in the planning process; time series analysis; judgmental forecasting techniques; population forecasting. Planning applications of the general linear model. Prerequisites: 203 and 220 or consent of instructor.

3 units, Win (Wiggins) MWF 11

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, Spr (French)

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

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

228. Environmental Planning—With additional assignments for students who desire graduate credit.

4 units, Win (Ortolano) TTh 1:15-2:30

alternate years, given 1988-89

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 (Campbell) M 2:15-4:05

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 9-10:30

alternate years, given 1988-89

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

237. Utility Systems Planning—Methods of forecasting demand for electric energy; incorporating conservation and uncertainty into demand forecasts; choice of technology including
political, environmental and cost considerations; implications of incorporating alternative technologies into the existing supply mix; the state role in determining need; system reliability; current issues, including rate making procedures, avoided cost pricing for cogenerators, and utility deregulation. Prerequisite: 222 or consent of instructor.

3 units, Spr (Wiggins) MWF 2:15-3:05

238. Planning for Decentralized Energy Systems—Defining and planning for an energy future that emphasizes energy efficiency and renewable energy systems. Solar access, subdivision planning, building codes, community energy audits, local energy plans, energy legislation. Solar/utility interface and cogeneration. Prerequisite: 176 or 236.

3 units, Spr (Staff) TTh 7 p.m.

239. Facility Siting—Site selection procedures for facilities which are difficult and controversial to locate because of their social and environmental externalities: landfills, hazardous waste sites, conventional power plants, and alternative energy systems. Siting techniques including constraint mapping, optimization procedures and decision analysis. New planning strategies, including environmental dispute resolution. Prerequisite: 234 or consent of instructor.

3 units, Spr (Wiggins) MWF 10

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, Aut (Fondahl, Tatum)

MW 9, F 9-10:50

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 course 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.

4 units, Win (Paulson, Katz) MWF 10-12

244. Marketing Construction Services—An introduction to the business aspects of marketing, business development, and selling for contractors and engineers. Establishment of a marketing plan: the contract as a marketing tool; bidding strategy; meeting competitive pressures; brochures; the call and the conference; prequalification; the proposal; salesmanship and advertising; change orders and claims; product development; pricing; and negotiations.

2 units, Win (Barrie) M 1:15-3:15


4 units, Spr (Fondahl) MWF 8 plus one hour by arrangement

248. Construction Financing in Real Estate and Land Development—The interrelationships between all of the variables that make up a successful real estate project. Emphasis 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, with 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

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) MW 10-11:50

252. Construction Methods and Estimating — Methods and equipment selection together with techniques for estimating and bidding construction works. Construction engineering topics include various equipment methods, and temporary facilities. Estimating topics include site investigation, quantity take-off, work analysis, costing and bid preparation. Prerequisites: 145 and 255.

3 units, Spr (Barrie) M 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, Win (Tatum) TTh 8-9:50

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.

259A. 1 unit, Aut (Staff) by arrangement

259B. 1 unit, Win (Staff) by arrangement

259C. 1 unit, Spr (Staff) by arrangement

259A,B,C. Construction Problems — Analysis of group selected problems in construction techniques, equipment, or management, followed by preparation of oral and/or written 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.


4 units, Win (Freyberg) MTWF 1:15

261. Watershed Hydrology — Techniques and models for the analysis of watershed hydrology, focusing on the flow of water on and near the earth's surface. Runoff generation mechanisms. Role of spatial and temporal variability. Analysis of watershed models with emphasis on calibration, parameter estimation, and practical application. Prerequisite: 160 or equivalent. Recommended corequisite: 260.

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

262. Transport and Mixing in the Environment — Same as 162 with additional assignments for students who desire graduate credit.

3 units, Aut (Koseff) MW 10

263. Modeling Environmental Flows — Introduction to turbulence concepts and models, and to basic concepts of computer modeling of turbulence. Application of models to open channel, estuary, lake, and reservoir simulations. Use of computer models for flood wave routing in dendritic river systems, for reservoir dynamics and for stream water quality. Prerequisites: 161, 162.

3 units, Win (Koseff) MWF 11

264. Problems in Water Resources — Detailed examination of a current problem in water resources. Topic varies each year, drawn from the general areas of groundwater flow and transport or experimental methods in environmental fluid mechanics. Seminar format. Consent of instructor required.

3 units, Spr (Kitanidis) MWF 10

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 are considered 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. Prerequisite: Experience with spreadsheets and communications software.

4 units, Win (Staff) TW 3:45-5

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 one 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 with emphasis on treatment process combinations for drinking water supply. Application of principles of chemistry, rate processes, fluid dynamics, and process engineering to define and solve water treatment problems. Control of particulate and dissolved pollutants by flocculation, sedimentation, filtration, disinfection, and adsorption. Prerequisites: 270 and Engineering 21 or equivalents; or consent of instructor. Recommended: 273.

3 units, Win (Roberts) MWF 8

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 (Roberts) MWF 11

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

272. Environmental Health Risk Assessment—(Enroll in 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, Spr (Pate-Cornell, North)

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 plus F 1:15

273A. Water Chemistry Laboratory—Laboratory application of techniques for the analysis of natural waters and wastewaters; special emphasis on instrumental techniques.

2 units, Aut (Leckie) T 1:15-5:05

274. Environmental Microbiology—Fundamental aspects of microbiology and biochemistry; microbial metabolism and growth, genetics, identification 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 control processes.

3 units, Aut (Grbič-Galić) TTh 10 M 1:15

274A. Environmental Microbiology Laboratory—Experimental approach to understanding fundamentals of microbiology; topics include morphology, metabolism, ecology, growth, microbial interactions, and water quality parameters.

2 units, Aut (Grbič-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: 273 and 273A.

3 units, Win (Leckie) by arrangement alternate years, given 1988-89

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: 274 and 273A (or equivalent) and 271B.

3 units, Spr (McCarty) M 1:15-5:05 and Th 2:15-5:05, alternate years, not given 1988-89
3 units, Spr (Grbic-Galic) TTh 9 F 1:15
alternate years, not given 1988-89

1 unit, Spr (Leckie) W 4:15

280. Matrix Analysis of Framed Structures—Theory of matrix methods for the analysis of framed structures. Virtual work and variational principles; force and displacement methods; formulation of element flexibility, stiffness, geometric stiffness, and mass matrices; element load vectors (including thermal effects); assembly and solution procedures; substructuring techniques; elastic stability, introduction to programming procedures. Prerequisites: Elementary structural analysis and linear algebra.
4 units, Aut (Pinsky) MWF 11
F 2:15-3:15, computer problems session

4 units, Win (Pinsky) MWF 11
F 3:15-4:15, computer problems session

282A. Earthquake Engineering I—Earthquake phenomena, faulting, ground motion; study of past major earthquakes; effects of earthquakes on man-made structures; response spectra; Fourier spectra; structural dynamics; analysis and design of structures; building codes; current research in earthquake engineering.
3 units, Win (Cere) MWF 9

282B. Earthquake Engineering II—Earthquake motions and their engineering interpretation; 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 9

285. Design of Structures I—Steel design; inelastic behavior of structures; limit analysis and limit design; ultimate strength of structural elements; collapse loads for frames. Reinforced concrete design; columns-axial load plus bi-axial bending; 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
and W 2:15-4:05

286. Design of Structures II—General aspects of design; serviceability and failure criteria; types of loading; methods of design; structural systems for buildings; 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, Spr (Krawinkler) TTh 9 and 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

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.
4 units, Win (Borja) TTh 9-10:50

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.
4 units, Spr (Borja) TTh 1:15-3:05
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: 180 and Engineering 12.
3 units, Aut (Gere) TTh 9-10:50

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.
3 units, Spr (Pinsky) MWF 11

298. Structural Engineering Seminar—Lectures on topics of current interest. Recommended for all graduate students.
1 unit, Aut (Krawinkler) W 4:15
Win (Gere) 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 11-12:15


3 units, Aut (Kitanidis) MWF 11

3 units, Aut (Monismith) TTh 9-10:30

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

2 units, Spr (Roberts) TTh 10 alternate years, not given 1988-89

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, Win (Leckie) TTh 9 alternate years, not given 1988-89

374. Microbial Degradation of Organic Pollutants—Analysis of mechanisms, biochemistry and enzymology 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, detoxifica-
tion 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 (Grbic-Galic) TTh 9 F 1:15 alternate years, given 1988-89


2 units, Win (McCarty) TTh 9 not given 1987-88

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, Win (Shah) TTh 11

399. Advanced Engineering Problems—Individual projects on selected topics. Provides for independent graduate work under the direction of a faculty member on a subject of mutual interest. Student must 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 C. Herriot, (Professor, Research) Arthur Samuel

Chairman: Nils J. Nilsson
Associate Chairman: Lester Earnest
Assistant Chairman for Education: Stuart T. Reges
Assistant Chair for External Relations: Carolyn E. Tajnai


Associate Professors: David Cheriton, Michael Genesereth, Jean-Claude Latombe, Joseph E. Oliger, Terry Winograd

Assistant Professors: Anoop Gupta, Manolis G. H. Katevenis, Keith A. Lantz, Ernst Mayr, Paul Rosenbloom, Yoav Shoham

Professors (Research): Thomas Binford, Bruce G. Buchanan

Associate Professor (Research): Gio Wiederhold

Associate Professor (Teaching): Charles A. Bigelow

Courtesy Professor: Michael J. Flynn (Electrical Engineering)

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 Lecturer: Jean Rogers

Lecturers: Roy Jones, James Wilson


Consulting Associate Professors: Richard P. Gabriel, Stanley J. Rosenschein

Consulting Assistant Professors: Joseph Y. Halpern, Fernando C. N. Pereira

Visiting Professor: Herbert S. Wilf

Visiting Associate Professor: Phokion G. Kolaitis

Industrial Lectureships: Cynthia Dwork, Paul Haley, John Sowa

FACILITIES

There are five large computer systems 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.

Sushi is a DECsystem-2065 running TOPS-20. It has 2.5 million words of main memory and 1.1 billion bytes of disk storage. Sushi is available to all graduate students of the department for unsponsored work.

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.

Navajo is a VAX11/780 running Berkeley Unix and is used predominantly for departmental research. There are 11 VAX computers running Unix associated with specific research projects.

The Computer Science (C.S.) Department also operates approximately 40 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 Sushi, SAIL, or Navajo, unsupported Masters students are offered Sushi accounts with access to other systems as needed.

The department conducts a weekly colloquium (C.S. 500), presented by the staff and visiting scientists, which covers a spectrum of current topics. A lecture series (C.S. 300) is offered, during Autumn Quarter and presented for new students, at which members of the department speak informally on their research interests and their views on the nature of computer science.

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 section “Degrees” 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.

MASTER OF SCIENCE IN COMPUTER SCIENCE

The degree “Master of Science in Computer Science” (M.S.C.S.) is intended as a 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. These applications will be considered each quarter for the next. 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 a 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), 108A, 108B, 110, 112, Math 109 or 120, Phil. 160A.

2. The following core courses or their equivalents must be completed: C.S. 137 or 237A, 140, 143A, 151, 154, 157, 161, 212, 223 or 224, 240A, 261, 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.

3. At least one, but no more than three 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. C.S. 393 (Computer Laboratory) is an approved elective and, subject to advisor approval, may be used for partial fulfillment of the requirements in any of the specializations.

1. Numerical Analysis/Scientific Computation
   a) The following courses: C.S. 237A, 237B, 237C.

2. Systems (23 units)
   b) At least three of the following courses: C.S. 211, 243, 244, 245, 312, Elect. Engr. 271, 243.
   c) At least 6 units selected from the remainder of the previous group and the following courses: C.S. 246, 247, 248A, 248B, 265, 317, 318, 340, 342, 343, 344, 345, Elect. Engr. 183, 272A, 272B, 281, 312, 374, 482, 486, 487.

3. Software Theory
   a) The following courses: C.S. 242, 243, 250, 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, 263.

5. Symbolic and Heuristic Computation
   a) The following courses: C.S. 223 and 224, 257, 323.
   b) At least 12 units from the following courses: C.S. 225A, 225B, 254, 275, 276, 306, 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, 393.
   b) At least two of the following courses: C.S. 225A, 244, 262, 265, 347.

MASTER OF SCIENCE IN COMPUTER SCIENCE:
ARTIFICIAL INTELLIGENCE (M.S.A.I.)

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, Bruce Buchanan (Chairman), 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. To be considered for this program, an application should reach the Office of Graduate Admissions by January 1.

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 subsequent Ph.D. application. Students planning to obtain the Ph.D. degree are strongly advised to apply directly for admission to the Ph.D. program.

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 three AI courses (9 units):
   a) C.S. 223.
   b) C.S. 225A.
   c) At least one of C.S. 225B, 271B, 275, 276, 326, 327A,B,C or 520.

2. Classical hardware and software (6 units): C.S. 242 and 261 are required. Students with prior equivalent courses may choose two from the following: C.S. 211, 212, 240A, 243, 245, 312.

3. Theoretical computer science (3 units), choose one course from: C.S. 157A or 306.

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 advisor, 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 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 section "Degrees" 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:
   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 two units as a teaching fellow for the same course.
   d) One unit as a teaching assistant for a course numbered 300 or above, and two 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 certif...
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.

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.

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.

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 ASSISTANTSHIP
Graduate student assistantships are available. Assistants receive a tuition scholarship for up to nine units of study per quarter during the academic year, and in addition receive stipends of at least $8,750 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 help an instructor teach a course by conducting discussion sections, consulting with students, grading examinations, etc. Research assistants help senior staff members with research in computer science. Approximately two hours of the work week are spent in attendance at Computer Science Department colloquia and seminars. Nearly all teaching and research assistantships are held by Ph.D. students in the Computer Science Department. 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, then 108A, 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. 108A, B together with 110 constitutes an 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.

There are two-quarter alternatives to C.S. 106X for students who have less previous ex-
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 about issues involving the computer and its relation to society should take C.S. 101.

To summarize the options for introductory Computer Science courses:


**For significant use**—C.S. 106A or 106H, C.S. 106B.

**For scientific/technical use**—C.S. 106A or 106H.

**For non-technical use**—C.S. 105A.

**For exposure**—C.S. 1.

**For appreciation**—C.S. 101.

### 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 Intelligence
- 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

### NONMAJORS

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.

   **1A.** 1 unit, any quarter (Reges)
   **contact arrangement**

   **1C.** 1 unit, any quarter (Reges)
   **ID.** 1 unit, any quarter (Reges)
   **contact arrangement**

3. **Programming in FORTRAN**—Introduction to FORTRAN for students with experience in programming in a high-level programming language other than BASIC. Taught live for the last time in Autumn and thereafter available any quarter as a self-paced course providing students videotapes, a textbook, and TA support to complete a specified set of programming problems. Prerequisite: 106A, or equivalent.

   **2 units, Aut (Reges) MWF 2:15, first 8 weeks only**

   **Win, Spr (Reges) by arrangement**

14. **Cray Architecture and Assembly Language**—Cray architecture; principles of vector processing, pipelining, parallel operation. Integer and floating point arithmetic, binary, octal, hexadecimal number representation. Data addresses and instruction labels. Machine code, instruction repertoire. Speed of execution, optimization, data packing. Subroutines, macros, system calls. Practice by courtesy of Cray Research, Inc. Prerequisite: 108A or 112

   **3 units, Spr (Buneman) TTh 8-9:15**

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 other than BASIC. Prerequisite: 106B or equivalent.

   **3 units, Win (Rogers) MWF 3:15**
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: Knowledge of a programming language other than BASIC.

* 4 units, Aut (Schoen) MWF 9

40. Introduction to UNIX and C—Introduction to the UNIX operating system and C programming language for students with programming experience in a high-level language other than BASIC. Prerequisite: 106B 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 (Kay) MWF 10

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 economics 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: 106H, 106X. Prerequisite for 106A: Math. 3 or equivalent. Prerequisite for 106B: Old 106 or 106A or 106H.

106A. (DR:8)

* 5 units, Aut (Jones) MWF 10

Win (Jones) MWF 1:15

Spr (Staff) MWF 9

106B. * 5 units, Aut (Staff) MWF 9

Win (Staff) MWF 10

Spr (Reges) MWF 1:15

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, Aut (Floyd) MWF 10

106X. Introduction to Software Engineering (Accelerated)—Covers 70% of the material in 106A,B. Intended as a one-quarter preparation for 108A,B, for students whose previous programming experience is sufficient to help them...
cover this fundamental material more rapidly. Prerequisite: Mathematics 3 or equivalent.

*5 units, Aut (Gorin) MWF 9
Win (Staff) MWF 1:15
Spr (Gorin) MWF 10


108A. Semantics of programs: simple languages; procedural, functional, and declarative paradigms; underlying models. Program specification: proofs of program correctness, weakest preconditions, loop invariants. Inside the machine: processors; fetch/execute cycle; states. Programming environments: compiled and interpreted; interactive. Propositional and predicate logic. Abstract Data Types (ADT’s) and data models; lists, stacks, queues, trees. Program analysis: efficiency and sorting. Programming problems include introduction to LISP and Prolog and practice implementing ADT’s as modules. Prerequisite: 106B or 106X. (DR:8)

5 units, Aut (Rogers) MWF 11
Win (Rogers) MWF 9
Spr (Staff) MWF 1:15

108B. Graphs: representation and simple algorithms. Describing languages: finite state machines and regular expressions; grammars, Backus-Naur Form; parsing and ambiguity; LR(1) languages. Computability: the halting problem. Programming language features, definition and implementation; naming, scope, parameter passing; activation of procedures and functions, recursion; linking of separately compiled modules; Ada packages and generic types; compilers versus interpreters; libraries and linking. Programming problems include introduction to UNIX, C, and object-oriented programming. Prerequisite: 108A or equivalent.

5 units, Aut (Wilson) MWF 1:15
Win (Wilson) MWF 9
Spr (Wilson) MWF 9


4 units, Aut (Chou) TTh 2:45-4
Win (Gill) TTh 9:30-10:45
Spr (Chou) MW 12:50-2:05

112. Computer Organization—(Enroll in Electrical Engineering 182.) Basic computer organization; computer arithmetic; memories, processors, control, input/output, and mass storage; data formats, addressing and instruction sets. Study of the control of a small computer. Prerequisites: 108A and 110, or Electrical Engineering 121.

3 units, Aut (Weise)
Win (Staff)

123. Cognitive Introduction to Artificial Intelligence—Introduction to the core concepts of artificial intelligence (AI): problem solving, representation of knowledge, learning, cognitive architecture, natural language, and AI programming languages. Views AI from a cognitive science perspective, making connections between these topics and corresponding work in cognitive psychology. Prerequisite: 105A or equivalent.

3 units, Aut (Feigenbaum) TTh 2:45-4

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 include: 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 or 130; or equivalents.

3 units, Sum (Staff)
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. Prerequisite: 110 and 106X or 106B.

3 units, Aut (Staff) MW 10-11:15

143A. Compilers—The grammars of programming languages; lexical analyzers, parsers, code emitters and interpretation; global and peephole optimization; run-time support; error management; translator writing systems. A small project is assigned. Prerequisite: 108B.

*4 units, Aut (Linton) MW 10

Spr (Staff) MW 3:15

143B. Compiler Project—Implementation of the phases of a compiler using current tools and techniques. Provides an opportunity to work on a large software project, in groups, specifically focused on the construction of a compiler. Units of credit vary depending on level of participation. Projects may be carried out over several quarters. Prerequisite: 143A or equivalent.

1-6 units (Staff) not given 1987-88

149. Object-Oriented Design with Ada—Introduction to the principles of software engineering and object oriented design using the Ada programming language. The process of design, specification, and implementation is demonstrated in the development of several packages and generic program units.

*4 units, Win (Bryan) MW 3:15

151. Proof Techniques in Discrete Mathematics—Review of simple counting techniques including inclusion/exclusion and the Pigeon Hole Principle. Proofs by inspection, induction, contradiction, case analysis, counting, and factoring. Proofs with existential and universal quantifiers. Infinite sets and diagonalization proofs. Prerequisite: 108A or Philosophy 159, or other exposure to basic discrete structures.

2 units, Aut (Reges) T 11-12:15

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. Complexity: time and space bounds on Turing machines; Nondeterministic Turing machines: properties, the class NP, complete problems for NP. Prerequisites: 108B, plus either 157 or Philosophy 160A.

*4 units, Win (Ullman) MW 3:15

Spr (Rogers) MW 1:15

154N. Introduction to NP Completeness—Reducibilities among problems; Cook's theorem; examples of NP-complete problems. Turing machines. 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) MW 3:15

Spr (Rogers) MW 1:15


*4 units, Aut (Manna) TTh 9:30-10:45

Win (Jones) TTh 1:15-2:30

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; efficient sorting algorithms; efficient search techniques; counting and generation of combinatorial objects, e.g., permutations, trees, Boolean algebras, lattices. Prerequisite: 108B.

*4 units, Aut (Staff) MW 3:15

Spr (Staff) MW 10

168. Assembly Language and Efficiency—Examination of algorithms, programming techniques, and introduction to the analysis of time and space consumption in the context of the assembly language for the DECSystem-20. Digital computer organization; binary arithmetic; representation of instructions, fixed-point and floating point numbers, and text in binary. Operand addressing; instruction execution; machine language. Symbolic assembly process; relocatable code; macros and conditional assembly. Debugging. Data structures: machine words, strings, stacks, multi-dimensional arrays, lists. Control structures: loops, subroutines, recursion, coroutines. Algorithms for bubble sort, heap sort, merge sort, linear, binary, and hash search. Sources of error in floating point arithmetic. Input, output, and random access; interrupts and traps. Prerequisite: 106B or 106B.

3 units (Gorin) by arrangement
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 (Reuling) by arrangement

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 Terman microcomputer cluster or other microcomputer cluster manager on campus.

   2-3 units, any quarter (Reges) TTh 7 p.m.

197. DECSYSTEM-20 Consulting—How to consult for the DECSYSTEM-20 mainframes available at the LOTS Computing Facility. Biweekly lectures on operating system conventions and available system software. Work as the on-duty consultant. Contact the LOTS Student Coordinators in Sweet Hall.

   1-3 units, any quarter (Reges) MW 7 p.m.

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. Positions are limited; see the receptionist in Computer Science/Tresidder for an application. Prerequisite: 106B or 106X.

   3 units, any quarter (Reges, Smith, McGrory) TTh 4:15

199. Independent Work—Special study under faculty direction, usually leading to a written report. A letter grade is given; if this is not appropriate, student should enroll in 199P.

   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

209. Mathematical Writing—Issues of technical writing on the effective presentation of mathematics and computer science. Preparation of theses, papers, books, and "literate" computer programs. A term paper on a topic of your choice; this paper may be used for credit in another course.

   3 units, Aut (Knuth) MWF 1:15

211. Logic Design—(Enroll in Electrical Engineering 351) 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, Win (McCluskey)

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, in particular the design of instruction sets. Prerequisite: 112.

   3 units, Aut (Hennessy) Spr (Gupta)

223. Intelligent Agent Architecture—A rigorous treatment of the problems involved in building intelligent agents that interact with the physical world. Topics include the representation of knowledge about states, actions, and procedures, simulation and planning, and knowledge level agents. Prerequisite: 157.

   3 units, Win (Genesereth, Nilsson) MWF 12:50-2:05

224. 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: 108B and 157. There are special logic review sessions for advanced students who wish to enroll without having taken 157.

   3 units, Win (Rosenbloom) TTh 11-12:15 Spr (Jones) TTh 2:45-4

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: 22 and 223.

   2-3 units, Spr (Genesereth) TTh 9:30-10:45
237A. Advanced Numerical Analysis—Three-quarter advanced undergraduate/graduate sequence designed to acquaint students with the derivation and analysis of methods for solving mathematical problems on digital computers. Organized so students 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 both 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. Operating Systems—Two-quarter sequence in operating systems design and implementation. 240A. The basic techniques necessary to construct a rudimentary operating system, motivations, functions, and evolution; basic structure; multiprogramming, processes and scheduling; implementation of concurrent programming mechanisms; memory management, static relocation, virtual memory techniques, load control; file systems, file structures, directory management, disk management; and device management. Typically taken in conjunction with 241. 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 (may be taken as a co-requisite in the Autumn Quarter only). Prerequisite for 240B: 240A.

240A. 3 units, Aut (Staff) TTh 1:15-2:30
240B. 3 units, Spr (Staff) TTh 2:45-4

241. Operating Systems Laboratory—A laboratory to supplement 240AB (principally A). Several small projects are assigned. May be taken separately by those who have had an operating systems concepts course, but little implementation experience. Prerequisites: 140L, 240A, or equivalent (may also be taken concurrently).

2 units, Win (Wilson) MF 2:15

242. Programming Languages—Survey of several programming languages, such as Ada, Snobol, Prolog, and/or Simula. Comparison of language features, considering power, ease of use, implementation. Memory management, scoping, compilation vs. interpretation, modules and classes, abstract data types, exception handling, generic and parameterized types. Program verification and specification as related to programming language design. Programming assignments in various languages. Prerequisite: 108B.

3 units, Spr (Ungar) MWF 3:15

243. Advanced Compiling Techniques—Theoretical and practical aspects of building modern compilers. Topics include machine code generation, optimization techniques, type analysis and checking, language and machine descriptions, compiler-compilers, incremental compilation, debugging support. 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 11-12:15
Win (Staff) (Enroll in Electrical Engineering 384.)

245. File and Database Systems—File organization and access, performance analysis, storage management. Database models, description, and implementation alternatives. Reliability, protection, and integrity. Design and manage-
246. Operating Systems Project—For students wanting experience in a large-scale, team project in operating systems or distributed systems. Students are responsible for selecting their own projects. Prerequisite: 140L; 240A for an operating system project; 340 for a distributed system project (may also be taken concurrently). In general, it is not advisable to attempt a project that entails concepts covered in 240B (or 340) until after 240B (or 340) are taken.

3-6 units (Staff) not given 1987-88

247. Software Engineering Laboratory—An apprenticeship program in the science, craft, and folklore of programming system design and implementation. Individual and group problem-solving techniques, design methodologies, project planning and management, communication skills, and the effective application of computer science theory. Practical and theoretical issues of computer systems through projects, written reports, oral presentations, and class discussions. Recommended: Some knowledge of programming and experience with Pascal.

3 units, Win (Allison) MWF 10

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-conversion 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: 108B and Math 113.

3 units, Win (Staff) TTh 9:30-10:45


3 units, Spr, alternate years, given 1988-89

254. Automata, Languages, and Computability—Finite automata: nondeterminism, regular expressions. Context-free grammars: normal forms and simplifications. Operations on languages. Pumping lemmas and languages provably not context-free. Turing machines: decidability, undecidable problems. Prerequisite: Familiarity with computer programming (i.e., 106A) and mathematical reasoning (e.g. Philosophy 159.)

3 units, Spr (Floyd) MWF 10


3 units, Win (Waldinger) 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: Mathematics 22, 42, or equivalent.

3 units, Aut (Wilf) MWF 9


3 units, Win (Floyd) MWF 3:15


3 units, Spr (Staff) MWF 3:15

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: Mathematics 44 or equivalent.

3 units, Win (Dantzig) 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 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, Wiederhold) TTh 12:15

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, expert systems.

3 units, Win (Shortliffe) TTh 12:15

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 (Pagan, Shortliffe, Buchanan) TTh 12:15

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 semiotic issues. Consists primarily of visual exercises.

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

275. Computational Models for the Syntax of Natural Language—(Same as Linguistics 227.) Formal systems and computer implementations for syntax with relevant material from linguistics and formal language theory. Past and current parsing systems. Relevant aspects of the syntax of English.

3 or 4 units, Win (Kay) MWF 10

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 (Winograd) MWF 10

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.

*d4 units, Spr (Perrault, Cohen)
TTh 11-12:15

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 (Earnest) 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 (Staff) 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 108B, or equivalent ability to program.

3 units, Aut, (Shankar) TTh 2:45-4

309. Industrial Lectureships in Computer Science—Each quarter the department invites one outstanding computer scientist from local industry to give a course in his/her specialty. Lecturers and topics change yearly, hence these courses may be taken repeatedly. This year's lecturers are: John Sowa, a member of the IBM Systems Research Institute where he teaches artificial intelligence and does research in computational linguistics; Cynthia Dwork, of IBM Almaden Research Center, works on the theory of parallel and distributed computation; Paul Haley, chief scientist for Inference Corp., one of the designers of ART, worked at Carnegie-Mellon University on several DEC expert systems.

309A. Conceptual Structures—Problems and issues in knowledge representation and
the semantics of natural languages. Theory of conceptual graphs. Structure of the lexicon, canonical graphs for English word classes, logical forms for various features, including quantifiers, relative clauses, anaphora, tenses, and contexts. Schemata and their use in word sense determination, metaphor, and definitions by family resemblances. Relationships to Montague grammar, situation semantics, game theoretical semantics, and discourse representation theory. Conceptual analysis as a basis for knowledge engineering. Prerequisites: Knowledge of first-order logic and natural language syntax.

3 units, Aut (Sowa)

309B. New Directions in Distributed Computing—Cryptographic protocols; interactive proof systems; zero knowledge and minimum knowledge proofs; applications of cryptographic and minimum knowledge techniques to distributed computing.

3 units, Win (Dwork)

309C. Rule-based System Architecture—Data-driven and control flow inference engines; the complexity of pattern matching; the Rete Algorithm. Subgoaling: reasoning with simultaneous goals; opportunistic backward chaining; subsumption versus reification. Propositions: semantic properties of relations; the propositional equivalence and logic of frames. Rule independence, evolution and maintenance. Logical deduction; opportunistic and demand-driven implications; open versus closed world assumptions; non-monotonicity, soundness and the asynchronous arrival of information; logical dependencies and the closed-world assumption. Assumptions truth maintenance; monostonic implementations of non-monotonic logic. Efficiency of rule-based systems; data driven “query” optimization; real-time knowledge-based systems; parallel inference machines.

3 units, Spr (Haley)

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, Spr (McCluskey)


3 units, Spr (Staff) alternate years, given 1988-89

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

323. Advanced Artificial Intelligence—Advanced topics including the representation of propositional attitudes (knowledge and belief); nonmonotonic reasoning; reasoning with uncertain beliefs; the representation of topics needed for commonsense reasoning (action, time, and processes); intelligent robots; machine learning. Prerequisite: 223 or equivalent.

3 units, Spr (Nilsson, Genesereth) MWF 11

325. Cognitive Architecture—(Same as Psychology 223.) The issues involved in designing a cognitive architecture. Topics: the role of the architecture in the construction of a general artificially-intelligent system, the role of the architecture as a large-scale psychological model, existing (and proposed) cognitive architectures, and the evaluation of architectures. Prerequisites: Advanced undergraduate standing and either 223, Psychology 126, or equivalent experience.

3 units, Spr (Rosenbloom) alternate years, given 1988-89

326. Epistemological Problems of Artificial Intelligence—(Same as Philosophy 326.) Formalisms for representing what a general, intelligent program must know about the common sense world including facts about causality, ability, knowledge, and action. Modes of rigorous and conjectural reasoning, especially nonmonotonic reasoning. Approximate theories and counterfactuals. Connections with philosophy, especially philosophical logic and epistemology. Some familiarity with first order logic is assumed.

3 units, Win (Lifschitz) TTh 2:45-4

327A. An Introduction to Robotic Manipulation—(Enroll in Mechanical Engineering}
329A. 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 familiarity with basic control theory and rigid body mechanics.

3 units. Aut. (Roth)

327B. Introduction to Computer Vision (Robotics)—Computer vision and perception. Image generation, the physics of images and sensors, statistical estimation, binary vision and industrial vision systems, structured light and ranging sensors, stereo vision, scene interpretation and image understanding in intelligent systems, geometric modeling and geometric reasoning, representations of the visual world, computation hardware for high speed image understanding, psychophysics. Prerequisites: Statistics, knowledge of programming at level of 106 in Pascal, C, LISP, or FORTRAN; linear algebra, orthogonal polynomials.

3 units. Win. (Binford) TTh 1:15-2:30

327C. Topics in 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, hill climbing, configuration space, and freeways; 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: 223 and 327A.

3 units. Spr. (Latombe) TTh 1:15-2:30

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 will 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 223, Psychology 106, or equivalent experience. 2 or 3 units. Win. (Pavel) alternate years, given 1988-89

328B. Applying Cognitive Psychology to Computer Systems—(Enroll in Psychology 286.) Broad issues in applying psychology to various domains with emphasis on 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) alternating years

328C. Advanced Seminar in Perception, Cognition, and Human Performance—(Enroll in Psychology 289.) Research-oriented course; in-depth analyses of selected current topics with emphasis on problems related to computer systems, artificial intelligence, and human information processing. Prerequisite: Consent of the instructor.

1-3 units. Win. (Latombe) TTh 8-9:15

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 that are relevant to practical statistical problems. Prerequisites: Statistics at the level of 219-220, matrix algebra, knowledge of a programming language.

3 units. Spr. (Audhikari) TTh 11-12:15

339. 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. Win. (Latombe) TTh 8-9:15

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 9:30-10:45

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, 343.

3 units, Aut (Staff) not given 1987-88

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, Spr (Staff)

344. Computer Networks: Modeling and Analysis — (Enroll in Electrical Engineering 484.) Review of network functions, architectures and protocols; computer traffic characterization; resource sharing; packet-switched store-and-forward networks (e.g., ARPANET); 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 — The entity-relationship model of the real world; object-oriented data models, i.e., the network and hierarchical models; value-oriented models, i.e., the relational model and Horn-clause logic; relational algebra and calculus; relational query languages, i.e., QUEL, SQL and Query-by-Example; functional dependencies and their influences on database design; other types of dependencies; query optimization; architecture of "knowledge-base" systems using Horn-clause logic applied to a database; algorithms for efficient processing of queries expressed in logic. Prerequisites: A familiarity with file organization, as in 245, and with predicate calculus, as in 157, or Philosophy 160A, is assumed.

3 units, Spr (Staff) MWF 2:15


3 units, Sum (Staff) 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


3 units, Win (McCarthy) not given 1987-88

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, FSPACE). Properties of complexity classes.

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


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. Examines formalizing reasoning about knowledge and the extent they are applicable to the areas above. Issues: the internal vs. external views of 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.

3 units, Win (Halpern) F 2:15-4:05

357. Advanced Theory of Computation—Concurrency systems; modeling real concurrency; fairness. Specification of properties by temporal logic and automata. Proving safety and liveness properties. A proof system for temporal logic. 3 units, Spr (Manna) MW 12:50-2:05


3 units, Aut (Floyd) Th 1:15-2:30 alternate years, not given 1988-89

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, Win (Knuth) MW 1:15 alternate years, not given 1988-89

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: 261, 262, 263, or equivalents.

3 units, Aut (Mayr) alternate years, given 1988-89

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. Prerequisites: 261, 262, 263, 363A, or equivalents.

3 units, Win (Mayr) alternate years, given 1988-89


3 units, Win (Papadimitriou) MW 3:15-4:30


3 units, Spr (Staff)


3 units, Aut (Staff)

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: 261, 264, and 351, or equivalents.

3 units, Aut (Mayr) MW 11:12-1:15 alternate years, not given 1988-89

367B. Parallel Computation — Principles for the design of parallel algorithms, systolic architectures and algorithms, shared memory management; complexity bounds for parallel computations; P-complete bounds and approximations. Prerequisite: 367A or equivalent.

3 units, Win (Mayr) MW 11:12-1:15 alternate years, not given 1988-89

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, Spr (Staff) Th 1:15-4:15

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.) Introduces 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) MWF 3:15-4:30


3 units, Aut (Winograd) not given 1987-88

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 imple-
440A, B. Understanding Concurrent Programs—Concurrent programs are difficult to understand and have subtle errors. This covers the intellectual tools that provide a foundation for the art of writing correct concurrent programs including an understanding of the basic principles of multiprocess synchronization and the ability to use rigorous methods for reasoning about concurrent programs. They apply to all programming languages and to distributed and nondistributed programs. Focus is on methods for reasoning about concurrent programs. Emphasis is practical techniques rather than the theory of verification. Develops the ability to prove the correctness of programs described in the languages of choice.

441. Topics in Ada Programming—The Ada language is used to focus on current research in high level languages for programming large systems and distributed systems, and related to programming environment tools. 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; and support tools—high level hardware design languages based on Ada. Prerequisite: 140 or 242 or equivalent.

3 or 4 units, Spr (Luckham) TTh 1:15-2:30

498. Comprehensive Examination Preparation /Reading—For graduate students in Computer Science; consent of instructor required. Register using the section number associated with the instructor.

any quarter (Staff) by arrangement

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

500. Computer Science Colloquium—Presentation of current research in computer science.

1 unit, Aut, Win, Spr (Staff) T 4:15-5:30

510. Digital 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, Win, Spr (McCluskey) M 4:15

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 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. Prerequisites: 223, 225A, and consent of instructor.

3 units, Win (Buchanan)

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: One course in artificial intelligence and familiarity with LISP. Enrollment limited to 20.

2 units, Spr (Buchanan, Shortliffe) T 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 390.) Discussion of current research in the design, implementation, analysis, and the 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 innova-
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

1-3 units (Staff) by arrangement

1-3 units (Staff) by arrangement

575. Artificial Intelligence and Language Seminar.
1-3 units (Staff) by arrangement

801. TGR-M.S. Project.
any quarter (Staff) by arrangement

802. TGR-Ph.D. Dissertation.
any quarter (Staff) by arrangement

ELECTRICAL ENGINEERING


Acting Chairman: Calvin F. Quate

Associate Chairmen: James B. Angell, Gene F. Franklin, Thomas Kailath, Gordon S. Kino, Malcolm McWhorter


Associate Professors: David M. Bloom, Abbas El Gamal, John T. Gill III, Umran S. Inan, Bruce B. Lusignan, Richard M. Swanson, Fouad Tobagi

Assitant Professors: Stephen P. Boyd, John M. Cioffi, Giovanni De Micheli, Mark Horowitz, Mark Linton, Brian Reid*, David Ungar, Daniel Weise


Courtesy Professors: Malcolm R. Beasley, William Brody, Gene H. Golub, Donald E. Knuth, John McCarthy, Jeff Ullman

Courtesy Associate Professors: G. C. M. Wiederhold, Lambertus Hesselink

Consulting Associate Professors: David Cheriton, Keith Lantz

Consulting Professors: Forest Baskett, Charlie C. Bass, Bruce Deal, Zvonko Fazarine, Joseph Feinstein, Owen K. Garriott, James L. Green, Stig B. M. Hagstrom, Narinder S. Kapan, Robert Kosut, Franklin Kuo, Stephen Mende, Madhav Narasimha, Yoshio Nishi, Jorma Rissanen, Nachum Shacham, Arden Sher, Jerome Tiemann, Martin Walt


Consulting Assistant Professor: Norman P. Jouppi

*On leave one or more quarters

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 "C" letter grade indicator (LGI) in the courses in the E.E. depth sequence and an overall LGI of "C" in all E.E. courses to obtain a Bachelor of Science in Electrical Engineering.

Interdisciplinary majors providing work in electrical engineering combined with study in another department are available.

Note that it is possible for a Stanford undergraduate to work simultaneously toward the B.S. and M.S. degrees (see the "School of Engineering" section 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, Old Union, Stanford, CA 94305, and are reviewed by this department. Inquiries may be addressed to the Committee on Graduate Admissions of the Department of Electrical Engineering.

Applicants who have not yet earned the equivalent of a Master of Science degree should apply for admission to study first toward the master's degree, indicating any intention of later working toward a more advanced degree. Admission to study directly toward either the Engineer or Ph.D. degree is normally available only to students who will have completed a master's degree prior to the quarter for which they are seeking admission. No time is lost in first completing the master's degree since a thesis is not required.

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:

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 of 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 42 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.). University regulations governing the degree of Engineer are described in the "Degrees" section of this bulletin.

Work toward the degree of Engineer in Electrical Engineering normally includes the requirements for work toward the master's degree in Electrical Engineering, 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.

A tentative application for candidacy, including a proposed program of study, must be filed in the department office before the end of the first quarter of post-M.S. study at Stanford. The program of study is prepared by the student with the help of an advisor and submitted to the faculty for approval. A formal application for candidacy, including the signature of a thesis supervisor, must be filed in the department office before completion of 25 units of work beyond the master's degree. Approval of formal application will normally be dependent on completion of courses at Stanford with a satisfactorily high record.

DOCTOR OF PHILOSOPHY

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

Admission to the graduate school does not imply that the student is a candidate for the Doctor of Philosophy degree. Advancement to candidacy requires superior academic achievement, satisfactory performance on a qualifying examination, and sponsorship by two faculty members. Enrollment in 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 application forms from the Office of Graduate Admission, Old Union, Stanford, CA 94305.

THE HONORS COOPERATIVE PROGRAM

Many of the department's graduate students are supported by the Honors Cooperative Program, 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 full-time professional employment (see the "School of Engineering" section of this bulletin).

AREAS OF RESEARCH

Candidates for advanced degrees participate in the research activities of the department as paid research assistants or as students of individual faculty members. At any one time, certain areas of research will have more openings than others. A new applicant should express a second choice of research interest in the event that there are no vacancies in the primary area of interest. At present, faculty members and students are actively engaged in research in the areas listed below.
COMPUTER SYSTEMS
- Compilers
- Computer Architecture
- Computer Networks
- Computer Organization
- Computer Reliability
- Concurrent Languages
- Concurrent Processes and Processors
- Design Automation
- 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
- Adaptive Signal Processing
- Biomedical Signal Analysis
- Computer Aided Design and Analysis of Systems
- Cryptography and Data Security
- Data Compression and Communication
- Digital Signal Processing
- Estimation Theory and Applications
- Fourier and Statistical Optics
- Information and Coding Theory
- Medical Imaging
- Multivariable Control
- Pattern Recognition and Complexity
- 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

MICROWAVES, ACOUSTICS, AND OPTICS
- Acoustic Microscopy
- Acoustooptic Devices
- Fiber Optics
- Holography
- Microwave Integrated Circuits and Devices
- Nondestructive Testing
- Scanning Optical Microscopes

SOLID STATE
- Applied Superconductivity
- Crystal Preparation: Epitaxy and Ion Implantations, 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
- 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
- Ionospheric 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

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:

- Bioelectronics
- 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 will be found in the following pages.

UNDERGRADUATE

Attention is called to courses listed under “Engineering” that may be of special interest to electrical engineering undergraduates.

100. Seminar—Weekly discussion of special topics of interest to electrical engineering undergraduates: 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, Win (Helliwell) MWF 9
  Spr (Hellman) MWF 9

  3 units, Aut (Inan) 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, interiors; rings of Saturn; 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 catastrophies (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, mathematic, or physics. (DR:8)
  3 units, Spr (Eshleman) MWF 9

111,112,113. Electronics — Basic solid-state devices, integrated circuits, and introduction to their applications in electronic systems. 111. 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. 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. 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. Prerequisites: 111, 112, and concurrent registration in 101 (or consent of instructor, in special cases).

111. 3 units, Aut (Siegman) TTh 9:30-10:45
   Win (da Rosa) MWF 11

112. 3 units, Win (Siegman) TTh 9:30-10:45
   Spr (da Rosa) MWF 11

113. 3 units, Aut (da Rosa) MWF 11
   Spr (Dutton) TTh 9:30-10:45

   3 units, Aut (Waterman) MWF 2:15
   Win (Inan) MWF 2:15

   3 units, Spr (Inan) MWF 2:15

180A,B. Fundamentals of Computer Science — (Enroll in Computer Science 108A,B.)

182. Computer Organization—Basic computer organization; computer arithmetic; memories, processors, control, input/output, and mass storage; data formats, addressing and instruction sets. Study of the control of a small computer. Prerequisites: 121 or Computer Science 108A, and Computer Science 110.
   3 units, Aut, Win (Manning) MWF 11

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 memories 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. Prerequisites: 121 and 182, or equivalent.
   3 units, Aut (Flynn) TTh 8-9:15
   Win, Spr (Staff) TTh 8-9:15
   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 written report or examination is required. A letter grade is given on the basis of the 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.

UNDERGRADUATE AND GRADUATE

192. Special Seminars—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.

192A. 0 units, Aut (Linvill) Th 11
192B. 0 units, Win (Pantell) Th 11
192C. 0 units, Spr (Manning) Th 11

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.

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.

201A. 1 unit, Aut (Linvill) Th 11
201B. 1 unit, Win (Pantell) Th 11
201C. 1 unit, Spr (Manning) Th 11

202. Medical Electronics—Primarily biological in nature. Introduces 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 (McWhorter) 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 considered for both bipolar (TTL, ECL and IIL) and MOS (NMOS and CMOS) technologies. Using first-order nonlinear device models, both 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 (Dutton, 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, Fazarine)
MWF 2:15
Win (Linvill) MWF 11

217. Electron and Ion Beams for Semiconductor Processing—Use of high resolution electronic and ion beams for fabrication and diagnosis of solid state electronic devices. Limits to resolution and current density. Interaction of beams with solid state targets; isotropic and anisotropic dry etching techniques; contrast mechanisms in scanning beam microscopy, electron beam metrology. Prerequisites: Physics 51, 53, 55 and 57, or equivalent.

3 units, Spr (Pease) MWF 8
21. 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: 113, Engineering 102. 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 include 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) MWF 9

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 (Staff) 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 wavefunctions (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 239.)

239B. Solid State Theory—(Enroll in Applied Physics 240.)

241. Waves I—Introduction to a variety of waves and wave phenomena as they appear in different natural, laboratory, and application settings. Electromagnetic, acoustic, seismic, atmospheric, plasma, and water waves and their mathematical and physical correspondence in terms of Hamilton’s principle. Propagation, attenuation, reflection, refraction, surface and laminal guiding, and intrinsic and structural dispersion; energy density, power flow, and phase and group velocities. Geometrical and structural complexities are minimized in order to stress basic wave concepts common to diverse fields of application. Analysis in terms of transmission line and impedance concepts using exponential notation and vector phasors. Treatment limited to plane harmonic waves in isotropic media. Nonhomogeneous cases limited to plane interfaces and exponentially stratified media. Prerequisite: 142 or equivalent or other wave course. 3 units, Aut (Eshleman) MWF 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

243. Integrated and Fiber Optics—Propagation of waves in dielectric thin films and cylindrical guides. Coupling from an optical source to dielectric guides. Mode cutoff and dispersion in step index and graded index fibers. Switching and modulation by integrated optics techniques. Prerequisite: 241. 3 units, Win (Pantell) MWF 11

244A. Communication Engineering Telephony—Current design problems in telephone transmission systems: transmission of analog and digital voice and data on wire, cable, and fiber optics. New design problems for Integrated Services Data Networks (ISDN). Telephone traffic theory, circuit capacity and network planning. International standards and signaling protocols. Rotary and cross-bar telephone switches, and new digital switch architectures. 3 units, Aut (Lusignan) TTh 1:15-2:30

244B. Communication Engineering Transmission 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 2:45-4

244C. Communication Engineering Project—Applications of material covered in 244A or 244B to design of a practical telecommunication system. Class works as a team with each member having responsibility for one area of the system. Past projects have included an International Satellite, Space Shuttle Communication Link, and Science Station Communication System. Project may coordinate with other areas of engineering in Engineering 235. Prerequisite: Permission of the instructor.

3 units, Spr (Lusignan) TTh 1:15-2:30

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 selected from the following examples related to research at Stanford: microwave interferometry, measurement of waveguide impedance, microwave cavity measurements, fiber optic waveguide measurements, optical diffraction, laser cavity and laser beam measurements, acousto-optic diffraction, and satellite communications. 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 (Auld) MWF 2:15

249. Introduction to Space, Telecommunication, 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 electromagnetic theory at the level of Physics 53 and senior or graduate standing.

3 units, Aut, alternate years, given 1988-89

250. Communications Design Seminar—Seminars on recent developments in telecommunication research, including satellite applications, mobile radio, telephone networks, digital switches, voice and data modulation. Speakers are from Stanford research laboratories and the telecommunications industries.

1 unit, Aut, Win, Spr (Lusignan) T 4:15


3 units, Spr (Bracewell) MWF 1:15

254. Principles of Radar Systems—Radar system analysis and design with emphasis on synthetic aperture radar. Radar equation and systems parameters, components of radar systems, radar cross-section and target characteristics, resolution, clutter rejection and waveform design; pulse compression waveforms, synthetic aperture radar, tracking and scanning radars, HIF(OTH) radar, radar remote sensing, radar astronomy. Prerequisite: Senior undergraduate or graduate student standing.

3 units, Win (Vesecky) MWF 1:15

alternate years, not given 1988-89

256. Elementary Plasma Physics—A broad-based elementary and interdisciplinary presentation of basic theoretical concepts, experimental evidence, and applications to astrophysics, space physics, and thermonuclear fusion. Topics include single-particle motion, collisions between charged particles, and the various models for collective plasma behavior, i.e. cold-plasma theory, fluid theory (MHD), kinetic theory, and particle simulation. Prerequisites: Basic physics and electromagnetics at the level of 141 or Physics 121.

3 units, Spr (Storey) MWF 3:15

alternate years, not given 1988-89
261. The Fourier Transform and Its Applications—The Fourier transform as a tool for solving physical problems. Convolutions and correlations, the Dirac delta function, Fourier transform theorems, measures of time duration and bandwidth, the uncertainty relation, and the central limit theorem. Also, analysis of linear systems, sampling theorems, the discrete Fourier transform, and two-dimensional Fourier analysis. Prerequisite: Previous exposure to Fourier series at the level of 102.

3 units, Aut (Goodman) MWF 10
Spr (Gray) TTh 2:45-4

262. Two Dimensional Imaging—Two dimensional autocorrelation, Fourier spectra, spatial frequencies, diffraction, antennas, Hankel and Abel transforms, circular symmetry, line integration, two dimensional impulses and sampling, restoration, principal solution, restoration with noise and correlation, reconstruction from line integrals, mapping instrumentation, applications to various fields. Prerequisite: 261 or equivalent.

3 units, Win (Bracewell) MWF 2:15

263. Digital Signal Processing—An introduction to computer-implemented signal processing systems. Digital impulse response and transfer functions; convolution; sampling theory; z-transforms; digital Fourier transforms; FFT algorithms; filters; generation of stochastic signals; quantization theory and roundoff; synthesis of digital filters to meet design specifications; digital Wiener filters. Prerequisite: Familiarity with Fourier and Laplace transforms.

3 units, Aut (Widrow) TTh 9:30-10:45
Win (Gray) MWF 3:15

264. Digital Filtering—An introduction to modern digital filtering techniques, filter approximation theory, s-plane to z-plane mappings, optimal design procedures for finite impulse response (FIR) and infinite impulse response (IIR) filters. Prerequisites: Knowledge of z-transform theory; 104, 263, or consent of instructor. Recommended: 261.

3 units, Win (Widrow) MWF 10

265. Introduction to Modern Optics—(Enroll in Engineering 170.)

271. Introduction to VLSI Systems—Large-scale MOS design. Topics include stick diagramming, MOS transistors; switch and gate logic; programmable logic arrays; 2-phase dynamic design; finite state machines; scalable design rules; speed and power considerations; floor-planning, and layout techniques. Ideas are reinforced through exercises in the design and layout of MOS ICs. Intended for EE and computer science students with background in computers, signal processing, or programming. Background in IC fabrication or physics not required. Prerequisites: Familiarity with the basic notions of circuits, logic, and digital systems; and programming.

3 units, Aut (Staff) TTh 2:45-4
Win (Staff) TTh 4:15-5:30

272A. Design Projects in VLSI Systems—Experience in designing large-scale MOS ICs. Working in teams of two, students must complete modest-sized CMOS projects through layout, simulation, and design-rule checking. Topics: design tools and techniques—instruction 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 research and applications interest in VLSI systems. Students taking 272A are expected to take 272B for at least one unit. Prerequisites: 271, experience with timesharing facilities.

4 units, Win (Staff) Th 1:15-2:30
plus lab by arrangement

272B. Testing and Simulation of VLSI Systems—A continuation of 272A, principally for simulating, testing, and elaborating projects designed in that course. Students must functionally simulate and test their projects and report the results. By arrangement, students may undertake more extensive work for additional credit. Lectures include simulation and testing techniques used in the laboratory and advanced topics in design. Prerequisite: Completing the 272A design project.

1 unit, Spr (Staff) TTh 1:15-2:30
plus lab by arrangement

278. Introduction to Statistical Signal Processing—Elementary probability theory: expectation, characteristic functions (transforms), limit theorems. Introduction to random processes: definitions and properties, covariance and spectral density, time average, stationarity, ergodicity, and linear system relations. Applications in noise analysis, communication systems, estimation theory. Prerequisites: Elementary linear systems, transforms, and probability, 102 or 261, and Statistics 116E or equivalent.

3 units, Aut (Gray) TTh 1:15-2:30

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.

3 units, Win (Macowski) TTh 4:15-5:30

281. Microcomputer Laboratory—Introduction to a specific microprocessor, e.g., the Zilog Z-80. Lectures covering the programming and
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 1:15-2:30

284. Basic Tools in Computer Systems Modeling—Basic tools for the analysis and performance evaluation of computer systems. Topics include: review of probability theory; Poisson distribution; exponential distribution; transforms; Poisson process; discrete-parameter Markov chains; birth-death processes; queueing theory; network of Markovian queues; elements of graph theory; graph algorithms. Examples drawn from the computer systems area. Prerequisite: Statistics 116. 3 units, Win (Tobagi) TTh 9:30-10:45


Emphasis on the 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: 216, 312, 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. Part of the course is a "hands-on" computer simulation of the exposure and development of patterns in resist. Prerequisites: Physics 53, 55, and 57, or equivalent; basic competence in computing.

3 units, Win, alternate years, given 1988-89

320. Condensed Matter Seminar—(Same as Applied Physics 390.) 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—Beginning with the failure of classical physics to describe phenomena on a microscopic level (black body radiation, photoelectric effect, etc.) the basic concepts of nonrelativistic quantum mechanics are introduced—operators, wave functions, eigenfunctions, probability amplitudes, eigenvalues, and stationary states. The basic postulates are given and the mathematical formalism is developed using the statistical interpretation. Schrödinger wave function approach and the matrix formulation of quantum mechanics and the equivalence of the two schemes is discussed emphasizing the former. Emphasis on three exactly soluble problems: constant potential, harmonic oscillator, and the hydrogen atom and the use of these to approximate the behavior of some real systems. Prerequisites: Physics 57 or equivalent, differential equations. Recommended: Linear algebra, classical mechanics.

3 units, Aut (Staff) MWF 1:15

322B. Basic Quantum Mechanics—Approximation schemes for determining the energy levels and other properties of real systems. The variational method, WKB approximation, time independent and time dependent perturbative schemes for solving time dependent problems. Applications to the calculations of the ground state of the helium atom, quantum mechanical tunneling, magnetic resonance, masers and lasers, and the two-level problem. Prerequisite: 322A.

3 units, Win (Staff) TTh 9:30-10:45

324. Applications of Quantum Theory—A unified approach involving the density matrix to lasers, field quantization, and multiple quantum effects. Emphasis on the techniques for obtaining the appropriate equations of motion, rather than on 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, alternate years, given 1988-89

325. Analog Signal Processing—Introduction to analog filters emphasizing acoustic surface waves and related optical and semiconductor devices. Topics: CCD and SAW transversal filter, correlators, convolvers, tapped optical fibers, the chirp z-transform, analog and digital coding, acousto-optical processors, and the storage correlator. Applications of these signal processing ideas to bandpass filters, adaptive filtering, acoustic imaging, spread spectrum, and other communication systems, radar, and sonar. Prerequisites: 142 and 261.

3 units, Aut (Kino) MWF 1:15 alternate years, not given 1988-89

325A-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. 325A concentrates on charge and heat transport in semiconductors. Topics include formal transport theory, the Boltzmann transport equation and its solution, scattering mechanisms, carrier trapping and recombination, and metal contacts. 325B considers the p-n junction and MOS capacitor, and bipolar and MOS transistors. Prerequisites: 216, 228, and 325A (for 325B). Recommended: 238.

3 units, Win, Spr (Swanson) 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...
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, Aut (Lindau) TTh 8-9:15


3 units, Spr, alternate years, given 1988-89

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. Course similar to 212. Prerequisites: 228, 238.

3 units, Win, alternate years, given 1988-89

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 (Beasley) TTh 1:15-2:30

335A. Energy States in Solids — (Enroll in Materials Science and Engineering 233.)

335B. Electronic Transport in Solids — (Enroll in Materials Science and Engineering 234.)

335C. Photoelectronic Properties of Solids — (Enroll in Materials Science and Engineering 235.)
352. Electromagnetic Waves in the Ionosphere and Magnetosphere—Magnetotail "meteoric" and collective phenomena (whistlers, low-frequency emissions); remote sensing in plasmas; communication; theory of wave-particle interactions in the magnetosphere. Prerequisite: 142 or equivalent.

3 units, Spr, alternate years, given 1988-89

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, Spr (Tyler) alternate years, not given 1988-89

356. Introduction to Plasma Physics—Plasma as a new medium; its significance in space and fusion research, individual and collective phenomena; ionization, charged particle orbits, collisions, plasma oscillations; Boltzmann distributions, Debye length, Landau damping, magnetization propagation and dispersion. Sheath and probe theory, magnetic confinement, pinch, mirror, reactors, magnetogasdynamics; computer simulation of plasmas. Prerequisite: 141 or equivalent.

3 units, Aut, alternate years, given 1988-89

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 358A.)

358B. Nonlinear Optics Laboratory—(Enroll in Applied Physics 358B.)

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, alternate years, given 1988-89


3 units, Spr (Staff) TTh 8-9:15

363H. Introduction to Linear System Theory (Honors)—All of 363, plus additional advanced topics. Recommended for students specializing in the Information Systems Laboratory or related fields—Aeronautics and Astronautics.

3 units, Aut (Boyd) MWF 1:15


3 units, Win (Boyd) MWF 1:15


3 units, Spr (Boyd) TTh 9:30-10:45 alternate years, not given 1988-89

366. Introduction to Fourier Optics—Application of Fourier theory to the analysis and synthesis of optical imaging and optical data processing systems. Propagation and diffraction of light, Fresnel and Fraunhofer approximations, Fourier transforming properties of lenses, image formation with coherent and incoherent light, transfer functions of imaging systems, optical data processing, and holography. Pre-
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, alternate years, given 1988-89

368. Digital Image Processing—(Enroll in Aero and Astro 268.) Topics in the field of digital image processing, including physical descriptions of continuous images; properties of the human visual system; sampling and quantization of images; matrix representation of image forming and image processing systems; unitary transforms; image enhancement and restoration; scene matching and recognition and applications. Demonstrations and students are asked to write image processing algorithms. Prerequisites: 261, Mathematics 113S or 363.

3 units, Spr (Hesselink)

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 (Macovski) 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, Win, Spr (Staff) Th 4:15


3 units, Win (Goodman) MWF 1:15

374. Digital Transmission Systems in Telecommunications—Introduction to and comparison of analog and digital telecommunications; voice digitization—PCM, DPCM, and DM techniques; low bit rate coding of speech; segment companding laws in PCM; time division multiplexing-framing, synchronization and pulse stuffing; transmission of digital signals-baseband and carrier techniques. Prerequisites: 261 or equivalent, and 278 or equivalent.

3 units, Win (Narasimha) MWF 9

375. Advanced Analysis of Feedback—For advanced students. The required mathematics and basic results in the analysis of linear and nonlinear feedback systems. Nonlinear ODE's, local and global stability, Lyapunov theory. Gains of operators, small gain theorems, loop transformations, circle criteria, Popov theorem. Passive and contractive operators, Kalman-Yacubovitch theorem. Robustness of multivariable linear systems, stability of feedback systems with nonlinear actuators and sensors, overflow and quantizer induced limit cycles in digital filters. Prerequisites: 363, Math 115, or consent of instructor. Recommended: 363H.

3 units, Spr, alternate years, given 1988-89


3 units, Aut (Cover) TTh 2:45-4:45

376B. Information Theory—Rate distortion theory and Kolmogorov complexity. Jointly typical sequences. Capacity theorems for multiple user channels: broadcast channels, multiple access channels, two-way channels, Gaussian channels, channels with feedback. Multiple-user data compression: Slepian Wolf theorem; data compression with side information. Prerequisite: 376A.

3 units, Win (Cover) TTh 2:45-4:45

384. **Computer Networks: Architectures and Protocols**—Objectives of computer networks; network structure and components; switching techniques (circuit-switching and packet-switching); network functions; layered network architectures (the ISO reference model); data link protocols (character-oriented protocols, bit-oriented protocols, error checking, window flow control, and multiaccess protocols); network control (datagrams, virtual circuits, routing, and congestion control); transport and session protocols (end-to-end communication, interconnection 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, Win, Spr (McCluskey) M 4:15

385B. **Computer Architecture and Emulation Seminar**—Student/faculty discussions of research problems in computer organization, memory hierarchy, machine representation, and emulation of both conventional and abstract machines. Students may use the Emulation Laboratory facilities and write interpreters for specific machines.

1-4 units, Aut, Win, Spr (Flynn) by arrangement

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

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.

(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 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 will be used. Registration by consent of instructor. Prerequisite: 212.

(by arrangement)

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 with emphasis on techniques for achieving advanced device performance. May be repeated for additional credit. Prerequisites: 312, 410, and consent of instructor.

(by arrangement)

3 units, Spr (Staff) 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 heterojunctions, quantum wells and structures of ultra-small dimensions. The fundamentals for creating new devices based upon quantum size effects, tunelling, 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 (Spicer) W 2:15-4:05
Spr (Lindau) W 2:15-4:15

431. Quantum Electronics—Quantum theory of lasers and of the interaction of radiation and atoms. Coupling of radiation to atoms; stimulated transitions; the density matrix; quantum noise. Provides the quantum theory underlying the semiclassical approach of 231-232. Prerequisite: Quantum theory to the level of 322B or Physics 231. Background reading may be necessary from a course in lasers such as 231-232.

7 units, Aut, Win (Spicer) W 2:15-4:05
Spr (Lindau) W 2:15-4:15


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 1987-88 will be drawn from bandlimited communications such as Trellis Coded Modulation, partial response channels, and equalization.

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

479. 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. The 1987-88 version focuses on optical computing. Students work in teams to master recent work in a variety of areas, including: nonlinear and optical phenomena of potential use in computing; computing architectures suitable for optical implementation; optical linear algebra processors, optical interconnections in computing, hybrid digital/optical processors, optical "neural" processors, spatial light modulators, fundamental limita-
tions of optical computers. Student presentations on the results.

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

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

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; multiaccess/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. Direct correspondent architectures. Prerequisites: 282, 382.

3 units, Spr (Flynn) TTh 11-12:15 alternate years, not given 1988-89


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, alternate years, given 1988-89


3 units, Spr (Mccluskey) TTh 2:45-4 alternate years, not given 1988-89

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

Chairman: David G. Luenberger
Professors: Donald A. Dunn, Willis W. Harman, 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: Kamal Golabi, Robert E. Larson, James E. Matheson, Richard D. Smallwood
Consulting Associate Professors: Michael R. Fehling, Peter A. Morris, D. Warner North
Consulting Assistant Professors: Charles D. Feinstein, 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 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. Incoming students who are not adequately prepared should plan to take suitable mathematics courses prior to taking the core courses. 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 faculty.

The degree of Master of Science requires a minimum of one academic year of study beyond the B.S. degree. University regulations governing the degree of Master of Science are described in the "Degrees" section of this bulletin. The department does not have a thesis requirement for the master's degree. 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, 24 units of which must be courses in Engineering-Economic Systems with letter grades. Included in these courses must be at least five of the department's core courses. An M.S. program must also contain at least 3 units of project work. (See "Courses" below for a list of courses that meet 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 EES Ph.D. program have found that, after completing the qualifying procedure, they are able to obtain financial support through a combination of research assistantships, teaching assistantships, and their internships, all of which contribute directly to their educational programs as well as providing financial support. 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 6 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, programmed 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) knowledge representation and inexact reasoning, (2) medical decision systems, (3) interactive environment for model simulation, (4) decision systems for interactive planning, (5) decisions systems for the management of oil resources.

ECONOMICS ANALYSIS

(Chiu, Dunn, Luenberger, Stacchetti, Sweeney, Tse)

This program includes modeling and analysis of economic entities and their interactions. Sev-
eral specific areas, described below, have com-
manded particular attention.

**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.

**Natural Resource Economics**—Examines the particular problems associated with depletable or renewable natural resources, including energy, biological, mineral, and environmental resources.

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 interorganizational 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 analysis and application of formal models 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.

The current EMF study focuses upon the demand for energy by industry.

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 transfer, 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, Larson, 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, 234, 235, 236, 283 (4 units), 286.

Lecture Courses:

Other Courses:
- 290, 292, 293, 294, 400 series.

Course descriptions, organized by general subject area, are listed below.

SYSTEMS

105. Mathematical Methods of Systems Analysis—Overview of the mathematical tools of systems analysis. Topics include vector and matrix operation, eigenvector and eigenvalue analysis. Dynamic systems composed of difference and differential equations. Unconstrained optimization, constrained optimization. Probability theory: probability distributions, mean and variance of a distribution; random variables, expected value, and probability trees. Material is heavily interspersed with illustrative examples from areas of engineering, resource economics, biology, and management.

3 units, Aut (Staff) TTh 11-12:15
Sum (Staff) TTh 10-11:50

201A. Dynamic Systems—An introduction with equal emphasis given to development of general dynamic system theory and to exploration of classical models from social, physical, and life systems. Goal: to recognize and analyze dynamic phenomena in diverse situations. Concepts include: formulation and analysis of difference and differential equations; state-space formulation: linear systems, fundamental solution sets, equilibria, dynamic diagrams; eigenvector analysis of linear systems, the concept of stability. Systems with positive variables: Frobenius-Perron theory, stability, existence of positive equilibria, comparative statics. Markov Chains: finite and infinite Markov Chains, limiting distributions, transient state analysis, state statistics. Applications include: cohort population models, social structures, migration models, national economics, price cycles, cultural media dynamics, Peter Principle of organizational hierarchies, Richardson’s theory of arms races, Homans-Simon model of group interaction, population growth. Prerequisite: Mathematics 113 or equivalent.

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. Implemenation 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 12:45-2
ing the revelation principle and optimal mechanism design. Examples: job market signalling, optimal auctions, and the regulation of a monopolist under asymmetric information.

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

ECONOMICS

60. Engineering Economics—(Enroll in Engineering 60.)

3 units, Aut (Paté-Cornell) MW 11; (Staff) MWF 2:15
Win (Sweeney) TTh 9:30-10:50
Sum (Staff) MWF 10

155. Economics of Natural Resources—(Enroll in Economics 155.)

5 units, Spr (Sweeney)

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; (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 include (1) equilibrium theory: existence of competitive equilibria, methods for computation, special models; (2) game-theoretic models: strategic behavior of firms, bargaining, market games; (3) welfare: public goods, externalities, truthful revelation of preferences; and (4) economics under uncertainty: lotteries, risk aversion. 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

214A, B. Public Policy Analysis—A public policy analysis drawing on law, economics, and system analysis. Neoclassical welfare economics as reference for studies of property rights, contracts, accident law, antitrust law, and public utility regulation. Political-economic models used to study non-market interactions among business firms, the government, and consumers. Emphasis on rulemaking as a process in which participation of the industry affected by the rules plays a central role. Student project teams analyze specific policies in depth in the second quarter. Prerequisite: Prior work in microeconomics at the level of Economics 51Q, or concurrent registration in 212A.

214A. 3 units, Win (Dunn) MW 11-12:15
214B. 3 units, Spr (Dunn) MW 11-12:15

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. Partly 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

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 include 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,
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, Win (Howard) TTh 11-12:15

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 (Howard) Th 2:45-5:15

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. Prerequisites: 31 or 231.

4 units, Spr (Holtzman) MWF 3:15-4:30

236. Decision Analysis Practice—An opportunity for students trained in the theory of decision analysis 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 (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 1:15-3:45

OPTIMIZATION


4 units, Aut (Stacchetti) TTh 9:30-10:45

theorem, Lagrange multipliers, saddle-point theorem and duality. Construction and analysis of iterative methods for optimization: steepest descent, Newton, conjugate gradient, variable metric, methods of feasible directions, reduced gradients, gradient projection, penalty, multipliers, and projected Lagrangian methods. Unified approach toward global and local convergence of algorithms. Prerequisites: Graduate standing, Mathematics 113 or equivalent. Recommended: Mathematics 115.  
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 9:30-10:45  
alternate years, given 1988-89

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, Aut (Tse) MW 9:30-10:45  
alternate years, not given 1988-89

APPLICATIONS AND RESEARCH

181. Product Planning—Product planning as a synthesis of technology, cost, user preferences and demand, potential competition from other products, and legal and regulatory issues. New product selection and design in the information-telecommunications field. Team work in the design process. Each student is responsible for developing one aspect of the design. Provides an introduction to the problem formulation process.  
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 energy planning problems. Policy problems involving issues of individual choice, social welfare, technology trade-offs, 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 context. The links between art, theory, and practice. Prerequisites: 212A and 212B, 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 include: 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) W 1:15-3

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 expert systems 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) W 1:15-3

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**

(Enroll in 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, Spr (Paté-Cornell, North) TTh 11

**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

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**INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT**

Emeriti: (Professors) Eugene L. Grant, W. Grant Ireson, Robert V. Oakford, David A. Thompson

Chairman: Warren H. Hausman (on leave, 1987-88)

Acting Chairman: Robert C. Carlson

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 J. 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. 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 (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 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.

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.

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 MS/MSE 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 Doctor of Philosophy degree in Industrial Engineering is for students who desire careers in teaching or in research, rather than in professional practice.

The degree is offered under the general regulations of the University. The program requires a minimum of three years (nine quarters) of graduate study, at least two years of which must be at Stanford. The first year of study is usually represented by the M.S. program. A minimum of three quarters of halftime service as a teaching assistant is required. The completion of an acceptable dissertation may occupy most of the candidate's third year of study.

The program of study will be arranged by the candidate with the advice of a Faculty Committee of three, appointed department head and having as chairman the faculty member who will direct the thesis work. The final program must be approved by the department.

ASSISTANTSHIPS AND SCHOLARSHIPS

A limited number of fellowships and assistantships up to $18,000 per year are awarded each year. Application forms and detailed information may be obtained by writing the Department of Industrial Engineering and Engineering Management or the Graduate Admissions Office. Applications for fellowships, assistantships and scholarships should be made by Feb-
ruary 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, Win (Sutton) TTh 9-10:50
Spr (Eisenhardt) TTh 10-11:50

107. *Work, Technology, and Society*—(Enroll in Values, Technology, Science, and Society 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


3 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.

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 (Riggs) MW 1:15 plus
1 hour by arrangement
Spr (Staff) MWF 10

144. *Simulation*—The design, creation, and analysis of simulations. The use of simulation for estimation, comparison of policies, and optimization. Emphasis on applications in the areas of production and management. Prerequisites: 121, Computer Science 106B, Operations Research 153, or their equivalents.

4 units, Spr (Staff) MWF 9

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 183 or 186. Not open to graduate students. Prerequisites: 100, 121, 125, 133, 144, 235, 260, Engineering 40, Operations Research 152, 153.

4 units, Win (Eisenhardt) 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 186. Not open to graduate students. Prerequisites: 100, 121, 125, 133, 144, 235, 260, Engineering 40, Operations Research 152, 153.

4 units, Win (Keeley, Pate-Cornell) 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,
4 units, Win (Brandeau, Staff)
TTh 11-12:15

191. Directed Study—Directed study on 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 undergraduates and graduates in any field.

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, Aut (Jucker) TTh 11-12:50

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

3 units, Aut (Hodder) MWF 9
Win (Keely) MWF 10

237. International Investment and Financing—Evaluating international corporate investments 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).
given 1988-89

240. Engineering Risk-Benefit 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, Win (Paté-Cornell) MWF 1:15

244. Environmental Health Risk Assessment — 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, Spr (Paté-Cornell, North) TTh 11

3 units, Aut, Win (Brandeau) TTh 9:30-10:45

261. Inventory Control and Production Systems—Scheduling and control of production—inventory 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 (Lee) TTh 11-12:15

268. Manufacturing Strategy—Development and implementation of the manufacturing func-
tional 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. Some 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 the discretion of instructor. Prerequisites: 100 or 203, 133, and 235.

4 units, Win (Keeley) TTh 8-9:30

270. Managing Technology for Competitive Advantage—(Same as Graduate School of 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. Prerequisites: 269 or first-year MBA core.

4 units, Spr (Adler) MF 10-11:45

271. New Enterprise Management—(Same as Graduate School of Business 359.) 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 are discussed. 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) MW 8:15-9:45

272. Automation and Work—(Same as Values, Technology, Science, and Society 172.) 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. Emphasis on current issues; some historical background. Enrollment limited and at discretion of instructor. Open to seniors and graduate students only.

4 units, Win (Adler) MF 3:15-4:30

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, Spr (Paté-Cornell) Th 4:15-5:30

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 Organizations—Topics from current published literature and working papers. Content varies each year with faculty and student research interest. Open to doctoral students interested in research problems and issues in the fields of strategy, organizational design, and behavior.

3 units, Spr (Eisenhardt) TTh 2:15-3:30
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 (Brandenau) MW 3:15-4:30

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.

given 1988-89

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.

given 1988-89

364. Advanced Models in Production and Distribution—A theoretical treatment of the management 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, Spr (Lee) 10-11:15

370. Management of Technology Doctoral Research Seminar—Intensive review of the academic literature in the management of technology field. Topics include 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, Spr (Adler) F 2:45-5:15

390. Doctoral Research Seminar—An overview of topics in Industrial Engineering and Engineering Management. Autumn Quarter: faculty members in the department present examples of ongoing research. Winter Quarter and Spring Quarter: presentations from speakers outside the department. In addition, selected doctoral students present ongoing research in the Spring Quarter. Ph.D. students must attend during every quarter in residence. No letter grades or units given.

Aut, Win, Spr (Staff) T 4:15-5:30

MATERIALS SCIENCE AND ENGINEERING

Emeritus: (Professor) G. Marshall Pound, O. Cutler Shepard, 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. Coterminous 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>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>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>Electives</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

**ELECTRICAL, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>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. 188</td>
<td>Electrical, Optical, and Magnetic Properties of Materials</td>
<td>4</td>
</tr>
<tr>
<td>M.S.E. 210</td>
<td>Semiconductor Materials Processing</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>
<td></td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>45</strong></td>
</tr>
</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.)

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 by arrangement

151. Thermodynamics and Phase Equilibria — (For undergraduates, see 181 for description.) 
5 units, Aut (Stevenson) MTWTh 9 and by arrangement

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 (Barnett) MWF 9 Th 4:15

158. Electrical, Optical, and Magnetic Properties of Materials—(For undergraduates, see 188 for description.) 
4 units, Win (Bube) TTh 9:30-11:15 M 4

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) Th 2:15
162. 2 units, Spr (Bates, Staff) M 4:15

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, crystalline defects, and diffraction phenomena. 
4 units, Aut (Bravman) MTWTh 10

181. Thermodynamics and Phase Equilibria —Application of thermodynamics to the control of the properties of materials. Heterogeneous equilibria with emphasis on solids. Prerequisite: Elementary thermodynamics. 
4 units, Aut (Stevenson) MTWTh 9

182. Rate Processes in Materials—Diffusion in solids, structural transitions including recrystallization and liquid-solid and solid-solid phase transformations, property control by microstructural control. Prerequisites: 180 and 181. 
3 units, Spr (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 (Barnett) MWF 9

4 units, Win (Bube) TTh 9:30-11:15

200. Graduate Special Problems. 
any quarter (Staff) by arrangement

201A. The Science of Crystallization: Principles—Emphasis on qualitative and semi-quantitative understanding with a broad look at phenomena involved in the growth and perfection of crystalline solids from the melt, solution, vapor, electrodeposition. Topics include thermodynamic coupling equations, interface energetics, molecular attachment kinetics, convection, heat transport, solute partitioning, solute redistribution, morphological stability, growth forms, and physical defect generation. 
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 include thin film formation via solid and liquid state epitaxial regrowth, liquid phase epitaxy, solvent zone migration, vapor-liquid-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 the
modynamics 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.


3 units, Spr (Barnett) MWF 9

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, Win (Huggins) TTh 1-2:15 given 1988-89

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 (Sherby) 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, Spr (Tiller) TTh 11-12:15

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 given 1988-89

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, Win (Nix) TTh 9:30-10:45

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, Aut (Barnett) MWF 10

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 include 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

215A. Photovoltaic Solar Energy Conversion I—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. Recom-
mended: First year graduate understanding of solid-state electronics.
3 units, Spr (Fahrenbruch) TTh 2:45-4

215B. Photovoltaic Solar Energy Conversion II—Advanced photovoltaic science with emphasis on electronic properties of materials, in-depth semiconductor junction theory, solar cell design, crystal growth, polycrystalline and amorphous thin film deposition and properties. Prerequisite: 215A or 3 quarters of graduate level courses in solid state physics and/or electronics.
3 units, Win (Fahrenbruch) Th 2:45-4

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, Aut (Staff) TTh 1:15-2:30 given 1988-89

224. Amorphous Semiconductors—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.
2 units, Aut (Redfield) M 3:45-5:45 given 1988-89

226. Electrochemistry and Corrosion—Development of electrochemical principles with application to corrosion, electrolytic processes, and galvanic cells. Prerequisite: Elementary thermodynamics.
3 units, Sum (Stevenson) by arrangement plus lab by arrangement

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) T 4

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, 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 (Huggins) MWF 10

233. Energy States in Solids—Introduction to formal quantum mechanics, approximate methods for solution of the Schroedinger equation, free electron model, origin and properties of energy bands in solids. A direct sequel to 188. Prerequisite: 188.
3 units, Spr (Bube) TTh 1:15-2:30

3 units, Aut (Bube) MWF 2:15

3 units, Aut (Bube) MWF 2:15, given 1988-89

3 units, Win (Sinclair) TTh 2:15-3:30 given 1988-89
238. Fracture of Solids—The stress fields about elastic cracks from a conventional elastic and a dislocational approach. Energy of deformation and the Griffith-Irwin brittle fracture criterion, and the extensions to incorporate small-scale plastic yielding. Fracture toughness testing. Microscopic mechanisms of crack nucleation and propagation; mechanisms of ductile fracture. Prerequisites: 185, 203
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, Win (Sinclair) TTh 2:15-3:30

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, Win (Sinclair) TTh 11 M 1:15-4

249. Time-Dependent Plasticity—Theories and mechanisms of creep. Temperature and strain rate effects on plastic flow of solids. Relation of high temperature strength and ductility of materials to structure. Prerequisite: 185 or 205 or Engineering 50.
3 units, Spr (Sherby) MWF 8

250. Life Prediction in Engineering Structures—Modelling of deformation and fracture in metals and alloys, emphasizing methods for quantitative predicting failure of structural materials under complex histories and environments. Topics include the modelling 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, Aut (Miller) TTh 10-11:15
given 1988-89

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) MW 2:15-3:30
given 1988-89

257. Structural Fatigue—(Enroll in Mechanical Engineering 245.)

258. Optical Properties of Solids—(Enroll in Electrical Engineering 332.)

259. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322A.)

260. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322B.)

269. 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, Win (Stevenson) TTh 11:20-12:35

300. Research.
any quarter (Staff) 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 (Miller)
Spr (Sherby)

1 unit, Aut, Win, Spr (Huggins) Th 4:15

343. Seminar in Electronic and Ionic Materials.
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

Emeriti: (Professors) Wilhelm Flügge, Henry O. Fuchs, Boynton M. Green, Erastus H. Lee, A. Louis London, Morton Mitchner, Rudolph Sher
Chairman: Charles H. Kruger
Associate Chairman: Thomas J. Connolly
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; Center for Design Research Laboratory), Elliott Levinthal (Stanford Institute of Manufacturing and Automation)


Associate Professors: Brian J. Cantwell, John K. Eaton, Rolf A. Faste, Larry J. Leifer, Parviz Moin, Drew V. Nelson

Assistant Professors: Mark Cutkosky, M. Godfrey Mongal, Stephen J. Niksa, Sheri D. Sheppard, Juan Simo

Professors (Research): Dean R. Chapman, Elliott Levinthal, Sidney A. Self, Felix E. Zajac

Associate Professor (Research): Dennis R. Carter
Associate Professor (Teaching): David W. Beach

Courtesies: Robert A. Chase, Robert L. Street, George S. Springer

Consulting Associate Professor: Leslie J. Doffman

Consulting Assistant Professors: John J. Csongradi, Peter M. Pinsky


Acting Associate Professor: David M. Kelley

Consulting Professors: Floyd L. Culler, Chauncey Starr

Consulting Associate Professor: Harry T. Whitehouse

Teaching Specialist: Francis E. Rinehart

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 tech-
nology. 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 Design Division provides facilities for laboratory work in experimental mechanics and experimental stress analysis. Additional facilities, including an MTS electrohydraulic materials test system, are available in the School of Engineering Structures and Solid Mechanics Research Laboratory. Laboratories for biological experimentation are available through the School of Medicine and the Palo Alto Veterans Administration Medical Center.

The Design Division maintains machine, foundry, welding, wood, and plastic shops. Laboratory space is available for use in instruction, for construction of projects, and for graduate research work in various disciplines of interest to the Design Division faculty. The School of Engineering Structures Laboratory is used extensively for experimental work in structural mechanics and biomechanics. A 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 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 10 high-performance graphic workstations, a VAX-750 system with 2 CAD workstations, an IRIS-2400 animation computer, and a SUN 3/160 AI workstation. 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, and IRIS 2400 real-time graphics workstations. 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 Thermo-sciences 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, and Physics, and other departmental libraries of which engineering students make frequent use. In addition, each division maintains a reading room and small library collection, and specific research collections in the areas of energy, high temperature gasdynamics, fluid mechanics, and heat transfer.

Graduate students participating in research are provided with office space in the laboratory buildings, and have access to substantial staff support from their research group.

**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 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;
The departmental requirements which must be met for the degree of Master of Science are:

1. **Mathematical Competence** in two of the following areas: partial differential equations, linear algebra, complex variables, or numerical analysis, as demonstrated by completion of two appropriate courses from the following list: M.E. 200-208; Mathematics 106, 113, 131, 132; Computer Science 237A,B. (Requirement: 6 units.)

   Students who completed comparable graduate-level courses as undergraduates and who can demonstrate their competence to the satisfaction of the instructors of the Stanford courses may be exempted from this requirement by their advisors, and place the units in the approved elective category.

2. **18 units of graduate-level courses in Mechanical Engineering consisting of:**
   a) **A Specialty in Mechanical Engineering:**
      A set of graduate-level courses in mechanical engineering to provide depth in one area. These sets have been approved by the faculty as providing depth in specific areas as well as a significant component of applications of the material in the context of engineering synthesis. Lists of approved depth packages are available from the department office. The currently approved depth packages involve 3 to 4 courses.
   b) **Breadth in Mechanical Engineering:**
      1) At least one additional approved mechanical engineering course numbered 210-285 in each of two additional depth areas outside of the depth area selected in item "2a."
      2) Additional graduate-level courses, if necessary, in mechanical engineering to bring the total number of graduate course units in mechanical engineering to 18.

   **Courses 200-208, 280, and 286-301 may not be counted in these categories.**

3. **Approved electives,** to bring the total number 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 consistent with the student's program objectives. 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 seminars. 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 encouraged to use these units outside of engineering, mathematics, or the sciences. Students should consult their advisors for recommendations on course loads and on ways to use the unrestricted electives to make a manageable program.

5. Within the courses satisfying the requirements above, there must be at least one graduate-level course dealing with **laboratory studies**. Courses which satisfy this requirement are 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 experience in an industrial or government research institute may be exempted from this requirement by his advisor.

Candidates for the degree of Master of Science will be expected to have the approval of the faculty, and a minimum letter grade indicator (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 courses numbered M.E. 290-299, 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 complete degree requirements at the end of 60 units of graduate registration will be disqualified from further registration. An exception to the 60-unit rule will be units used to fill deficiencies arising from inadequate undergraduate preparation for mechanical engineering graduate work.

**Computational Fluid Dynamics**—A graduate program in Computational Fluid Dynamics (CFD) is operated jointly by the Departments of Aeronautics and Astronautics, and Mechanical Engineering. At the master's level, this program is an option with the general structure of the master's requirements of each department. At this level, a student interested in a still greater emphasis on CFD may register for the M.S. in Engineering or Engineering Science and design a program, in consultation with 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 must be 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:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Art 360A,B,C. Master's Project</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>*M.E. 211A,B,C. Master's Project</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>M.E. 214. Philosophy of Design</td>
<td>3</td>
<td></td>
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<tr>
<td>M.E. 221. Human Factors</td>
<td>3</td>
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<tr>
<td>**Approved Electives</td>
<td>15</td>
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<tr>
<td>Free Electives</td>
<td>6</td>
<td></td>
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<tr>
<td>**Total</td>
<td>45</td>
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</tr>
</tbody>
</table>

*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. Orthopaedic 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. Smart Product Design

**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 265. 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 M.A. 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 management-oriented individuals with hands-on knowledge of state-of-the-art integrated manufacturing systems and their components, such as computer-aided design, computer-aided manufacturing, robotics, automation, automated storage/retrieval systems, flexible manufacturing systems, and integrated circuit applications.

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:

- Visual Thinking (M.E. 101)
- Engineering Design (M.E. 210A,B,C)
- Computer-Aided Design (M.E. 212A)
- Manufacturing and Design (M.E. 213)
- Microprocessor Applications (M.E. 218A,B,C)
- Introduction to Robotics and Manipulation (M.E. 219)

The engineering management subjects include:

- Engineering Economy (Engr. 60)
- Statistics and Quality Control (Indust. Engr. 121)
- Industrial Accounting (Indust. Engr. 133)
- Organization Behavior and Management (Indust. Engr. 203)
- Analysis of Production Systems (Indust. Engr. 260)

Manufacturing Strategy (Indust. Engr. 265)

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 (M.E. 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.

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 super-
vising post-master's research will generally require some such evidence that a student has research potential before committing themselves to supervision and a research assistantship. It is most efficient to carry out this preliminary research effort during the M.S. degree year.

At their first post-master's registration, students seeking post-master's degrees must report their status of faculty supervision to the department. A student who has not arranged for faculty supervision must petition for registration after completing 45 units of graduate work at Stanford.

ENGINEER

The basic University requirements for the degree of Engineer are discussed in the "Degrees" section in this bulletin.

This degree represents nominally an additional year of study beyond the Master of Science degree, and includes a research thesis. This program is designed for students who desire to do professional engineering work upon graduation, and who desire an opportunity to engage in more specialized study than is afforded by the master's degree alone.

The admission standards for this program are substantially the same as indicated under the master's degree. However, since thesis supervision is required, and the availability of thesis supervisors is strictly limited, the department cannot admit a student to candidacy until the student has personally arranged with some member of the faculty to supervise a research project. This will frequently involve a paid research assistantship, and research assistantships are awarded by individual faculty members (usually from the funds of sponsored research projects under the direction of individual faculty members) and not by the department, so again a personal arrangement is necessary. Students studying for their master's degree at Stanford and desiring to continue to the engineer degree ordinarily make such arrangements during their M.S. degree year. Students holding master's degrees at other universities 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 age 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. A sufficiently well-qualified student from Stanford or elsewhere will be admitted and assigned to an advisor. If the student has not arranged with a faculty member for supervision or research prior to admission, the student's advisor will assist him or her in making the arrangement. However, the department cannot guarantee research supervision as this involves a personal arrangement between the student and the individual faculty member, and such an arrangement is entirely the responsibility of the student. Once a student has obtained a research supervisor, this supervisor becomes thereafter the student's academic advisor. Research supervisors may require that the student pass the departmental oral examination before starting on research work and before receiving a paid research assistantship. Note that research assistantships are awarded by the individual faculty research supervisors and not by the department.

Prior to being formally admitted to candidacy for the Ph.D. degree, the student must demonstrate his or her knowledge of engineering fundamentals by passing 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 letter grade indicator 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 290 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 section on "Degrees" 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 representative timetable for progress toward the Ph. D. degree may be obtained from the departmental office. A student wishing to complete the Ph. D. requirements in four years of graduate study should ordinarily complete the M. S. by the Spring 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 thesis research work and write their theses 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
roduction 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) MW 8-10

103. Manufacturing and Design — Fundamentals of machining, welding, and casting introduced in lecture and supported by laboratory experience. Emphasis on prototype techniques as part of the design process. Manufacturing processes described through lecture, films, and field trips. Design aspects are developed in an individual term project which is designed, described in engineering drawings, and fabricated by the students. 103D is normally taken concurrently with 103 unless the student has previous experience doing engineering drawing. Recommended: 101, Engineering 11.

4 units, Aut, Win (Beach) T 9 Th 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.)


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

112. Mechanical Systems—Emphasizes quantitative aspects of the design process. Applications of basic principles and empirical relationships in the evolution from conceptual design to the detailed specification of critical components. Individual term projects apply principles developed to the quantitative design on paper of a complete mechanical system to meet specified functional goals. Prerequisite: 111.

3 units, Win (Barkan) MWF 9

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 (Cutkosky, Sheppard) TTh 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 their freehand drawing skills.

1 unit, any quarter (Scott, Reeder) 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 will 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—Offers 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—Covers internal combustion engines, including conventional and turbocharged spark ignition engines, diesel, and gas turbine engines. Lectures review 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. Lecture and laboratory covering 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 (Johnston) MWF 10 plus lab one afternoon by arrangement

131B. Heat Transfer—Continuation of 131A.

5 units, Win (Moffat) MWF 10 plus one lec hour and lab one afternoon by arrangement

131C. Thermosciences—Continuation of 131B.

4 units, Spr (Bowman) 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 include 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

176. Nuclear Energy—(Enroll in Engineering 176.)

180. Energy and Society—Unified analysis of the production, distribution, and consumption of energy in the U.S. and world. Topics: kinds and magnitude of energy resources; various technologies for conversion to electric energy and other consumer forms; priorities and strategies for future development; social conflicts between growing demands and environmental degradation, technological assessment; legal and economic framework of energy industry. Technical information is in terms understandable to the non-engineering student. Prerequisites: High school physics, Mathematics 21, and junior standing, or consent of instructor.

3 units, Aut (Connolly) MWF 1:15

191. Engineering Problems and Experimental Investigation—Directed study and research for the undergraduate student on a subject of mutual interest to student and staff member. Student must find faculty sponsor and have approval of his advisor.

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.

Course No. Subject

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

176. Nuclear Energy (Enroll in Engineering 176)

180. Energy and Society

250. Introduction to Heat Transfer

255. Gasdynamics
PRIMARILY FOR GRADUATES

ENGINEERING MATHEMATICS


3 units, Aut (Moin) MWF 11

200B. Mathematical Methods in Mechanical Engineering—Solution of partial differential equations arising in mechanical, thermal, and hydrodynamic problems. Analytical considerations include self-similar transformations, separation of variables, eigenvalue problems, eigenfunction expansions, special functions, characteristics, Laplace Transform. Prerequisites: Background in linear algebra, advanced calculus, and ordinary differential equations.

3 units, Win (Ferziger) MWF 9


3 units, Spr (Moin) MWF 11

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.)


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

205B. Methods of Mathematical Physics—(Enroll in Mathematics 220B.) Continuation of 205A.

3 units, Win (Keller)

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 Tensors 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, given 1988-89
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, each group under supervision of an instructor from the 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, both oral and written is stressed. Students unfamiliar with manufacturing processing or drafting are encouraged to enroll also in 103 and 103D. Limited enrollment. Prerequisite: 113 or equivalent.

210A. 4 units, Aut (Barkan, Staff) TTh 3:15-5:05
210B. 3 units, Win (Barkan, Staff) W 3:15-5:05
210C. 3 units, Spr (Barkan, 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 (enroll concurrently in Art 360). 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.

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

213. Computer Aided Prototyping—Design and fabrication emphasizing the use of computer supported tools in the prototyping process. Students choose, design, and build individual projects. The available tool set includes Hewlett Packard CAD (ME10), CNC part programming software, and CNC milling machines. Lectures alternate between student and instructor presentations of work in progress. Enrollment limited to 12. Prerequisite: Programming ability in a language such as Pascal, ME101, ME103.

3 units, Spr (Paste, Kelley) MWF 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. Prerequisite: Concurrent enrollment in 210A or 211A.

3 units, Aut (Thornburg) M 2:15-5:05

215. The Designer in Society—An intensive personal experience in which 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 disciplines.

3 units, Win (Roth) W 1:15-4:05


3 units, Spr (Wilde) MWF 1:15-2:05

217. Design for Manufacturability—The relationship between design and each aspect of
manufacturing, from part layout and material selection to product inspection and repair. Topics include 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.

3 units, Spr (Cutkosky, Barkan) MWF 9-10 alternate years, given 1988-89

218A. Foundation Concepts in Smart Product Design — An introduction to the fundamentals of design for electromechanical products incorporating microprocessor technology, software engineering, human factors, and product design methodology. Topics: digital logic, microprocessor organization, development system architecture, interactive high-level language programming (FORTH), assembly language programming in a high-level language environment, real-time task control, and electronics for electro-mechanical systems. Assignments stress balanced hardware and software design practice. Grading is based on laboratory assignments in which each student builds several microprocessor interface circuits; writes microcomputer control programs for each interface; creates a stand-alone product using a small target system; and writes a laboratory report for each assignment. Prerequisites: Computer Science 111/Electrical Engineering 181/182, or their equivalents. There is a laboratory fee. Enrollment limited.

3 units, Win (Leifer) TTh 1:15-2:45

218B. Integrated in Smart Product Design — The interface methodology of 218A is extended for real-time control of a variety of external electro-mechanical devices. Open ended assignments include human I/O, discrete system I/O, and analog system I/O. Logic analysis, in-circuit-emulation, and high performance peripheral communication protocols are used. Where the emphasis in 218A was on acquiring the basic tools, 218B stresses the application of these tools in design. Prerequisite: Computer Science 111.

3 units, Spr (Leifer) TTh 1:15-2:45

219A. An Introduction to Robotic Manipulation Vision — The basics of robot manipulators and a review of current applications. Topics emphasized are: 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 (Robotics) — (Enroll in Computer Science 327B.)

219C. Advanced Robotics — (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 with emphasis on 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 (Barkan) MWF 9 alternate years, not given 1988-89

224. Advanced Manufacturing Automation — Sensor-driven flexible manufacturing. Basic issues at the unit process level include the acquisition and interpretation of sensory data, adaptive
control, machine learning, in-process inspection, and integration with CAD. At the cell level, topics include architectures and strategies for manufacturing cell control. A major part of the grade is based on individual projects involving an in-depth application of the material to a manufacturing problem of the student’s choice. Typical applications include robotic grinding, assembly and welding, CNC machining, part inspection, deformation processes and cell control. Prerequisite: Engineering 105 or equivalent. Recommended: 103 or 213 and 219A.

3 units, Win (Cutkosky) MW 11-12:15 plus individual meetings by arrangement

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, Spr (DeBra) MWF 9 alternate years, not given 1988-89

MECHANICS OF SOLIDS

230. Advanced Kinematics—Kinematics from both the mathematical and engineering view-points. Introduction to algebraic geometry. Application of matrix, tensor, and dual-quarternion methods to kinematic analysis and synthesis. Students are required to prepare reports on problems in kinematics.

3 units, Win (Roth) M 2:15-4:45


3 units, Win (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, Spr (Kane) TTh 9:30-10:45 alternate years, given 1988-89


3 units, Spr (Kane) WF 11-12:15 alternate years, given 1988-89

232C. Nonlinear Oscillations—Derivation and classification of nonlinear differential equations governing various phenomena of mechanics. Phase plane trajectories and integrals of the
equations of motion of autonomous systems. Response curves and stability criteria for forced oscillations of systems with nonlinear characteristics. Systems with several degrees of freedom. Large nonlinearities, chaotic behavior.

3 units, Win (Breakwell) MWF 2:15


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

alternate years, not given 1988-89


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

given 1988-89


3 units, Win (Hughes) TTh 2:45-4

alternate years, not given 1988-89


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

alternate years, not given 1988-89


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

given 1988-89

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. 236A is not a prerequisite.

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

237. Free and Forced Motion of Structures — (Enroll in Aeronautics and Astronautics 244A.)


3 units, Aut (Herrmann) MWF 10

238B. Theory of Elasticity — Continuation of 238A. Analysis of plane stress and plane strain. Stress functions. Axisymmetric problems. Complex potentials. Prerequisite: 238A.

3 units, Win (Herrmann) MWF 10
238C. Theory of Elasticity — Continuation of 238B. Westergaard solutions for plane crack (in terms of complex potentials). Derivation of the asymptotic stresses at crack tip. Strain energy and material conservation laws in linear elasticity. Their relation to path-independent integrals of fracture mechanics: J, L, M. Three-dimensional problems in terms of displacement potentials such as Boussinesq-Papkovich-Neuber functions and the Galkerkin vector. Fundamental solutions to the Kelvin, the Bossinesq and the Mindlin problem and their extensions. Rigid punch and elastic contact (Hertz) problems. Introduction to nonlinear elasticity.

3 units, Spr (Barnett, Herrmann) MWF 11


3 units, Aut (Simo) TTh 2:45-4
alternate years, given 1988-89


3 units, Win (Simo) TTh 2:45-4
alternate years, 1988-89


3 units, Spr (Simo) TTh 2:45-4
alternate years, given 1988-89

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
and computational implications of the basic theory are emphasized.

3 units, Aut (Simo) TTh 9-10:30
alternate years, not given 1988-89


242B. 3 units, Win (Simo) TTh 9-10:30
alternate years, not given 1988-89

242C. 3 units, Spr (Simo) TTh 9-10:30
alternate years, not given 1988-89


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, Spr (Herrmann) TTh 11-12:15
alternate years, not given 1988-89


3 units, Win (Nelson) MW 2:15-3:05

246. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)

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 (Niksa) 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 (Mungal) 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 (Mungal) 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


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, particularly as applied in high-temperature energy conversion systems. Such students should also 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 (Hanson) 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 (Bowman) 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, Spr (Johnston) TTh 8:35-9:50 alternate years, not given 1988-89


2 units, Spr (Self) by arrangement


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 9

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 (Kruger) 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, Win (Bowman) MWF 1:15

alternate years, not given 1988-89

263. Partially Ionized Plasmas and Gas Discharges—Introduction to partially ionized gases and the nature of gas discharges. Discharges in the context of both low pressure and atmospheric pressure applications including energy conversion and materials processing. Prerequisite: 262A or consent of instructor.

3 units, Win (Self) 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, Win (Hanson) MWF 9

alternate years, not given 1988-89


3 units, Win (Hanson) MWF 9

alternate years, given 1988-89


3 units, Spr (Hanson, Niksa) MWF 9 plus one 3-hour lab by arrangement

alternate years, given 1988-89

268. Experimental Methods in the Thermosciences—Planning experimental programs, uncertainty analysis, and the selection of instrument systems. Steady-state measurements of heat flux, temperature, pressure, and flow rate. Mean-velocity and mean-temperature measurements in boundary layers. Advanced laboratory problems in heat transfer and fluid dynamics. Prerequisites: At least one graduate course each in heat transfer and fluid mechanics, or consent of instructor.

4 units, Spr (Moffat) MWF 10 plus one 4-hour lab by arrangement

3 units, Spr (Ferziger) MWF 11
alternate years, not given 1988-89

THERMODYNAMICS AND ENERGY CONVERSION

270. Engineering Thermodynamics—Thermodynamic analysis of engineering systems emphasizing systematic methodology for application of basic principles. Entropy production and availability analysis. Thermodynamics of mixtures, reacting systems. Applications to a wide variety of energy conversion 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

271. Combustion and Pollution—Heat of reaction, adiabatic flame temperature, and chemical composition of products of combustion; production of pollutants in combustion systems; kinetics of reactions; emissions of oxides of nitrogen and carbon monoxide, explosions, fuel oxidation; propagation and structure of laminar premixed flames; detonations; reduction of pollutant emissions by modification of combustion parameters. Prerequisite: 262A or 270, or consent of instructor.

3 units, Win (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 (Niksa) MWF 2:15

273. Thermodynamics of Propulsion Systems—Analysis of the performance of propulsion systems from thermodynamic and dynamic points of view including rocket, ramjet, turboprop, and turbofan engines as well as piston, gas turbine, and compound piston-turbine type engines. Prerequisite: 270 or consent of instructor. Recommended: Some familiarity with compressible gas dynamics.

4 units, Win (Staff) plus one hour by arrangement, alternate years, given 1988-89

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) MWF 1:15

276. Nuclear Energy—Theory, design, and applications of nuclear energy systems; radioisotope heat sources, fission chain reactors and concepts of fusion reactors. The information is applied to topics of current interest: nuclear waste disposal, health effects of nuclear radiation, fusion reactor development, laser separation of isotopes, etc.

3 units, Spr (Connolly) MWF 1:15

BIOMECHANICS

281. Special Projects: Orthopedic Biomechanics—Engineering mechanics applied to the human musculoskeletal system. Material and structural characteristics of bones, ligaments, muscle/tendon, and synovial joints. Engineering evaluation of orthopedic procedures and devices. Correlations between engineering predictions and clinical/biological results. Introductory anatomy and physiology is presented. Prerequisites: Engineering graduate standing and consent of instructor.

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; applications to sports and rehabilitation such as posture, walking, jumping, and cycling.

3 units, Spr (Zajac) T 3:15-5:40
alternate years, given 1988-89

284. Dynamics of Viscous Fluids and Suspensions—(Enroll in Aeronautics and Astronautics 209.)
285. Biomedical Fluid Mechanics—(Enroll in Aeronautics and Astronautics 229.)

SPECIAL AREAS

286. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)

289. The Nature of Technology and Modern Society —(Enroll in Engineering 221, VTSS 105.)

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 Values, Technology, Science, and Society 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 (Kline) given 1988-89

294. Design Forum — Invited speakers address issues of interest to designers. Brief presentation followed by open discussion.
1 unit, Aut, Win, Spr (Staff) 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, Spr (Beach) F 1:30-3

297. Energy Policy Seminar—Weekly presentations and discussions on energy policy emphasizing technological aspects. The status of various national programs for the advancement of energy technology. Views on the political, social and economic aspects of projects to which engineers devote their efforts. Prerequisite: Graduate standing in engineering.
1 unit, Win, Spr (Connolly) M 4:15-5:30

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

3 units, Win (Moin) TTh 11

309. Finite Element Analysis in Mechanical Design—Part I: the basic concepts of finite elements, with applications to problems confronted 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

351. Vortex Dynamics—Basic of vorticity 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, Aut (Shariff) TTh 11

OPERATIONS RESEARCH

Chairman: Donald L. Iglehart
Associate Chairman: Frederick S. Hillier
Associate Professor: Peter W. Glynn
Professor (Research): Walter Murray
Affiliated Associate Professor: Charles P. Bonini
Consulting Professor: Alan J. Hoffman
Senior Research Associates: Philip E. Gill, Michael A. Saunders, Margaret H. Wright
Research Associate: John C. Stone

OFFERINGS

Operations Research is concerned with the formulation, analysis, and use of mathematical models relevant to the understanding and/or solution of significant problems of decision making. The department's principal objectives are to provide a comprehensive program of instruction in the mathematical foundations of operations research, to acquaint students with applications of these methods to significant problems, and to develop research scholars.

The department offers programs leading to a Master of Science, Engineer, and Doctor of Philosophy, and participates in a program leading to a Bachelor of Science in Mathematical and Computational Science. Under the Graduate Division Special Ph.D. Programs, it is also possible to arrange a well-considered program that is a combination of Operations Research with some other departmental area.

Among the many areas of operations research, the department has special competence in the following: applied probability; dynamic programming; inventory, queueing, reliability theory, and simulation methodology; linear, nonlinear, and integer programming; networks and combinatorial optimization; nonlinear equations; and energy and economic modeling.

The department's Systems Optimization Laboratory provides students with the opportunity to gain firsthand experience with computational methods, to participate in research on new algorithms, and to learn about modeling complex systems dealing with energy, the economy, water, etc.

Office facilities are available for doctoral students. In addition the department has its own library, remote-access computer terminals, dedicated word processors, microcomputers, and computer workstations.

INTRODUCTORY COURSES

The department offers introductory courses for both undergraduate and graduate students. The courses are given at several levels and in a variety of combinations to accommodate the needs of different students.

Operations Research (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. 151 is similar except that it also assumes a knowledge of the elements of matrix algebra, includes a discussion of game theory, and gives less emphasis to nonlinear and dynamic programming. 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 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 151 and 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 a Master of Science 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 lifelong 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>
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<tbody>
<tr>
<td>Math. 113S</td>
<td>Linear Algebra and Its Applications</td>
<td>3</td>
</tr>
<tr>
<td>Math. 115*</td>
<td>Fundamental Concepts of Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

*Comp. Sci. 135 or 237A may be substituted with the permission of the student's advisor.

No thesis is required. A minimum letter grade indicator of 2.75 is expected.

OPERATIONS RESEARCH

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. Res. 240</td>
<td>Linear Programming</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 116</td>
<td>The Operations Research of Probability</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 217</td>
<td>Introduction to Stochastic Processes</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 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>Electives from the 200 or higher-level offerings of the department (with at most two units of O.R. 290 counted) or from authorized courses in other departments</td>
<td>8</td>
<td></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.

ENGINEER

The Engineer degree in Operations Research is for students desiring additional academic preparation beyond the master's degree for a career of professional practice in operations research.

This degree nominally represents an additional academic year of full time study beyond the Master of Science degree in Operations Research, including a thesis. The thesis normally is in the form of a technical report on a successful contribution to (and participation in) an applied project, such as those being carried on in the department's Systems Optimization Laboratory or Energy Studies Project.

Since thesis supervision is required, and the department gives precedence to providing thesis advisors for qualified students in the Ph.D. program, the availability of thesis supervisors for the Engineer degree is very limited. Therefore, before being permitted by the department to continue study after the M.S. degree toward this degree, the student must have personally arranged for a faculty sponsor for thesis supervision and, if financial support is needed, for a research assistantship for the thesis project. These arrangements are then subject to the approval of the department's Admissions and Financial Aid Committee.

The University's basic requirements for the Engineer degree are outlined in the "Degrees" section in this bulletin.
DOCTOR OF PHILOSOPHY

The program leading to a Doctor of Philosophy in Operations Research is directed to those primarily interested in a career of research, teaching, or high-level technical work in universities, business, or government. Therefore, emphasis is given to the scientific foundations of operations research. In particular, the program is focused on:

1. The study of the abstract mathematical structure of models derived from real life situations such as allocation models of an enterprise or an economy, energy modeling, network flow models of transportation and communication systems, reliability models of complex engineering systems, queueing models of congestion, modeling and control of dynamic systems, discrete selection models for routing and pattern cutting, policy decisions for production and inventory control, and models for conflict resolution.

2. The development of the mathematical theory necessary for the study of these models.

Examples of the disciplines studied include energy and economic modeling, mathematical programming, dynamic programming, stochastic systems, stochastic processes, network and combinatorial theory, reliability, queueing theory, inventory theory, and game theory.

Candidates for the Ph.D. in Operations Research will normally meet the course requirements shown below.

1. Prerequisites: Mathematics 113, 115, 116; Statistics 116, 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, 349, 363, 371, 376, 380B, 390A, 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.

In addition to the above requirements, all candidates for a Ph.D. in Operations Research are required to serve as a teaching assistant in the department for at least two quarters.

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 (Manne) 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 (Manne) MWF 10
151. Introduction to Operations Research I — Theory and computation of optimal selection of decisions under certainty with common or conflicting objectives. Linear programming (simplex method and duality theorem), network flows, dynamic programming, game theory (minimax theorem), nonlinear programming. Applications drawn from problems in pricing resources, production planning, inventory control, transportation, pollution control, taxation, personnel assignment, construction management, political tactics, equilibria of competitive economies, and financial management. Prerequisites: Mathematics 43 and 103 or consent of instructor.

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

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, capacity expansion, and financial management. Prerequisite: Mathematics 43 or consent of instructor. (DR:8)

4 units, Aut (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


3 units, Win (Wright) TTh 2:45-4
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 4:15-5:30
Sum (Staff) MW 3:15-5:30

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) TTh 2:40-3:55
Sum (Staff) MW 1:15-3:15


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

260. Scientific Computing and Numerical Optimization—(Same as 160.)

3 units, Win (Wright) TTh 2:45-4:00

280A. Applications of Operations Research—(Doctoral students register for 380A.) Applications of operations research to problems in business, nonprofit institutions, and government. Case studies illustrate the interplay between theory and practice. Student use of microcomputers for spreadsheets, optimization, and probabilistic simulation.

3 units, Win (Eaves) TTh 8:30-9:45

280B. Applications of Operations Research—(Doctoral students register for 380B.) Applications of operations research 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) MF 3:15-4:30

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.

340. Linear Programming—Basic theory plus laboratory for learning about the numerical, software, and applicational aspects of the field. Formulation of standard linear programming models. Alternative techniques for solving linear programs. Theory of polyhedral convex sets, linear inequalities, alternative theorems, and duality. Variants of the simplex method, dual simplex method, product form of the inverse. Upper bounding, sensitivity analysis, economic interpretations. Large-scale linear programming, decomposition principle. Prerequisite: Mathematics 113, or consent of instructor.

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 include 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

343. Nonlinear Programming—Motivation and analysis of algorithms for solving nonlinear programming problems. Descent algorithms for n-dimensional minimization (convergence analysis, steplength criteria). Newton-type, quasi-Newton, and conjugate gradient methods for unconstrained optimization. Extensions to linear-
ly constrained problems including linear and quadratic programming. Algorithms for nonlinearly constrained optimization, including penalty and barrier function methods, augmented Lagrangian methods, and sequential quadratic programming methods.

3 units, Aut (Murray) by arrangement

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, Aut (Hillier) F 9

345. Network Optimization—(Same as 245.)

3 units, Win (Papadimitriou) MW 8:30-9:45

346. Mathematical Programming Computation—(Same as 246.)

3 units, Sum (Staff) TTh 3:15-5


3 units, Win (Manne) given 1988-89


3 units, Win (Papadimitriou) MW 3:15-4:30


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 (Glynn) TTh 2:40-3:55

358. Queueing Theory—(Same as 258.)

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


3 units, Win (Glynn) 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)

366. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 286, Psychology 283, Business 694.) The study of normative and descriptive decision making, particularly in the face of uncertainty. The way decisions are made and problems arising in making decision analyses in applied policy contexts. Meets irregularly during one or two quarters.

1-2 units, Win (Arrow, Tversky, Wilson) by arrangement

367. Welfare Economics—(Same as Economics 280.) The normative and descriptive theory of social choice. Alternative axiomatizations of social choice, with special reference to inter-
personal comparisons of utility; possibility and impossibility theorems. Measurement of inequality from a social choice viewpoint. Individual rights and social choice. Strategic considerations in social choice procedures; the Gibbard-Satterthwaite theorem on manipulability; demand revelation.

5 units, Win (Staff)


4 units, Spr (Wilson) by arrangement

371. Topics in Mathematical Programming— Seminar with presentations by students and invited speakers. General 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. Corequisite: 341.

3 units, Win (Dantzig) by arrangement

374. Topics in Integer Programming—Mathematical developments inspired by the practical problems of integer programming. Topics: group problem and corner polyhedra; integer hull and its facets; Helly’s theorem; cutting planes and Chvatal-Gomory rank; Hermite and Smith normal forms; Lenstra’s algorithm.

3 units, Win (Hoffman) by arrangement

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) TTh 8:30-9:45

380B. Applications of Operations Research—(Same as 280B.)

3 units, Spr (Manne) MF 3:15-4:30

390A,B. Advanced Topics in Operations Research—Two seminars offered, topics to be announced. Prerequisite: Consent of instructor.

390A. 3 units, Sum (Staff) by arrangement

390B. 3 units, Sum (Staff) by arrangement


any quarter (Staff) by arrangement
Dean: Norman K. Wessells
Administrative Associate Deans: Susan W. Schofield, Arnice P. Streit
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; 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 section on 'Graduate Division Special Programs' 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), Sylvia Wynter (Spanish and Portuguese), and undergraduates by appointment
Participating Faculty: Ronald Alexander (Communications), Clay Bates (Engineering), Clay Carson (History), Gregson Davis (Classics), Sandra Drake (English), John Gill (Engineering), William Gould (Law), Donald Harris (Economics), 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), Sylvia Wynter (Spanish and Portuguese), Edgar Yhap (Medicine)

UNDERGRADUATE MAJOR

The revised 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 a student major or double major complete a total of 63-65 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>

#### IIB. 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>
</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:

- **African History and Society**—(an extension of IIA): History 146B, Afro-America and Africa; History 248S, The Colonial State and Society in Africa; Education 195, Introduction to Africa Through Film.

- **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 1987-88. Essentially, the scholars program is an attempt to promote contacts between faculty and students on an intensive individual basis. In 1987, 30 students were placed with 15 professors in a variety of fields. Each student receives a stipend to assist their research, plus a certificate upon completion of the project. In the future, 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.

A.A.A.S. PROGRAM OFFERINGS

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.) 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, Wynter) MWF 11

113. Western Culture and the Black Diaspora: The Semiotics of Self and Other—Selected texts examine the significations accorded Africa, the "Negro," and the Black Diaspora in the signification system of Western culture. The deconstruction of these significations by some schools of modern Western scholarship and by counter-discourse of emancipatory movements in the Diaspora, itself.
5 units (Wynter)

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 USA, Brazil, Spanish-speaking Latin America, and the Caribbean. (DR:5*)
5 units, Win (Wynter)

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 development and opportunities for Black and Third World communities.
3 units, Spr (Bates)
130. Coding Differences: Race/Class/Sex/Culture/I.Q. and the Gender Model as Functions of the Contemporary Human System — Seminar examines the use made of the analogy of gender, i.e., biological difference, to code socially produced differences as natural difference. Focuses on the function of this analogy in the representation of the social constructs of race/class/sex/culture and I.Q. as differences that are “naturally pre-determined,” and the function of the metaphorical construct of “natural determinism” in the status-organizing processes of the contemporary human order. Uses the frames of reference of Black, ethnic, and feminist scholarship.
5 units (Wynter)

165. Afro-Hispanic Culture and Literature—An outgrowth of Africa and the Black Diaspora, concentrating on Spanish-speaking countries with a sizeable Black population, particularly Colombia and Cuba. Introduction to other, less-known Afro-Hispanic cultures. Emphasis on: the relationship of these cultures to the countries in which they are found; their relationship to other African cultures and peoples; and the uniqueness of the individual cultures.
5 units (Wynter)

166. Designing a North American Core Curriculum for Stanford University—A new course, on the Work Shop model, in which students organize a ¾ class that would be taught at Stanford. The issue integrates all the ethnic histories.
4-5 units, Win (Wynter)

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)

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/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 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 (Wynter)

DEPARTMENT OFFERINGS
See respective department listings for course descriptions and (DR) information.

ANTHROPOLOGY
15/116. Anthropological Perspectives on American Culture.
3-5 units, Aut (G. and L. Spindler)

5 units, Aut (Gibbs)

DANCE
82. Jazz Dance II.
1 unit, Aut, Win, Spr (Staff)

83. Jazz Dance III.
1 unit, Win (Osumare)

2 units, Aut (Osumare)

DRAMA
5. Introduction to Black American Drama.
4 units, Spr (Richards)

1-3 units (Staff) any quarter

1-5 units (Staff) any quarter

157N. Contemporary Black Playwrights.
4 units (Richards) alternate years, given 1988-89

ECONOMICS
118. The Economics of Development.
5 units, Win (Anderson)

EDUCATION
175X. Women and Development in Africa—(Same as Anthropology 109, Feminist Studies 138.)
4 units, Spr (Samoff)

201. History of Education in the United States—(Same as History 158.)
3 units, Spr (Tyack)

217X. Teaching A Global Perspective: Cross-Culture Approaches.
4 units, Aut (Grossman)

395. Education and Radical Change: African Experiences—(Same as Political Science 221S.)
5 units, Spr (Samoff) alternate years, not given 1988-89
ENGLISH

161A. The Afro-American Novel.
5 units, Aut (Drake)

166A. Literature and Politics in South Africa
(Same as German Studies 158A.)
4 units, Win (Berman)

5 units, Spr (Thompson)

306. Colloquium: Afro-American Women Nov-
elists.
5 units, Win (Drake)

FOOD RESEARCH INSTITUTE

103. The World Food Economy—(Same as Economics 106.)
3 units, Spr (Johnston)

121. Development and Population Interaction
in the Third World—(Same as Economics 119.)
5 units, Win (Yotopoulos)

136. Population Perspectives in the Third
World—(Same as Economics 133, Human Biol-
ogy 136, Sociology 153.)
5 units, Win (Wilson)

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)

251. Food and Nutrition Strategies in Devel-
opment.
5 units, Spr (Johnston)

HISTORY

21. The World Outside the West: Change and
Tradition Before the Age of European
Imperialism—(Same as Anthropology 21.)
5 units, Win (Rick, Roberts, Van Slyke)

22. The World Outside the West in the Age of
European Imperialism.—(Same as Anthropol-
ogy 22, Political Science 22.)
5 units, Spr (Abernethy, Van Slyke, Varese)

5 units (Jackson)

249. Undergraduate Colloquium: Africa Since
1945.
5 units, Win (Jackson)

343D. Empire and Race: The Decline and
Fall of the British Empire in India and South
Africa.
5 units, Spr (Worger, Zaftoutil)

LINGUISTICS

73. Black English.
4 units, alternate years, given 1988-89

AFRICAN STUDIES

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 (Moshi)

4 units, Aut, Win, Spr (Moshi)

PSYCHOLOGY

127. Afro-American Psychology.
3 units, Spr (Hudson)

POLITICAL SCIENCE

118J. Africa: Development and Dependence.
5 units, Aut (Samoff)

221. Education and Political Change—(Same
as Education 306B.)
5 units, Win (Samoff)

5 units, Spr (Abernathy)

SOCIOLOGY

145. Race and Ethnic Relations.
3-5 units, Spr (Walker) MWF 10
one section by arrangement

AFRICAN STUDIES

Emeriti: St. Clair Drake (Anthropology and
Sociology), Joseph H. Greenberg (Anthro-
pology and Linguistics), William O. Jones
(Food Research Institute)
Chairman: James Lowell Gibbs, Jr. (Anthropol-
y)
Professors: David B. Abernethy (Political Sci-
ence), Martin Carnoy (Education), James
Lowell Gibbs, Jr. (Anthropology), William B.
Gould (Law), Bruce F. Johnston (Food Re-
search Institute), William R. Leben (Linguis-
tics), Scott R. Pearson (Food Research Insti-
tute), Hans N. Weiler (Education and Polit-
ical Science), Sylvia Wynter, (African and
Afro-American Studies)
Associate Professors: Paul F. Basch (Medicine),
Kennell A. Jackson, Jr. (History), Joel Samoff
(Education)
Assistant Professors: Joel S. Beinin (History),
Donald L. Donham (Anthropology), Sandra
E. Drake (English and Comparative Litera-
ture), Sandra Richards (Drama), Richard
Roberts (History)
Lecturer: Lioba Moshi (Linguistics)
Curators: Peter Duignan (Senior Fellow
Hoover Institution), Karen Fung (Senior
Librarian)
The aim of the Committee on African Studies is to provide a comprehensive interdisciplinary program in African Studies for undergraduate and graduate students from a variety of departments. Under the aegis of the Stanford/Berkeley Joint Center for African Studies, it is possible to incorporate courses from both institutions into one's program by special arrangement.

The Joint Center for African Studies sponsors instruction in a wide variety of African languages, most of them on an individual basis, at the request of interested students. In the past three years, over a dozen different languages have been offered for credit by instructors who grew up speaking these languages.

Courses in African Studies are offered by departments and programs throughout the University. A sampling of courses is 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 Université 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 program in International Development Education in the School of Education focuses on issues of educational policy and planning in Africa and in the Third World more generally. It offers both a Ph.D. and an A.M., 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**

Introduction to African and Afro-American Studies — (Enroll in African and Afro-American Studies 105, Anthropology 105). 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 include 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 (Wynter, Staff) MWF 11

Women and Development in Africa—(Enroll in Anthropology 109, Education 175X, Feminist Studies 138.) A survey of women's roles and experiences in formal and informal development activities in Africa. Topics: women in African history; women and decolonization/liberation, development and dependence; crisis in
production and productivity; education and work; women and development planning; women, politics, and power; and feminism in the U.S. and Africa. Reviews relevant theoretical orientations and empirical research, drawing on concrete case studies. Recommended: Prior or concurrent work on Africa and/or women in the Third World.

4 units, Spr (Samoff) TTh 4:15-6:05

Core Seminar: Africa and the Black Diaspora: An Introduction to its Literature, Thought, and Cultural Worlds—(Enroll in African and Afro-American Studies 114.) Introduction to the parallelisms and differences in the literature, thought, and cultural worlds, both of contemporary Africa and of the African-descended communities in the New World, i.e., the U.S.A., Brazil, Spanish-speaking Latin America, and the Caribbean. (DR:5*)

5 units, Win (Wynter) TTh 11

Law in Radically Different Cultures—(Enroll in American Studies 176L, 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. First class meeting January 26.

2 units, Win, plus 3 units, Spr (Barton, Foster-Simmons)

African Societies in a Changing World—(Enroll in Anthropology 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, changing forms of expressive arts, the emergence of new classes, the impact of Islam and Christianity, and the emergence of national consciousness. Guest lecturers from the Stanford-Berkeley Joint Center for African Studies. Five Wednesday evening sessions are devoted to films and guest presentations.

1 or 5 units, Aut (Gibbs, Staff) MWF 10

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 Stanford or Berkeley professor and consists of a lecture followed by a seminar discussion of assigned readings.

1-5 units, Aut (Leben, Staff) T 2:15-3:15

Literature and Politics in South Africa—(Enroll in English 166A.) The impact of political and social conflict in South Africa on writing and literary life. With reference to historical context, addresses the changing literary articulations of politics, the status of the political novel and essay, the transformation of the stage and the role of the author in political controversies. Texts by: Biko, Breytenbach, Brink, Brutus, Gordimer, Head, La Guma, Mtwa, Ndebele. All readings in English.

4 units, Win (Berman) MWF 11

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, Win (Rick, Roberts, Van Slyke) MTWThF 10

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 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 22.)

5 units, Spr (Abernethy, Varese, Van Slyke) MTWThF 10

History of South Africa—(Enroll in History 147B.) The historical origins of South Africa's contemporary problems. Survey of South African history from the time of the first significant interracial contact in the 17th century through the impact of Dutch and British colonialism in the 18th and 19th centuries and the effects of the rise of an industrializing economy in the late 19th and 20th centuries. Explores a number of recurring issues: the nature and extent of white supremacy in thought and action; the original rise of Africaner nationalism; the role played by mining capital in the development of segregation and apartheid; the changing nature of the South African state; the role of
blacks in the economy; and the problems besetting the rise of African nationalism and black consciousness.

5 units (Worger) MTWTh 9

Africa: The 20th Century—(Enroll in History 148C.)
alternate years, given 1988-89

History of East Africa—(Enroll in History 149A.)
4-5 units, Spr (Jackson)

Empire and Race: The Decline and Fall of the British Empire in India and South Africa—(Enroll in History 243D/343D.) Concentrating on the 19th and 20th centuries, examines in comparative perspective the heritage of conquest, economic change, "orientalism," nationalism, apartheid, and colonization.

5 units, Spr (Worger, Zastoupil)

The New History of Africa—Enroll in History 246.
5 units, Aut (Jackson)

Colloquium: The End of Slavery in Africa and the Americas—(Enroll in History 248A/348A.)
5 units, Win (Roberts)
alternate years, given 1988-89

Colloquium: Africa Since 1945—(Enroll in History 249A/349A.)
5 units, Aut (Jackson) M 3:15-5:05

Graduate Core Colloquium on African History—(Enroll in History 347B.)
5 units, Win (Roberts) W 2:15-4:05
alternate years, given 1988-89


5 units, Aut (Samoff) MWF 11-12

Decolonization in Asia and Africa, 1940-80—
(Enroll in Political Science 222.) Comparative study of the dynamics of decolonization and "new-state" formation. Factors affecting the timing, speed, nature, and extent of violence in the decolonization process, and character of the regime ruling the new state. Case studies: India/Pakistan, Indonesia, Indochina, Ghana, Algeria, Zambia, Angola, and Zimbabwe.

5 units, Spr (Abernethy)

Beginning Hausa—(Enroll in Linguistics 602A, B, C.) Successful completion of 602C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Leben, Daba)

Beginning Swahili—(Enroll in Linguistics 606A, B, C.) Successful completion of 606C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Moshi)

Intermediate Swahili—(Enroll in Linguistics 607A, B, C.)
4 units, Aut, Win, Spr (Moshi)

Beginning Bambara—(Enroll in Linguistics 6118A, B, C.)
2 units, Aut, Win, Spr

Beginning Arabic—(Enroll in Linguistics 620A, B, C.) Successful completion of 620C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Barhoum)

Intermediate Arabic—(Enroll in Linguistics 621A, B, C.)
4 units, Aut, Win, Spr (Barhoum)

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: Amharic, Kikuyu, Twi, Ewe, and Oromo. Contact the Special Language Program Office, (415) 723-3636.

Decolonization in Asia and Africa, 1940-80—
(Enroll in Political Science 222.) Comparative study of the dynamics of decolonization and "new-state" formation. Factors affecting the timing, speed, nature, and extent of violence in the decolonization process, and character of the regime ruling the new state. Case studies: India/Pakistan, Indonesia, Indochina, Ghana, Algeria, Zambia, Angola, and Zimbabwe.

5 units, Spr (Abernethy)

Beginning Hausa—(Enroll in Linguistics 602A, B, C.) Successful completion of 602C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Leben, Daba)

Beginning Swahili—(Enroll in Linguistics 606A, B, C.) Successful completion of 606C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Moshi)

Intermediate Swahili—(Enroll in Linguistics 607A, B, C.)
4 units, Aut, Win, Spr (Moshi)

Beginning Bambara—(Enroll in Linguistics 6118A, B, C.)
2 units, Aut, Win, Spr

Beginning Arabic—(Enroll in Linguistics 620A, B, C.) Successful completion of 620C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Barhoum)

Intermediate Arabic—(Enroll in Linguistics 621A, B, C.)
4 units, Aut, Win, Spr (Barhoum)

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: Amharic, Kikuyu, Twi, Ewe, and Oromo. Contact the Special Language Program Office, (415) 723-3636.

The World Food Economy — (Enroll in Food Research 103, Economics 106.) The interrelationships between food, population, and economic development. Emphasis on the role of agricultural and rural development in achieving economic and social progress in low-income nations. Attention to the economic and nutritional characteristics of the major types of food and to changes in food consumption associated with economic development in Asia, tropical Africa, and Mexico. The U.S. and Japan highlight structural changes in agriculture and in food consumption. A 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, Spr (Johnston) MWF 10

Food and Nutrition Strategies in Development— (Enroll in Food Research 251.) The major policy issues related to raising food consumption levels and improving nutritional status of populations in developing countries, assessing both production and consumption-oriented policies and programs, and problems of determining an appropriate balance between income-generating activities and social services.
Focus on the low-income developing countries. The economic, technical, institutional, and political factors that influence design and implementation of food and nutrition strategies, problems of restructuring growth to achieve broad participation of rural populations in gains in productivity and income.

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

Seminar: International Agricultural Policy—(Enroll in Food Research Institute 367.) Prepares students for comprehensive examination and dissertations in the international agricultural policy field.
3 units, Spr (Josling, Pearson)
TTh 3:15-5:05

Introduction to the Study of International Development Education—(Enroll in Education 306A.) 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.
3-5 units, Aut (Weiler) M 1:15-3:05

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; three 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, Textor, Fuenzalida) W 7:30-9:30 p.m.
workshops by arrangement

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 include 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, Win (Inkles) TTh 10-12

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

Education and Political Change—(Enroll in Education 306B, Political Science 221.) 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 development, the politics of educational planning and reform, processes and conditions of political learning.
5 units, Win (Samoff) TTh 2:15-4:05
and by arrangement

Education and Radical Change: African Experiences—(Enroll in Education 395, Political Science 221S.) Schools as sites of political protest and mobilization and with education as a central pillar in development strategy. Emphasis on efforts in independent Africa to accomplish a fundamental social transformation. After an initial overview of Guinea-Bissau and Tanzania, explores experiences in Angola, Mozambique, and Zimbabwe.
5 units, Spr (Samoff) TTh 12-2:05

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 (Weiler)
TTh 4:15-5:05

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 (Ramirez)
TTh 4:15-6:05

RELATED MATERIALS
Students who wish to increase their knowledge of Africa may wish to consider the following courses, of which at least 25 percent of the content is devoted to Africa:
AFRICAN AND AFRO-AMERICAN STUDIES
113. Western Culture and the Black Diaspora: An Introduction to its Literature, Thought, and Cultural Worlds.

ANTHROPOLOGY
128. Ethnographic Film—(Same as Communications 115.)  
not given 1987-88

147. Rural Urbanization and Social Change.
164. Ecological Anthropology.
177. Pidgins and Creoles.
262. Economic Anthropology.

DANCE
(Osumare)

ECONOMICS
166. International Trade Policy—(Same as Food Research 166.) (Graduate students enroll in 266.)

EDUCATION
306A. Education and Economic Development.
306C. Education and Sociocultural Change—(Same as Anthropology 239.)
306D. Sociology of Development and Education.

FOOD RESEARCH
121. Development and Population Interactions in the Third World—(Same as Economics 119.)

250. Nutritional Problems of Developing Nations—(Same as Anthropology 250, Human Biology 110.)

The following courses have some Africa content and present conceptual substance that is helpful to understanding African societies and institutions:

ECONOMICS
118. Economics of Development

EDUCATION
206B. Project Workshop in International Development Education.

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

277X. Education and Work.

307X. Knowledge and Legitimation: The Politics of Educational Research—(Same as Political Science 328.)

FOOD RESEARCH
129. Analysis and Management of Development Projects—(Same as Economics 129) (Graduate students enroll in 229.)

136. Population Perspectives in the Third World—(Same as Economics 133, Human Biology 136, Sociology 153.) (Graduate students enroll in 236.)

AMERICAN STUDIES

Administrative Committee: (Chairman) Jack N. Rakove (History), Barton Bernstein (History), Joseph Corn (American Studies, on leave, Autumn 1987), Wanda Corn (Art, on leave, Autumn 1987), Jay Fliegelman (English), George Fredrickson (History), Albert J. Gelpt (English, Coe Professor of American Literature), Richard Gillam (American Studies), Judith Goldstein (Political Science), Hubert R. Marshall (Political Science), Barbara Staley, Robyn Weisman, 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 distributions: 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 of study
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 100. Reflections on the American Condition—(Same as English 128, History 174.) Interdisciplinary perspective of the analytical techniques of history and literary criticism to analyze the American character as reflected in imaginative literature. Readings include classic American works that address the complex fate of being an American.

Authors: Henry James, Ralph Waldo Emerson, Henry David Thoreau, Mark Twain, Harriet Beecher Stowe, Edith Wharton, Ralph Ellison, and Norman Mailer. (Thought and Imagination) (DR:2 or DR:3)

5 units, Aut (Chace, Kennedy) MTWTh 9

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)
English 112. Masterpieces of American Literature.  
5 units, Spr (Gelpi)

English 123. American Literature, 1917-Present.  
5 units, Spr (Fields)

5 units, Win (Moser)

English 161A. The Afro-American Novel.  
5 units, Spr (Miller)

English 161B. American Literature, 1917-1945.  
5 units, Win (Moser)

English 179. Melville.  
5 units, Win (Isas)

English 179A. Fitzgerald and Hemingway.  
5 units, Win (Islas)

English 186A. American Autobiography.  
5 units, Aut (Fliegelman)

English 187A. Psychological Themes in American Fiction.  
5 units, Win (Moser)

5 units, Spr (Thompson)

English 239. American Short Fiction.  
5 units, Win (Fields)

5 units, Spr (Schmidt)

5 units, Win (Schmidt)

History 163. America and the 'Bomb': Politics, Diplomacy, and Culture in the Nuclear World, 1929-Present.  
4-5 units, Spr (Bernstein)

History 165A. 18th-Century America—(Required for the American Studies major.)  
5 units, Aut (Rakove)

History 165B. 19th-Century America—(Required for the American Studies major.)  
5 units, Win (Degler)

History 165C. 20th-Century America.  
5 units, Spr (Camarillo)

History 172A. America Since 1945.  
4-5 units, Win (Bernstein)

5 units, Win (Freedman)

5 units, Spr (Freedman)

Linguistics 50. Language and Social Issues in America.  
5 units, Spr (Ferguson)

Sociology 130. American Society in Film and Literature.  
3-5 units, Win (Zelditch)

American Policy and Institutions

American Studies 176L. Law in Radically Different Cultures—(Same as Anthropology 157, Law 316, Political Science 182L.) Using American law as a benchmark, compares legal systems in Western capitalist, secular, industrialized societies with legal systems in China, Egypt, and Botswana to identify the historical, philosophical, social, and cultural factors that contribute to the development of different attitudes and practices regarding law. Students must register for Winter and Spring Quarters starting January 25.  
2 units, Win plus 3 units, Spr (Barton, Foster-Simmons) MWTh 2:15

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)

Communications 139. Literature of the Press.  
4 units, Win (Lewenstein)
Political Science 1. Major Issues of American Public Policy.
  5 units, Aut, Win (Marshall)

Political Science 10. American National Government.
  5 units, Win (Manley)

Political Science 106M. Politics of Bureaucracy.
  5 units, Spr (Moe)

Political Science 145J. American Foreign Policy.
  5 units, Win (Sagan)

Political Science 180. Civil Rights and Civil Liberties in the U.S.
  5 units, Spr (Steyer)

Political Science 186K. American Education and Public Policy—(Same as Education 105, History 115B.)
  3 units, Aut (Kirst, Tyack)

Political Science 189. Voting in the American Electoral System.
  5 units, Aut (Brody)

Political Science 193. Seminar: Civil Rights and the Constitution.
  5 units, Spr (Steyer)

Political Science 195. Political and Economic Power in the U.S.
  5 units, Spr (Manley)

Political Science 292A. Seminar: American Political Institutions.
  5 units, Aut (Ferejohn)

Political Science 292B. Introduction to Political Behavior.
  5 units, Win (Brody, Sniderman)

  5 units, Spr (Moe)

VTSS 101. Technology and Science in Contemporary Society.
  4 units, Win (McGinn)

CORE SEMINARS

American Studies 200. The American Character—(Same as History 261.) Descriptions of historical, literary, psychological, and sociological insights into the American character since the 17th century. (Required for the American Studies major.)
  5 units, Spr (Gillam)

American Studies 201. The South Since 1860—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.
  5 units, Spr (Sosna) TTh 2:15-4:05

American Studies 203. American Autobiography—(Same as English 186A.)
  5 units, Aut (Fliegelman) MW 1:15-3:05

American Studies 209. Women in America—(Same as History 263.)
  5 units, Spr (Degler) M 3:15-5:05

American Studies 211. Modern America in Historical Perspective—(Same as History 258.)
  5 units, Spr (Kennedy) Th 2:15-4:05

American Studies 212. Ideas in America from the Revolution to 1900—(Same as History 271A.)
  5 units, Aut (Fredrickson) M 1:15-3:05

American Studies 213. Sexuality in American History—(Same as History 265A.)
  5 units, Aut (Freedman) Th 1:15-4:05

American Studies 214. The American 1960s: Thought, Protest, and Culture—Attempts to define the meaning of the American 1960s, emphasizing the "new sensibility" that emerged during this crucial decade in American history. Topics include 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.
  5 units, Aut (Gillam) TTh 1:15-3:05

American Studies 215. Medicine and Culture in America—(Same as English 189A.) The cultural issues present in the writings on health in America through the 19th century. Readings include religious sermons, folk literature, works of health reformers, literary, and historical treatments.
  5 units, Aut (Burbick) TTh 3:15-5:05

  5 units, (Gillam) by arrangement

American Studies 217. 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.
  5 units, Spr (J. Corn) TTh 1:15-3:05

American Studies 220. Photographs as Historical Documents—(Same as Art 231A.)
  5 units (J. Corn, W. Corn) given 1989-89

American Studies 221. The Machine and American Culture—(Same as VTSS 157.)
  5 units, Aut (J. Corn) given 1988-89
American Studies 223. American Lives—
(Same as English 187B.)
5 units, Win (Islas)

INDIVIDUAL WORK
3-5 unit (Staff) by arrangement
American Studies 199. Directed Reading.
2-5 units (Staff) by arrangement
American Studies 250. Honors Project—Pre-
requisite: Consent of the chairman of American
Studies.
5-15 units, any quarter (Staff)

HOUSE SEMINAR
American Studies 21. Basic Criminal Law—
Criminal law and criminal procedures: do they
deter crime and punish wrongdoers? (Pass/NC
only)
2 units (Mendez) by permission

ANTHROPOLOGY
Emeriti: (Professors) St. Clair Drake, Bert A.
Gerow, Joseph H. Greenberg, Benjamin D.
Paul, George D. Spindler
Chairman: James L. Gibbs, Jr.
Professors: Clifford R. Barnett, Harumi Befu,
George A. Collier, Charles O. Frake, James
Lowell Gibbs, Jr., Renato I. Rosaldo, Ber-
nard J. Siegel, G. William Skinner (on leave
Winter), Robert B. Textor, Arthur P. Wolf
Associate Professors: Jane Collier, Jose Cuellar,
William H. Durham, James A. Fox, John W.
Rick, Sylvia Yanagisako
Assistant Professors: Carol Delaney, Donald L.
Donham
Professor (Research): Thomas P. Rohlen
Professor (Teaching): Donald C. Johanson
Affiliated Associate Professors: Shirley Brice
Heath, Reynaldo Martorell
Affiliated Assistant Professor: Elois Berlin
Lecturer: Louise S. Spindler
Visiting Associate Professor: Stefano Varese

The Anthropology Department is respon-
sible for a large collection of historic and prehis-
toric material, culture, and skeletal material
from all over the world, but more notably from
Native North America, the Pacific, Central and
South America, and Africa. Some of these ob-
jects are used in anthropology courses and are
exhibited in the Felix M. Keessing Museum
(Rm. 111K) in the Anthropology Department.
Continuing excavations on Stanford property by
department archaeologists contribute materials
to the collections.

The courses offered by this department are
designed (1) to provide undergraduate students
with instruction in anthropology, a discipline
dealing with humanity from the broad viewpoints
of biological heritage, culture, society, and per-
sonality; (2) to provide undergraduate majors in
Anthropology with a program of work leading to
the bachelor's degree; and (3) to prepare candi-
dates for advanced degrees in the discipline.

UNDERGRADUATE
PROGRAMS

BACHELOR OF ARTS

The Department of Anthropology offers
three programs leading to the Bachelor of Art
degree: the Major in Anthropology, the Honors
Program in Anthropology, and an interdiscipli-
nary program entitled Major in Social Sciences
(Anthropology). To declare a major in one of
these fields a student must apply to the depart-
ment's Undergraduate Committee through 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 ad-
visor. Students majoring in anthropology are
required to meet with their advisor at least once
every quarter. Each student's progress towards
fulfillment of the major requirements is record-
ed 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 Undergrad-
uate Committee will review applications and
notify students of their admission to the pro-
gram.

The Major in Social Science (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 stu-
dent's junior year. The Major in Social Science
(Anthropology) allows a candidate to combine
3 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) at
advised to petition for an Individually Designed 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 on the second-year level, but the requirement may be met by special examination, presentation of superior foreign language placement scores, or certification in writing from an appropriate department.

2. A passing grade in Anthropology 90. This course is required of all anthropology majors and 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, but such 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 on the second year level or are in a second language. The units in anthropology must include at least one course each in four of the five following topical categories: (1) Area Studies (8, 100-127); (2) Social and Cultural Anthropology (1, 11-22, 128-168, 219-244, 246-276); (3) Linguistic Anthropology (4, 5, 75-78, 172-178, 245, 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 will be read by the candidate’s advisor and a second reader appointed by the Undergraduate Committee. An honors candidate may enroll in Anthropology 95 for as many as 15 units but may not count more than 10 of these units in fulfilling the 60 unit 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 on 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 colloquia (Mondays) and Friday films. 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 should consult the “Degrees” section of this bulletin. Coterminal students and graduate students in other departments or
students at Stanford should consult with the Academic Assistant in the department. Students from outside of Stanford should address a letter of inquiry to the Academic Assistant of the Anthropology Department. Successful applicants for the A.M. program may enter during any quarter. Application deadlines: April 15 (for Autumn), November 1 (for Winter), and February 1 (for Spring). Applicants must file a report of their scores on the Graduate Record Examination. Students accepted for the terminal A.M. degree program cannot transfer to the Ph.D. program. Students planning to obtain the Ph.D. degree should apply directly to the Ph.D. program.

The requirements for the A.M. degree consist of residence at Stanford University as a graduate student for at least three quarters. Students must take a minimum of 45 quarter units in anthropology with a letter grade indicator of "B" or better in each course. They must have at least 15 additional units of anthropology, taken at Stanford or elsewhere, constituting a minimum total of 60 units in anthropology. Within the 45 units taken at Stanford, students must take one quarter (5 units) of History of Anthropological Theory plus one additional course from those designated as "core courses" by the faculty. The remaining units may be made up of courses selected in consultation with the faculty advisor to meet the needs and interests of the student. A field or library research paper read and approved by at least two departmental faculty members must be presented. Full-time students entering the program with appropriate background in anthropology can complete the A.M. program in one calendar year. Others may require a longer time. To provide a meaningful A.M. program within a one-year period, advance planning of coursework with an advisor is required.

DOCTOR OF PHILOSOPHY

Prospective graduate students should apply formally through the Graduate Admissions Office, which will transmit their records to the department for consideration when application requirements have been completed. Applicants for admissions must file a report of their scores on the Graduate Record Examination and submit a sample of their writing. 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 consists of a number of required courses and examinations which also allow students to develop a flexible program designed to reflect their special interests under the supervision of a faculty committee chosen by them. Students are encouraged to plan a program that will enable them to complete all work for the Ph.D. in five years.

The requirements for the Ph.D. degree include:

1. Pass within the first two years, at an acceptable graduate level, four of the courses designated as "core courses" by the faculty.
2. Submit an acceptable, substantial research paper in the Spring Quarter of the first year.
3. Serve as a teaching assistant for two courses, usually during the second year of graduate study. 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 shall 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/method and one course in a geographical area.

FINANCIAL SUPPORT

The department endeavors to provide financial support (tuition plus scholarship) when needed to all students admitted to the Ph.D. Program who maintain a satisfactory course
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. 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.

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:5*)
   3 or 5 units, Aut (L. Spindler)
   Spr (Rosaldo)

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 include Mendelian genetics, molecular biology, Darwinian theory, the modern synthesis, the concept of culture, cultural evolutionary theory, differential social transmission, and the scientific method. 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, Aut (J. Rick)

4. Language and Culture—(Same as Linguistics 4.) Lecture on 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, Win (Fox) alternate years, given 1988-89

5. Biology and Evolution of Language—(Same as Human Biology 113, Linguistics 5.) 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, Spr (Fox)

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 (Johanson) not given 1987-88

7. Experiencing Anthropology: An Introduction to Culture—Primarily for freshmen, introduces the concept of culture as a way to stimulate critical questions about one’s own cultural assumptions. Drawing on the experience of entering the University, compares and contrasts disorientation and reorientation with that experienced by anthropologists entering another culture, providing a means for examining the ways, generic and specific, 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. Students design a small fieldwork project in their own environment that will become the term paper.
   5 units, Aut (Delaney)

8. Introduction to China—Chinese society in the late imperial period, the origins of its characteristic institutions, and the revolutionary
changes that have transformed China in modern times. (DR:5*)
5 units (Wolf) not given 1987-88

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, in order to provide a critical perspective on contemporary views of the 'nature' of women and men, and to understand how women and men shape and are shaped by particular forms of social life. (DR:5*)
3-5 units, Spr (J. Collier)

12. Introduction to Feminist Studies: Issues and Methods—(Same as Feminist Studies 101.) Interdisciplinary approaches to understanding the creation and perpetuation of gender inequality. Topics include feminist theory, the family, gender and work, sexuality, the politics of reproduction, domestic violence, and women's culture. Examples from non-western societies illuminate the cultural and historical construction of gender in western society. (DR:5)
5 units, Win (J. Collier)

13. Culture and History—Seminal works in social thought, cultural history, and anthropology—Benedict, Huizinga, Marx, Weber, de Tocqueville, and Freud. Problems include relation of cultural pattern and historical process; culture and social class; change as gradual transition and revolution.
5 units (Rosaldo) not given 1987-88

15. Anthropological Perspectives on American Culture—(Upper division students register for 116.) Convergence and divergence in values, life styles, and psychocultural attributes are analyzed for mainstream, minority, and variant cultural patterns in United States society. Processes of boundary maintenance and identity reference. Current social movements are placed in the perspective of counter-culturalism, marginality, and cultural change. Field studies of relevant phenomena are encouraged. (DR:5)
3-5 units, Aut (G. and L. Spindler)

16. Culture and the Sea: Maritime Orientations and Adaptations in Human Societies—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 (Frake) not given 1987-88

17. Culture and Astronomy—A cross-cultural and 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.
5 units, Spr (Fox, Frake)
alternate years, not given 1988-89

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, Win (Rick, 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.
5 units, Spr (Varese, Abernethy, Van Slyke)

SPECIAL

69. Practicum in Ethnographic Futures Research—(See 269.)

75. First-Year Classical Nahuatl—Introduction to the language of the Aztecs of coloni Mexico. For beginners.
5 units, not given 1987-88

5 units (Fox) not given 1987-88

77A. 5 units, Aut (Fox)
77B. 5 units, Win (Fox)
77C. 5 units, Spr (Fox)

78. Intermediate Quechua and Colonial Peruvian Ethnohistory—Readings in colonial Qe
Introduction to palaeography and historiography of early colonial Peru. Prerequisite: 77A, B, C or equivalent.

**5 units (Fox) not given 1987-88**

**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, Win, Spr (Donham, Wolf)**

**91. Archeological Field Methods**—Field course involving students in actual archeological field research in the local area covers the practical working methodology of the archeologist, primarily through excavation and site survey, but including training in registration, preservation, and analysis of archeological. Recommended: 3.

**5 units, Spr (J. Rick)**

**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 (Skinner)**

**94. Post-Field Research Seminar**—Training and experience in coding, processing, and analyzing quantitative and qualitative research data. Participants complete a full-scale report on a body of field data normally collected during the preceding summer.

**5 units, Aut (Cuellar)**

**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

**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, Win (Bogenchild, Jacksic)**

**102. Indians 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)**

**103. Peoples of Mesoamerica**—Survey of the Mayas, the Aztecs, and their prehistoric neighbors, of how they fared under Spanish colonial rule, and what their descendants are like today. (May be taken in sequence with 104.)

**3-5 units (Staff) not given 1987-88**

**104. Native American Civilizations: The Incas, Mayas, and Aztecs**—Compares and contrasts three notable Native American civilizations from the point of view of theories of the development of civilization. How did they evolve? What were the ecological factors in their evolution? Did they influence one another? What were their economic, religious, and political institutions and how did these differ from those of less-developed Native American societies. How do these civilizations compare in their organization and development to the pre-industrial civilizations of the Old World? Also the fate of these civilizations under Spanish colonial rule and the legacy of their cultural heritage for the Americas.

**4 units (Staff) not given 1987-88**

**105. Introduction to African and Afro-American Studies**—(Same as African and Afro-American Studies 105.) 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. Consider why interpretations developed at particular times and the relationship between African and Afro-American Studies and other disciplines. (DR:5*)

5 units, Aut (Wynter, Staff) MWF 11

107. Latin American Migration to the United States—Lectures and discussions dealing with migration from Mexico, Central America, and the Spanish-speaking Caribbean. Addresses current debates about U.S. policies and procedures asking: (1) Who migrates and what are their patterns of movement? (2) What are the causes of this migration and what are its effects, both in the U.S. and in the source areas? (3) How do the migrants organize their lives and make sense of their experiences? (4) What is their relationship to U.S. society and culture? 

3 or 5 units, not given 1987-88

108. African Societies in a Changing World—(Same as 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 include 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. Women and Development in Africa—(Same as African and Afro-American Studies 175X, Education 175X, Feminist Studies 138.) A survey of women's roles and experiences in formal and informal development activities in Africa. Topics: women in African history, women and decolonization/liberation, development and dependence, crises in production and productivity, education and work, women and development planning, women, politics, and power, and feminism in the U.S. and Africa. Reviews relevant theoretical orientations and empirical research, drawing on concrete case studies. Prior or concurrent work on Africa and/or women in the Third World is useful.

4 units, Spr (Samoff) TTh 4:15-6:05

110. Introduction to Chicano Life and Culture—(Same as History 64.) 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, Aut (Camarillo, Cuellar)

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, Spr (Frake)

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 phenomena of corruption, the position of women; and differential impact of British and French colonialism and America 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, Win (Textor)

115. Peoples of Island Southeast Asia—Topics include: 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) not given 1987-88

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. Attention is given to the nature of social change in this premodern agrarian civilization. (DR:5*)

5 units, Win (Skinner) given 1988-89

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, Spr (Skinner) given 1988-89


5 units, Win (Befu)
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, Spr (Befu)

125. Japanese Culture Through Novels and Films—(Same as Asian Language 125.) Explorations of Japanese social structure (family, socialization, community, work, etc.) and cultural values through novels (in translation) by leading writers (Mishima, Natsume, Takizaki, etc.) and feature length films by well known directors (Kurosawa, Ozu, etc.). Focuses on the individual in the social and cultural setting of modern, changing Japan.

5 units (Befu) not given 1987-88

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 (Gibbs) not given 1987-88

129. Evolution of Mesopotamian Civilization—The evolution of the world's first complex society and state system, the Sumerian Akkadian civilization of the Middle East in what is now Iraq. Origins of agriculture and domesticated animals; processes by which sedentary villages were transformed into urban societies and states; the role of stratification; bureaucracies; trade; population growth; writing systems; and militarism. Mesopotamia as a model for theoretical study of other pristine states.

5 units, Win (Siegel)

131. Cultural Evolution—Analysis of the origins of human culture using evidence from primate ethnology, paleontology, archaeology and modern hunter-gatherer ethnography. Theories of cultural development from foraging stages through agricultural revolution to industrialization. Systematic outline of processes and stages of cultural development.

not given 1987-88

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; three units additional credit for optional workshops treating selected issues in more depth. (Sequential registration not required.)

1 unit, section 1 (lecture only) or 4 units, section 2 (lecture plus workshop)

Aut, Win, Spr (Fagen, Fuensaldia, Lusignan, McWhorter, Siegel, Textor) lecture W 7:30-9:30 p.m.

workshops by arrangement

137. Applied Anthropology—(See 237.) (Same as VTSS 153.)

138. Sociocultural Implications of High Technology—(See 238.) (Same as Values, Technology, Science and Society 159.)

139. Seminar in Cultural Identity—The nature of ethnicity, the mechanisms of ethnic boundary maintenance, and the role of ethnic groups in social, cultural, and ecological systems.

5 units, Win (Frake)

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 in all populations across 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 in the population? What implications do they have for social policy? These questions are addressed through readings, lectures, films, and guest panelists. Students are assisted in research and encouraged to work as volunteers with the elderly.

3-5 units, Win (Barnett)

141. Feminist Theory in Anthropology—(Graduate students register for 241.) Seminar examines 10 years of feminist scholarship in anthropology. Topics: the debate over universal
sexual asymmetry; the utility of analytic dichotomies, nature/culture, domestic/public and reproduction/production for understanding sexual inequality; the contribution of a feminist perspective to anthropological analyses of kinship, politics, religion, and gender; the relationship between feminist and marxist analyses; feminist analyses of human biology and evolution; and the issue of whether there is a distinctively feminist perspective. Prerequisite: 11, courses in Feminist Studies, or consent of the instructor.

5 units (J. Collier) not given 1987-88

143. Kinship and Family in a Changing World—Lecture/discussion analyzing adaptation of kinship and family organization in the context of political, technological, and economic changes. Topics include: impact of modernization upon descent, marriage, and kin groupings.

5 units, Spr (Befu)

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 include women and migration, changing forms of the sexual division of labor, changing family and kinship structures, prostitution, and political activism.

5 units, Spr (Yanagisako)

146. Urban Problems in Anthropological Perspective—A series of issues derived 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 (Yanagisako) not given 1987-88

147. Rural Urbanization and Social Change—Rural-to-urban migration as indicator and consequence of social change. Models of migration processes; impact of policies in sending and receiving notions; motives and adaptive strategies of migrants; significance of emigration for peasant villages. Case studies from Africa, Latin America, Asia, and Europe.

3 units, Aut (Siegel)

148. Political Anthropology—A lecture/discussion introduction to some of the principal ways anthropologists view politics. Political structures and processes at the band, tribe, minimal state, and advanced levels of sociocultural evolution. Anthropological models and ethnographic case studies dealing with the formation and functioning of non-Western national political systems—particularly Japan and Thailand. Identifies political perceptions and values characteristic of U.S. culture, and seeks an understanding of the problem of ethnocentrism in American politics and foreign policy.

5 units, Spr (Textor)

149. Anthropology of Development—(Same as Values, Technology, Science, and Society 161.) A history of anthropology in development projects from the Colonial Period through World War 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 system 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) MWF 11

150. Advanced Cognitive Anthropology—How people give meaning to behavior and other events they experience. The anthropological side of the intersection of anthropology, linguistics, cognitive psychology, and sociology, thus presenting a cross-cultural perspective on the relations among knowledge, language, and social behavior.

5 units (Frake) not given 1987-88

152. Symbolic Anthropology—Symbolic Anthropology, an approach to the study of human society, developed along with the concept of culture, as a system of symbols and meanings. The system presumed to be embedded in and expressed by institutions, values, attitudes, structures of everyday life, and social action. Students become acquainted with the intellectual roots of this approach, some contemporary works motivated by it, and recent critiques.

5 units, Win (Delaney)

153. Religion—Interpretation of myths, symbols, and rituals, in sacrifice, magic, and witchcraft; stress on non-Western case studies rather than survey.

5 units (Rosaldo) not given 1987-88

154. Cosmology and Gender—An alternative to cosmology and gender as distinct categories and separate domains of study. The gendered aspects of cosmological 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, primitive, non-Western, and 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, Win (Delaney)

156. Law and Conflict Management—Lecture focusing on problems of order and conflict in society. Whether all societies have "law," and the social settings of such dispute handling mechanisms as negotiation, mediation, arbitration, and adjudication. Readings in ethnographic accounts of conflict management in other societies and are required visits to local courts to obtain first-hand knowledge of disputing in our society.

3 units (J. Collier) not given 1987-88

157. Law in Radically Different Cultures—(Same as American Studies 176, 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 25.

2 units, Win plus 3 units, Spr

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, not given 1987-88

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; deixis and self-justification; and life cycle transitions. Prerequisite: 1 or Psychology 1, or consent of instructor. (DR:4*)

5 units, Spr (Gibbs)

166. Incest and the Incest Taboo: The Social, Psychological, and Biological Dimensions—Seminar reviews and evaluates all theories attempting to explain the incest taboo and violations of the taboo. Emphasis on what constitutes an adequate explanation and to the question raised by attempts to explain social phenomena in biological terms. Open to graduate students and majors in Anthropology and Human Biology.

5 units (Wolf) not given 1987-88

167. Ethnography of Communications: Research Methods—A research seminar designed to provide intensive preparation in ethnographic field methods for the study of communication. Earlier efforts and current research problems (determining unit of study, defining speech community) are examined. Case studies: (1) selected speech events for interpreting value orientation to language and social roles (2) oral-literate continuum models, (3) use of cognitive style theories for understanding cross-continuum models, and (4) use of cognitive style theories for understanding cross-cultural dimensions of first and second language acquisition.

4-5 units (Heath) not given 1987-88

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


5 units (Fox) not given 1987-88

173. Mayan Hieroglyphic Writing—Lecture on the principles of archeological decipherment as applied to the writing of the ancient Maya. Attention to the origins and functions of writing in Mesoamerica.

5 units (Fox) not given 1987-88

177. Pidgins and Creoles—(Same as Linguistics 151.) Lecture on 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.

5 units, Win (Fox, Frake, Rickford)
not given 1987-88

178. Historical Linguistics and Culture History—Lecture on the basic principles of historical linguistics, emphasizing cultural inferences from language distribution and classification, reconstructed protovocabulary, and loanwords or other areal influences. Topics: the comparative method; the rate of language change; glottochronology; migration theory. Prerequisite: Introductory course in linguistics, or consent of instructor.

5 units (Fox) not given 1987-88

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 (Johanson) alternate years,
given 1988-89

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. Prerequisite: 2, or consent of the instructor.

4 units (Durham) not given 1987-88

185. Prehistoric Peoples of California—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, Win (J. Rick)

188. The Evolution of Prehistoric Civilizations—(Same as Human Biology 188.) The radical transitions involved in the evolution from original non-complex societies to complex state organizations. Topics: the change from food collecting to food-producing societies; the evolution of rank and stratification in society; the role of trade, interaction, mobility, population growth, and ideology in the development of civilizations. Theories of state evolution are examined in the light of prehistoric Mesoamerican and South American complex societies. (DR:5)

5 units (J. Rick) alternate years,
given 1988-89

189. Peruvian Archeology—The development of high civilizations in Andean South America from hunter-gatherer origins to culmination in the powerful and expansive Inca empire. Examines contrasting ecologies of coast, sierra and jungle areas of early Peruvian societies of 12,000-2,000 B.C. and domestication of various indigenous plants, which provided the economic foundation for later complex societies best known for their monumental cities, beautiful ceramics, and textiles. Describes this cultural evolution, and explains why and how major transitions occurred.

5 units (J. Rick) not given 1987-88

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. Continu
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 such as a technological innovation (tele-microelectronic, 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) not given 1987-88

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) not given 1987-88

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 (Gerow, Staff) by arrangement

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 (Leben, Staff)

203. Latin American Ethnohistory—Seminar concerning native peoples of Latin America and their experience of conquest, colonial rule, and post-independence state formations. The methods, materials, and substantive findings of anthropologists and historians on these topics.

5 units (G. Collier) not given 1987-88

206. Seminar on Structure and Change in Rural Latin America—(See 106.)

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 1987-88


5 units, Win (Okimoto, Rohlen)

227. Seminar: Mediterranean Anthropology—Selected problems in the study of agrarian societies and cultures of Mediterranean Europe: Italy, Greece, Spain, and Portugal. Focus is on ecology; land tenure and production; family and kinship; power and patronage; cultural codes and systems of meaning (beliefs and values). The relations between local communities, and national and international forces that have historically shaped their adaptations.

5 units, Aut (Siegel)

237. Applied Anthropology—(Undergraduates register for 137. Same as Values, Technology, Science, and Society 153.) Application of anthropological knowledge and skills to a variety of practical problems: developing and evaluating medical care delivery systems and educational programs at home and abroad; assisting in the transmission of technological innovations, and predicting and measuring their impact; serving as planners, administrators, and advisors for development programs at the national and community level. Addresses the substance of such programs; the utility of anthropological theory and techniques in solving contemporary problems; and the ethics of professional practice. Field research requires attention to the desires and needs of the study population; students with strong research but not applied interests will find this useful.

5 units (Barnett) not given 1987-88

238. Sociocultural Implications of High Technology—(Undergraduates register for 138. Same as Values, Technology, Science, and Society 159.) Seminar on the development, diffusion, and utilization of technology as a cultural process. Emphasizes the high technology developed in and around Stanford: biogenetics, microelectronics, and the new information technology. Local technologists and venture capitalists give weekly in-class presentations. Also, unintended human damage such technological
innovations have produced; ways such innovations can drive or enable profound changes in other parts of a sociocultural system (its symbolic, value, and belief patterns, and its social and economic organization); 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. 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 the 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)

241. (See 141.)

242. Comparative Family Systems—Proseminar devoted to inter- and intrasocietal variation in family structure, the domestic cycle, and family interaction. Research in historical demography, social psychological studies of birth order and child development, and sociological work on small groups and families is brought into confrontation with anthropological work on family and kinship.

5 units, Spr (Wolf)

244. Family and Kinship Organization—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 (Yanagisako) not given 1987-88

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 (Jackson, Rosaldo)
not given 1987-88

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)

253. Religion—Theory complemented by ethnography and contemporary works which continue, and further, interpretation of such phenomena as religious sects, worship, rites of passage, magic, shamanism, and dreaming. Prerequisite: Consent of instructor.

5 units, Win (Rosaldo)

254. Stories and Culture — The use of narrative in understanding social practices and problems in studying the text and context of storytelling.

5 units (Rosaldo) not given 1987-88

255. Political Anthropology—Seminar focusing on theoretical approaches to the study of politics and political development in traditional societies ranging from bands to agrarian civilizations. Prerequisite: Graduate status in anthropology, sociology, or political science, or consent of instructor.

5 units (J. Collier) not given 1986-87

257. (See 157.)

258. Anthropology of Modern Institutions—The cultural nature of modern institutions, hospitals, companies, police forces, government bureaucracies, and other organizations in a number of countries. Ethnographic, comparative, and historical approaches. Emphasis on the epistemology of cultural forms, socialization, institutional ideology, informal and formal aspects of organization, and conflict within institutional frameworks.

5 units, Win (Rohlen)

259. Marxism and the Interpretation of Cultures—Orthodox Marxism has not always been the most sympathetic stance from which to consider problems of cultural interpretation. Yet in the last decade, a body of influential work has been done. Seminar considers, among others, the works of Pierre Bourdieu, Anthony Giddens, Raymond Williams, E. P. Thompson and Fredric Jameson.

5 units (Donham) not given 1987-88
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) not given 1987-88

261. **Foucault and Social Theory**—A seminar on the significance of Michel Foucault's works in the context of modern social theory.

5 units, Aut (Donham) not given 1987-88

262. **Economic Anthropology**—Seminar on the dominant issues in current attempts to analyze the economic organization of noncapitalist societies. Emphasis on competing theoretical approaches, particularly neoclassical, substantivist, and Marxist, and to the social organization for production, the circulation of goods and services, the generation and maintenance of economic inequality, and the encapsulation of local economic units within larger social systems.

5 units, Win (Donham)

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) not given 1987-88

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 radiation), 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, Aut (Durham)

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 (Gibbs) not given 1987-88

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)

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. Among the 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 (Hochberg, Skinner)

269A. **Practicum in Ethnographic Futures Research I**—(Same as Education 212A.) (Undergraduates register for 69.) The rationale and guidance in the practice of Ethnographic Futures Research (EFR), loosely structured, open-ended, interactive, non-directive method for eliciting from a sample of interviewees their middle-range perceived and preferred sociocultural scenarios for their society or organization. EFR is an auxiliary method for research on cultural values and change, augments conventional policy-making and planning approaches; and provides an educational experience for both interviewer and interviewee. Students work alone or join a team working on Stanford Futures or Biotechnical Futures. (IDE, SSE)

3-5 units, Aut (Textor) W 7-10 p.m., alternate years, not given 1988-89

269B. **Practicum in Ethnographic Futures Research II**—(Same as Education 212B.) Continuation of 212A for those who require additional time and guidance, especially in writing up research results for publication. (IDE, SSE)

3-5 units, Win (Textor) W 7-10 p.m., alternate years, not given 1988-89

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 (Barnett)

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 1987-88

276. Advanced Cognitive Anthropology—Seminar on how people give meaning to behavior and other events they experience. The point of view is from the anthropological side of the intersection of anthropology, linguistics, cognitive psychology, and sociology, thus presenting a cross-cultural perspective on the relations among knowledge, language, and social behavior.

5 units, Aut (Frake)

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) alternate years, given 1987-88

278. Topics in Linguistic Anthropology—(Same as Linguistics 256.) Seminar devoted to a key issue in the relationships between language and culture.

5 units (Fox) alternate years, given 1988-89

280. Training Seminar: Ethnography of Schooling—(Same as Education 214.) 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

280. History of Anthropological Theory: The 19th Century—A comparative analysis of the development of social and cultural anthropology in three nations (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, Win (J. Collier, Maddox)

290. History of Anthropological Theory: The 20th Century—A comparative analysis of the development of social and cultural anthropology in three nations (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, Win (J. Collier, Maddox)

292. Dissertation Seminar—For graduate students in the process of writing dissertation and preparing for professional employment.

5 units, Aut, Win, Spr (Donham)

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 (Donham)

294. Design of Field Research—Seminar treating research design and the research process, with attention to the interrelation of both with theory and method. Also, problems of preparing dissertation proposals and applications for research grants. Prerequisite: Consent of instructor. Limited enrollment.

5 units, Spr (J. Collier)

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
Emeriti: (Professors) Marvin Chodorow, C. Chapin Cutler, W. Conyers Herring, Mitchel Weissbluth
Chairman: Malcolm R. Beasley
Assistant Professor: Aharon Kapitulnik
Professors (Research): Bertram A. Auld, George S. Brown, Philip H. Scherrer, H. John Shaw, J. Gethyn Timothy, Helmut Wiedemann, Herman Winick
Affiliated Professors: Gordon S. Kino (Electrical Engineering), Anthony E. Siegman (Electrical Engineering), William E. Spicer (Electrical Engineering)
Courtesy Professor: Douglas D. Osheroff
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, 1988. 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 courses are listed under several categories: 1) General; 2) Astrophysics; 3) Condensed Matter Physics; 4) Quantum Electronics, Optics, and Acoustics. These reflect major programs for graduate study. From time to time, “Special Topics” courses are offered to emphasize new developments in the various research areas.

The University’s basic requirements for the master’s degree are discussed in the “Degrees” section in this bulletin. Thirty-six units, of 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—1 quarter (3 units).
      (Physics 210, 211, Mathematics 220A, 220B, Electrical Engineering 261)
   b) Electrodynamics—2 quarters (6 units).
      (Physics 220, 221, Electrical Engineering 241, 242)
   c) Quantum Mechanics—2 quarters (6 units).
      (Physics 230, 231, 232, 330, 331, 332, 340, 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.

There are no departmental or University examinations, and a thesis is not required. If a student is admitted to the Master of Science Program only but later wishes to change to the Ph.D. Program, the student must apply to the department’s Admissions Committee.

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 program leading to a Ph.D. in Applied Physics consists of course work, research, a departmental Oral Examination, a Research Progress Report, a University Oral Examination, and a dissertation as follows:

1. Course Work:
   a) Courses in physics and mathematics to overcome deficiencies, if any, in undergraduate preparation.
b) Basic graduate courses.
   1) Mathematical Physics—2 quarters (Physics 210, 211, Mathematics 220A, 220B, Electrical Engineering 261)
   2) Electrodynamics—2 quarters (Physics 220, 221, Electrical Engineering 241, 242)
   3) Quantum Mechanics—3 quarters (Physics 230, 231, 232, 330, 331, 332, 340, Electrical Engineering 324)
   4) Laboratory—1 quarter (Applied Physics 358A, 358B, 365, Physics 200, 201, Electrical Engineering 245)

   c) 24 units of additional advanced courses in science and/or engineering, not including Directed Study (Applied Physics 290) and Dissertation Research (Applied Physics 300).

d) A letter grade indicator of "B" or better 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, appropriate faculty from other departments, or certain senior research associates in University laboratories.

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 Autumn 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.

ASTRONOMY, ASTROPHYSICS, AND SPACE SCIENCE

Applied Physics students may specialize in one of the above fields. Courses relevant to these studies are offered in Applied Physics and other departments. For further information, please see "Astronomy Course Program," and "Center for Space Science and Astrophysics" in this bulletin.

COURSES

GENERAL

3A. Breakthroughs and Inventions in Science and Technology—(Enroll in Freshman Sophomore Seminars 3A.)
   Aut (Cutler)
   3 units, Aut (Byer) TTh 1:15-2:30 alternate years, not given 1988-89

130. 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 receptors. Physics of nerve impulse propagation. Prerequisites: Biology 21, Chemistry 30 series, Physics 50 series, or equivalents.
   3 units, Spr (Doniach) given 1988-89


3 units, Aut (Doniach) TTh 11-12:15
alternate years, given 1988-89

245. Wave Measurement Techniques—(Enroll in Electrical Engineering 245.)
3 units. Spr (Kino)

250. 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

300. Dissertation Research
any quarter (Staff) by arrangement

315. Computational Physics—Survey of recent advances in numerical simulation of systems with many degrees of freedom. Emphasis on applications to problems in condensed matter physics. Topics include: random-number generators; Monte Carlo simulations in classical statistical mechanics; critical phenomena and finite-size scaling; transfer matrices and Lanczos' algorithm; quantum systems, projector and Green's function Monte Carlo; Fermion systems; molecular dynamics and phase transitions; polymers; cellular automata and kinetic phenomena; diffusion-limited aggregation and pattern formation.
3 units, Spr (Doniach) TTh 11-12:15

320. Atomic Physics—(Enroll in Physics 320.)
3 units, Aut (Chu)

321. Quantum Optics—(Enroll in Physics 321.)
3 units, Spr (Danzmann)

322. Bound States and High Precision Tests of QED and Electroweak Unification—(Enroll in Physics 322.)
3 units (Staff) given 1988-89

3 units, Aut (Harris) MWF 2:15
given 1988-89

350. Special Topics in Applied Physics—The special topics courses are not taught regularly, and the subject of these courses varies each year.

1 unit, Aut (Huberman) W 11

350B. Light-Atom Interactions—Quantum theory of interactions between matter and electromagnetic radiation. Topics include stochastic processes and reservoir theory, magnetic and atomic two-level systems, optical Bloch equations, statistical properties of the radiation field, damping phenomena, generalized susceptibility and response functions, fluctuation-dissipation theorem, scattering theory, nonlinear and multiphoton processes.
3 units, Win, Spr (Weissbluth)
alternate years, given 1988-89

350C. 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, Aut (Auld) MWF 9
alternate years, given 1988-89

354. 3 units, Aut (Wiedemann)
355. 3 units, Win (Wiedemann)

356. Topics in the Physics of Particle Accelerators—Advanced topics in the technology and design of particle accelerators, drawn from the
following areas: technologies of importance for the operation of accelerators; mathematical treatment of beam dynamics and instabilities; design of ultra-high-energy accelerators.
3 units, Spr (Miller, Wilson)

357. Microstructures Fabrication Laboratory
(Enroll in Electrical Engineering 357.)
3 units, Sum (Bloom, Khuri-Yakub)

ASTROPHYSICS

Applied Physics 15 and Physics 15 (see Astronomy Course Program listing) are addressed to students not majoring in the sciences. They are taught in different quarters by different instructors but are closely related in topic. Students are advised to take only one or the other of these two courses.

15. The Nature of the Universe—For undergraduates 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 (Susskind)

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, with emphasis on modern development both in astronomy and elementary particle physics relevant to the subject matter. Also, the development of life and position of intelligent beings in the universe. Algebra is used. Recommended: High school physics and calculus.
3 units, Aut (Petrosian) MWF 11

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 Astronomy and Astronomy Laboratory—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

110. 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 (Sturrock) MW 2:15-3:30

111. 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) TTh 2:15-3:30

190A,B,C. Independent Study In Astrophysics and Honors Thesis—(Enroll in Astronomy 190A,B,C.)
Aut, Win, Spr (Staff)

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

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, Win (Petrosian)

alternate years, not given 1988-89

364A, B. 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 292T, or Electrical Engineering 356, or permission of the instructor.

3 units, Win, Spr (Sturrock) MW 2:15-3:30

alternate years, given 1988-89

365. 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, given 1988-89

366. Cosmology and Extragalactic Astrophysics—Basic observational data and theories of the structure and evolution of the universe. Emphasizes 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, Spr (Petrosian)

alternate years, given 1988-89

369. Gravitation—(Enroll in Physics 368, 369.)

3 units, Win, Spr (Dimopoulos)

CONDENSED MATTER PHYSICS

172. Physics of Solids—(Enroll in Physics 172.)

3 units, Spr (Kapitulnik)

238. Electric and Magnetic Properties of Solids—(Enroll in Electrical Engineering 238.)

3 units, Win (Spicer)


239. 3 units, Aut (Harrison) MWF 10

240. 3 units, Win (Harrison) MWF 10


3 units, Spr (Beasley) MWF 10


3 units, Spr (Harrison) MWF 9

304A. Materials 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 deposits, crystal growth, fiber pulling, electrochemistry, ion implantation, and ceramic techniques. Physical measurements include: magnetization, resistivity, Hall effect, magnetoresistance, optical measurements, and computer analysis of thin film micrographs.

3 units, Win (Kapitulnik)
334. Superconducting Electronics—(Enroll in Electrical Engineering 334.)
3 units, Win (Beasley)

340. Theory of Many-Particle Systems—(Enroll in Physics 340.)
3 units, Win (Doniach)

370. Phase Transitions and Critical Phenomena—(Enroll in Physics 370.)
3 units, Spr (Fetter) not given 1987-88

385. 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.
385A. Topic to be announced.
385B. Topic to be announced.
385C. Topic to be announced

390. Condensed Matter Physics 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

QUANTUM ELECTRONICS—OPTICS-ACOUSTICS

161. Intermediate Optics—(Enroll in Physics 161.)
3 units, Aut (Schawlow)

231. Lasers—(Enroll in Electrical Engineering 231.)
3 units, Aut (Staff)

232A. Lasers—(Enroll in Electrical Engineering 232.)
3 units, Win (Staff)

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

324. Applications of Quantum Theory—(Enroll in Electrical Engineering 324.)
3 units, Spr (Staff) alternate years, given 1988-89

346. Introduction to Nonlinear Optics—(Enroll in Electrical Engineering 346.)
3 units, Spr (Harris)

347. The Fourier Transform and Its Applications—(Enroll in Electrical Engineering 261.)
3 units, Aut (Goodman)
Spr (Gray)

348. Introduction to Fourier Optics—(Enroll in Electrical Engineering 366.)
3 units, Win (Goodman)

349. Two Dimensional Imaging—(Enroll in Electrical Engineering 262.)
3 units, Win (Bracewell)

358A. Lasers Laboratory—Laser theory and practice. Lectures on the theoretical and descriptive background for the laboratory experiments, the helium neon laser, laser beams and resonators, argon ion laser, cw dye laser, semiconductor diode laser, carbon diode 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 mode-locking. Prerequisites: Electrical Engineering 231 and 232, or consent of instructor.
3 units, Win (Byer)

358B. 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 four wave mixing interactions such as wavefront conjugation, and optical bistability. Optical pumping and spectroscopy of atomic and molecular species. Limited enrollment. Prerequisites: 358A, Electrical Engineering 231 and 232, or consent of instructor.
3 units, Spr (Byer)

395. 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

431. Quantum Electronics—(Enroll in Electrical Engineering 431.)
3 units, Spr (Sigman) alternate years not given 1988-89
ART

Emeriti: (Professor) 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: Keith Boyle
Director of Graduate Studies in Art History: Paul V. Turner
Professors: Keith Boyle (Drawing, on leave Spring), Elliot W. Eisner (Art Education), Lorenz Eitner (18th-19th century French art), Albert Elsen (mid-19th-20th century European art, American art since 1940, on leave Autumn and Winter), Matthew S. Kahn (Design), John-David La Plante (Indian art), Suzanne Lewis (Medieval Art), Frank Lobdell (Painting), Dwight C. Miller (Baroque art, on leave Autumn), Nathan Oliveira (Painting/Printmaking), Paul V. Turner (Architectural History)
Associate Professors: Wanda M. Corn (American Art, on leave Autumn), Richard Randell (Sculpture)
Assistant Professors: Kristina Branch (Painting/Design), Greg Lynch (Design), Jody Maxmin (Ancient art), Melinda Takeuchi (Japanese art)
Affiliated Professor: John H. Merryman (Art and Law)
Senior Lecturers: Joel Leivick (Photography), Laura Volkerding (Photography)
Visiting Assistant Professor: Alessandro Nova (Renaissance art, Winter and Spring)

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.

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 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, student 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 of two from among the term papers written during the year, for consideration by the faculty.
5. Demonstration to the faculty, by course work and/or examination, that the student has adequate knowledge of the major areas of the history of art.

DOCTOR OF PHILOSOPHY

The University’s basic requirements for the degree of Doctor of Philosophy are set forth in the "Degrees" section in this bulletin.

Admission to Candidacy—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. program 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 thesi
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 student’s 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 four 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 51 or 52, 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 I)
18 units of painting courses
12 or more units of the modern art series (Art 120A through Art 121B)
Total Units Required: 48

REQUIREMENTS FOR SCULPTURE
Art 40, 50 or 51 or 52, 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: 48

REQUIREMENTS FOR MONOTYPE
Art 40, 50 or 51 or 52, 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 I)
Art 145 and 146
18 units of monotype courses
Art 120A, 121A, and 122
Total Units Required: 57

REQUIREMENTS FOR DESIGN
Art 40, 50 or 51 or 52, 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: 57

REQUIREMENTS FOR PHOTOGRAPHY
Art 40, 50 or 51 or 52, 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: 45

The above requirements for a major in one of the five areas are part of the total of 65 units. A major in studio may take units pass/no credit in courses outside the 65 units required for the major area of interest.

Students are required to meet with both their advisor and the department’s academic secre-
tary 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 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 Pro-
grams 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 to two years (six full quarters) of graduate work in residence or its equivalent at this University.

2. First year graduate students are required to complete 54 units of coursework chosen in consultation with an advisor. At least 18 of the 54 units must be in Art 360A, B, C and Mechanical Engineering 211A, B, C.

3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.

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.

TEACHING CREDENTIAL

(SINGLE SUBJECT—SECONDARY)

A program leading to a Master of Arts degree with a specialization in art education and/or including a California Teaching Credential in art is offered in art education by the School of Education. This program is available to students who have majored in art at the undergraduate level who have had no teaching experience, and who wish to become teachers of art at the elementary or secondary levels. For details with respect to this program consult the "Teaching Credential Program" listed in the "School of Education" section in this bulletin.

COURSES

HISTORY OF ART

BASIC

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 (Wright)

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, Aut (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, Spr (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.

   (DR:2)
   4 units (Takeuchi) not given 1987-88

5. Introduction to Ancient Art—Survey of the arts of Greece and Rome emphasizing architec-
ture, 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, Spr (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 Proto-geometric 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 1987-88

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 1987-88

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. Byzantine Art and Architecture—A survey of major works in the Eastern Mediterranean world from the founding of Constantinople (330 A.D.) to the Turkish conquest (1452), centered on patterns of imperial patronage.

4 units, Win (Lewis)


5 units, Aut (Lewis)

105. Art and Architecture in Medieval France—A survey of major works and patterns of art patronage from the time of Charlemagne to the reign of Charles V (1375). (DR:2)

5 units (Lewis) not given 1987-88

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)

5 units (Lewis) not given 1987-88

108. 15th Century Netherlandish Painting—Rediscovery of the visual world in the 15th century in the art of France and the Low Countries from Van Eyck to Bosch.

5 units (Lewis) not given 1987-88

110A. Renaissance Art I. (DR:2)

4 units, Aut

110B. Renaissance Art II. (DR:2)

4 units, Win (Nova)

110C. Renaissance Art III. (DR:2)

4 units, Spr (Nova)

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 1987-88
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 (Miller) not given 1987-88


4 units (Miller) not given 1987-88

116A. Masterpieces and Monuments of the Baroque Age. (DR:2)

4 units, Win (Miller)

120A. Modern Art I: Rococo to Revolution—Main currents in European art in the periods of the Enlightenment and Neoclassicism, Watteau, Boucher, Tiepolo, Chardin, Hogarth, Greuze, Fragonard, Robert, Piranesi, and early works of David, Goya, and Blake. (DR:2)

4 units, Spr (Eitner) not given 1987-88

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 (Eitner) not given 1987-88

120C. Modern Art III: Realism and Impressionism—The origins of Impressionism in mid-19th century realist art and in the work of the Barbizon 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, Win (Eitner)

120D. Modern Art IV: Alternatives to Impressionism—European art 1880-1900, Cezanne, VanGogh, Seurat, Gauguin, Symbolism, Lautrec, Ensor, Munch. (DR:2)

4 units (Elsen) not given 1987-88

121A. Modern Art V: 20th Century Painting I, 1900-1920—Fauvism, Matisse, German and Austrian Expressionism, Picasso, and Cubism, Orphism, Futurism, and Abstraction.

4 units (Elsen) not given 1987-88


4 units, Spr (Elsen)

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 (Elsen) not given 1987-88

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, Lichitz, 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 (Elsen) not given 1987-88

124. Picasso—Given either as a colloquium or lecture course depending upon enrollment.

4 units (Elsen) not given 1987-88

125A. Indian Painting—The major expressions of painting in India beginning with the Buddhist period as seen in the wall paintings of the Ajanta Cave Temples and tracing the changes in style until the introduction of papermaking in the 16th century which permits the full bloom of the well-known Moghul and Rajput schools of the 16th through the 18th centuries.

4 units (LaPlante) not given 1987-88

125B. The Art of India.

4 units, Win (LaPlante) not given 1987-88

125C. The Art and Architecture of Moghul India.

4 units, not given 1987-88

126A. Introduction to Chinese Art.

4 units, not given 1987-88

126B Introduction to Chinese Painting.

4 units, not given 1987-88

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 1987-88

128A. Ritual Bronzes of Ancient China.

4 units (LaPlante) not given 1987-88

128B. Chinese Ceramics.

4 units (LaPlante) not given 1987-88

128C. Buddhist Art in Asia.

4 units (LaPlante) not given 1987-88


4 units (LaPlante) not given 1987-88

128E. Japanese Ceramics.

4 units, Win (LaPlante)

129A. Arts of Japan I—Introduction to the important historical developments in Japanese
art from prehistory to the 14th 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 1987-88

129B. Arts of Japan II—Survey of the highlights of Japanese art from the 14th century to the present: the medieval Zen monastery and its attendant arts of painting, architecture and garden design, the decorative programs of the mighty castles, changes in patronage and the secularization of the opulent pre-modern era, and Japan's response to the West.

4 units (Takeuchi) not given 1987-88

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 1987-88

129D. 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 1987-88


4 units (W. Corn) not given 1987-88

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 (W. Corn, A. Gelpi) not given 1987-88

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, Win (W. Corn)

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, Spr (W. Corn)

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 1987-88

130E. The Poet and the Artist in American Modernism—(Same as English 269C.) 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 1987-88


4 units, Aut (Turner)

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 (Turner) not given 1987-88

176. American Architecture and Urbanism—The development of architecture and city planning in the United States since colonial times, concentrating on those characteristics and problems which are distinctively American. (DR:2)

4 units, Win (Turner)

ADVANCED UNDERGRADUATE AND GRADUATE


4 units, Aut, Win, Spr (Maxmin)

201. Colloquium: Beyond the Development of Attic Black-Figure Painting—(Same as Classics 201.) 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 Byzantine Art and Architecture.
4 units, Win (Lewis)

204. Studies on Art and Architecture in Medieval Britain.
4 units, Aut (Lewis)

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, Aut (Lewis)

205. Studies on Art and Architecture in Medieval France.
5 units (Lewis) not given 1987-88

4 units (Lewis) not given 1987-88

207. Studies on Medieval Architecture.
5 units (Lewis) not given 1987-88

208. Studies on 15th-Century Netherlandish Painting.
5 units (Lewis) not given 1987-88

210A,B,C. Studies on Renaissance Art I, II, III.
4 units each, Win, Spr (Nova)

214A,B,C. Seminars on Renaissance Art.
4 units each, 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 1987-88

215B. Studies on 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt.
4 units (Miller) not given 1987-88

4 units, Win (Miller)

216A. Studies on Great Masterpieces and Monuments of the Baroque Age.
4 units (Miller) not given 1987-88

216B. Colloquium on the Baroque in Rome—Questions on the origins and development of the art of the Carracci, Caravaggio, Bernini, and Borromini.
4 units, Aut (G. Wright)

217. Connoisseurship in 17th Century Italian Drawings.
4 units (Miller) not given 1987-88

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—Monarchical eulogy and related political allegory; the art of religious propaganda of the age of the Counter-Reformation.
4 units, Spr (Miller)

219A. Colloquium on Caravaggio and the Artistic Culture of the Caravangisti.
4 units (Miller) not given 1987-88

219B. Colloquium on the History of Printmaking.
4 units (Miller) not given 1987-88

219C. Colloquium: The 17th Century School of Bologna.
4 units (Miller) not given 1987-88

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 1987-88

221B. Studies on 20th Century Painting From 1920-1960.
4 units, Spr (Elsen)

223. Studies on Rodin.
4 units (Elsen) not given 1987-88

223A. Studies on Modern Sculpture in Europe and America.
4 units (Elsen) not given 1987-88

223C. Seminar on Late 19th Century Art: Rodin.
4 units (Elsen) not given 1987-88

223D. Colloquium: Modern Sculpture in Europe and America.
4 units (Elsen) not given 1987-88

224. Picasso.
4 units (Elsen) not given 1987-88

225A. Studies on Indian Painting.
4 units (LaPlante) not given 1987-88

225B. Studies on the Art of India.
4 units (LaPlante) not given 1987-88
225C. Studies on the Art and Architecture of Moghul India.
4 units (LaPlante) not given 1987-88

226A. Studies on Chinese Art.
4 units, not given 1987-88

226B. Studies on Chinese Painting.
4 units, not given 1987-88

226E. Studies on Meeting of Eastern and Western Art.
4 units, not given 1987-88

227A,B. Seminar on Chinese Art.
4 units, not given 1987-88

227C. Seminar on Far Eastern Art.
4 units, not given 1987-88

228A. Studies on Ritual Bronzes of Ancient China.
4 units (LaPlante) not given 1987-88

228B. Studies on Chinese Ceramics.
4 units (LaPlante) not given 1987-88

228C. Studies on Buddhist Art in Asia.
4 units (LaPlante) not given 1987-88

228D. Studies on the Architecture and Gardens of Japan.
4 units (LaPlante) not given 1987-88

228E. Studies on Japanese Ceramics.
4 units, not given 1987-88

229A. Studies on the Arts of Japan I.
4 units (Takeuchi) not given 1987-88

229B. Studies on the Arts of Japan II.
4 units (Takeuchi) not given 1987-88

229C. Studies on Japanese Painting.
4 units (Takeuchi) not given 1987-88

229D. Seminar on Japanese Art.
4 units (Takeuchi) not given 1987-88

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 ukiyoe (“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 1987-88

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 1987-88

229G. Studies on Japanese Buddhist Art.
4 units (Takeuchi) not given 1987-88

229H. Colloquium: Art, Culture, and Society in Tokugawa Japan—An investigation of the interaction between social change, culture, and the visual arts in Tokugawa Japan. Interdisciplinary, focusing on how certain basic human issues, the relation of man to nature, the tension between individual and society, the ultimate purpose of existence, were dealt with in art and formal thought.
4 units (Duus, Takeuchi) not given 1987-88

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 (Takeuchi) not given 1987-88

230. Studies on American Art and Culture, 1670-1830.
4 units (W. Corn) not given 1987-88

230A. Studies on American Art and Culture, 1830-1900.
5 units (W. Corn) not given 1987-88

4 units, Win (W. Corn)

230C. Studies on American Art in the 1930s.
4 units, Spr (W. Corn)

230D. Studies on American Art After World War II.
4 units (W. Corn) not given 1987-88

230E. Studies on the Poet and the Artist in American Modernism.
4 units (W. Corn, A. Gelpi) not given 1987-88

231A. Undergraduate Seminar: Photographs as Historical Documents—(Same as American Studies 220.)
5 units (J. Corn, W. Corn) not given 1987-88

232A,B. Americanisme: The European Avant-Garde and American Culture—Two-quarter research seminar studying the European avant-garde’s response to American culture, 1910-1950. 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 1987-88

235. Proseminar 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, Win (Lewis)

236. Art History Bibliography and Library Methods—Introduction to important reference works in art and architectural history. Familiarity with this material is encouraged through the frequent assignment of relevant bibliographical problems. A working reading knowledge of German, French, and Italian is assumed. Primarily for art history graduate students, although junior or senior undergraduate majors who plan to continue in art history on the graduate level may enroll with the consent of the instructor.  
4 units, Aut (Ross)

4 units (Elsen) not given 1987-88

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, Spr (Elsen)

any quarter (Staff) by arrangement

274. Studies on Baroque Architecture.  
4 units, Aut (Turner)

275A,B. Studies in Modern Architecture I, II.  
4 units (Turner) not given 1987-88

4 units, Win (Turner)

277. Seminar on Modern Architecture: Le Corbusier—(Prior consent of instructor required.)  
4 units, Aut (Turner)

278. Seminar on American Architecture: The Design of the American College Campus—(Prior consent of instructor required.)  
4 units (Turner) not given 1987-88

279. Seminar on Frank Lloyd Wright—(Prior consent of instructor required.)  
4 units (Turner) not given 1987-88

4 units, Win (Stout, Turner)

295. Teaching and Professional Work Experience.  
4 units, Aut, Win, Spr (Staff) by arrangement

299. Colloquium on Post-Modernism: Theory, Context, Art, and Architecture—(Same as German Studies 209A.) Occasional outside speakers focus discussion on readings by Kraus, Jencks, Foster, Jameson, Habermas, and others. Recommended: 200 level course on modern art theory or literature, or equivalent. Enrollment limited.  
2 units, Aut (Turner)

any quarter (Staff) by arrangement

any quarter (Staff) by arrangement

RELATED TOPICS

Topography and Monuments of Greece—(See Classics 108.)
The City of Athens—(See Classics 109.)
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.  
3 units, Aut (Mahosky)
Win (Staff)

15. Special Seminar in Printmaking.  
3 units

3 units, Spr (Staff)

17. Special Seminar in Photography.  
3 units, Win (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, Win, Spr (Randell)

51. Clay Modeling: The Head—Study of the figure tradition in sculpture with emphasis on modeling the human head in clay.

3 units, Aut, Win, Spr (Randell)

52. Clay Modeling: The Figure—Study of the figure tradition in sculpture with emphasis on modeling the human figure in clay.

3 units, Aut, Win (Randell)

53. Constructed Art—Simple assembly techniques, welding, and metal fabrication are used to construct non-representational sculpture using wood, metal, plastic.

3 units, 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.

3 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.

3 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)


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, Aut (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 emphasis is on the silkscreen printing process. Prerequisite: 160 or 161.

3 or more units (Kahn)
167. **Metalsmithing**—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. A 5-week term urban design problem summarizes principles discussed in the readings, seminars, and workshops.

5 units, Win (Gast)

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 (Gast)

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)

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242. **Advanced Drawing and Painting Criticism II**—Prerequisite: At least two quarters of painting or drawing.

Aut, Win, Spr (Boyle) by arrangement

243. **Advanced Drawing and Painting Criticism III.**

Aut, Win, Spr (Lobdell) by arrangement

244. **Advanced Drawing and Painting Criticism IV.**

Aut, Win, Spr (Branch) by arrangement

246. **Individual Work: Drawing and Painting.**

Aut, Win, Spr (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)

250. **Individual Work: Sculpture.**

any quarter (Randell) by arrangement

260. **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, Aut (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)

266. **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 his skill in image-making. 4 x 5 view
cameras are provided. Class limited to eight students.
3 units, Aut (Volkerding)
Win (Leivick)
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)
Aut, Win, Spr (Boyle) by arrangement
any quarter (Staff) by arrangement
360A,B,C. Master’s Project (Seminar): Design.
Aut, Win, Spr (Kahn) by arrangement
RELATED TOPICS
Philosophy of Design—(See Mechanical Engineering 214.)
Visual Thinking—(See Mechanical Engineering 101.)
Human Values in Design—(See Mechanical Engineering 115A.)
ART EDUCATION
Artistic Development of the Child—(Enroll in Education 219.)
4 units, Win (Eisner) given 1988-89
Seminar for Doctoral Students in Art Education—(Enroll in Education 461.)
2-5 units, Aut (Eisner) given 1988-89

ASIAN LANGUAGES

Emeritus: (Professor) Frederic Spiegelberg
Chairman: John C.Y. Wang
Professors: Albert E. Dien, David S. Nivison, Makoto Ueda, John C.Y. Wang
Associate Professors: Kung-yi Kao, Ian Levy (on leave 1987-88), William A. Lyell (on leave 1987-88), 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 1987-88), Harumi Befu (Anthropology), Albert E. Dien (Asian Languages), Peter Duus (History), Lawrence Lau (Economics), John W. Lewis (Political Science, on leave 1987-88), Jeffrey Mass (History), David S. Nivison (Asian Languages, Philosophy, and Religious Studies), 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: Harold L. Kahn (History), Kung-yi Kao (Asian Languages), Ian Levy (Asian Languages, on leave 1987-88), William A. Lyell (Asian Languages, on leave 1987-88), Susan K. Matisoff (Asian Languages), Daniel I. Okimoto (Political Science, on leave Autumn), Lee H. Yearley (Religious Studies, on leave 1987-88)
Assistant Professors: Carl W. Bielefeldt (Religious Studies), Nina Halpern (Political Science), Thomas W. Hare (Asian Languages), John D. LaPlante (Art), William J. Poser (Linguistics), Terry Sicular (Food Research Institute, on leave 1987-88), Melinda Takeuchi (Art), Steven Van Zoeren (Asian Languages)
Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Kimie Nishimura Nebrig, Hiroshi Sakamoto, Dorothy Shou (Asian Languages)
Lecturers: Kazuko M. Busbin (Asian Languages), Anne Klein (Religious Studies)

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: Anthropology, Art, Economics, Humanities Special Programs, History, Law, Philosophy, Political Science, Religious Studies, and Sociology. For additional offerings in literature, see Comparative Literature. Students interested in Asian languages not listed above should contact the Special Language Program, Department of Linguistics.

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:

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, Asian Languages 136, 137, 138, and four other content courses dealing with Japan at the 100 level, as approved by the Undergraduate Advisor.

These requirements are in addition to the University's basic requirement for the bachelor's degree. 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.

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 Languages, 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 section "Degrees" 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, 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, 213, 248, 299; four courses in Japanese numbered between 255 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, 248 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 for the Ph.D.
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 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
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 section "Degrees" in this bulletin. The candidate will be examined on questions related to his or her dissertation, after acceptable parts thereof have been completed in draft form.

Dissertation—The candidate will write a dissertation demonstrating ability to undertake original research based on primary materials in Chinese or Japanese.

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. He or she must elect either Chinese 201-202 or Japanese 201-202 unless the department is satisfied that work done elsewhere has provided similar training. He or she must also pass a written examination in the Chinese or Japanese language.

SPECIAL PROGRAMS
Properly qualified students may plan special interdepartmental programs in the Asian field for the degree of Doctor of Philosophy. See the section "Graduate Division Special Programs" in this bulletin.

SPECIAL OPPORTUNITIES FOR STUDY ABROAD
Attention is called to the programs of the Inter-University Program for Chinese Language Study in Taipei and the Inter-University Center for Japanese Studies in Tokyo (both of which are administered by Stanford University). See the section "Center for Research in International Studies" 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 see the chairman of the department early in the academic year.

COURSES
NOT REQUIRING KNOWLEDGE OF AN ASIAN LANGUAGE
46. Introduction to Chinese Philosophy —
(Same as Philosophy 46, Religious Studies 55.)
The history of Chinese philosophy to 200 B.C., and a brief introduction to Classical Chinese as used by early philosophers. Enrollment limited to 80. (DR:3*)
4 units, Aut (Ivanhoe) MWF 10
discussion by arrangement
91. Traditional East Asian Civilization: China —
An introduction to Chinese culture (thought, literature, and art) set against the backdrop of history. (DR:2*)
5 units, Aut (Van Zoeren) MWThF 10
92/192. Traditional East Asian Civilization:
Japan — An introduction to traditional Japanese culture emphasizing the relation between intellectual currents and the arts from the 8th through 18th centuries. (DR:5*)
5 units, Win (Hare) MWThF 10
110. Japanese-Western Literary and Cultural Interaction—Discussion of cross-literary and cross-cultural topics, such as haiku in English, Marxism in Japanese prose fiction, and Zen in American literature. (DR:2*)
3 units, Aut (Ueda) given 1988-89
114. Haiku—Reading and discussion of representative Japanese haiku from the 16th century to the present. Works of Bashō, Buson, Issa, and other poets are treated in English translation. Students exchange their interpretations of individual poems in class, collectively trying to reach for the ultimate meaning of each. Aspects of traditional Japanese aesthetics are touched on in the discussions. (DR:2*)
3 units, Aut (Ueda) given 1989-90
125. Japanese Culture Through Novels and Films—(Same as Anthropology 125.) Explorations of Japanese social structure (family, socialization, community, work, etc.) and cultural values through novels (in translation) by leading writers (Mishima, Natsume, Tanizaki, etc.) and feature length films by well known directors (Kurosawa, Ozu, etc.). Focus is on the individual in the social and cultural setting of modern, changing Japan.
5 units, Spr (Befu) not given 1987-88
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) MWThF 11
132. Chinese Fiction and Drama in Translation—A survey of Chinese prose fiction from early times to the late Ch'ing period, emphasizing literary and thematic discussions of major representative works available in English translation. (Students who need to take this course to fulfill requirements may take 176 instead.) (DR:2*)
4 units, Win (Wang) MWThF 11
133. Modern Chinese Literature in Translation—Readings in representative 20th-century works of fiction, drama, and poetry in translation. (DR:2*)
4 units, Spr (Staff) MWF 1:15

136. Classics of Japanese Literature in Translation I—An introduction to the Japanese literary tradition, from the Man'yōshū poetry anthology to The Tale of Genji. All readings in English translation. (DR:2*)
4 units, Aut (Staff) MWF 1:15

137. Classics of Japanese Literature in Translation II—An introduction to major works of prose, poetry, and dramatic literature of the 14th to 19th centuries. Works read in translation include masterpieces stemming from the courtly, the samurai, and the urban-commoner traditions of Japan. 136 is not a prerequisite. (DR:2*)
4 units, Win (Matisoff) TTh 12:50-2:05

4 units, Spr (Ueda) MWF 1:15

144. Confucianism Since Wang Yang-ming—(Same as Religious Studies 254.) History of Confucian moral philosophy in China and Japan since the death of Wang Yang-ming in 1529. (Dr:2) 4 units, Spr (Nivison) given 1987-88

152. Nomad Empires of Inner Asia—(Same as History 193.) Inner Asia as an arena of conflict between agricultural and nomadic societies and the traces of cultural diffusion. (DR:5*) 5 units, Spr (Dien) given 1988-89

153. Science, Technology, and Material Culture 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, Spr (Dien) TTh 2:15-4:05

156. China from Earliest Times to the 9th Century—(Same as History 192A). Geo-historical origins to the Tang period: the first 4,000 years of social formations and historical transformations of ancient and early medieval China. (DR:5*) 5 units, Aut (Dien, Kahn) MTWThF 11


177/277. Classic Japan—The cultural achievements of Heian (794-1185) Japan. Students are introduced to The Tale of Genji, Japan's greatest work of prose fiction, and to the visual arts, music, and poetry of the age. The religious and historical background of the period is discussed. (Graduate students may register under 277, with additional readings in Japanese.) (DR:2*) 4 units, Aut (Hare) not given 1987-88

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. Readings include poems by Sappho, Tu Fu, Zeami, Keats, Whitman, and Apollinaire. Recommended: A reading knowledge of a foreign language (classical or modern). Upperclass students have priority. Enrollment limited to 15. 3 units, Spr (Hare) given 1988-89

179. Classical Japanese Drama—The development of Japanese drama from early religious ritual forms through no, puppet theatre, and kabuki. Readings include translation from several genres emphasizing no. Plays are analyzed as dramatic literature and in terms of performance. Video tapes and short films extensively supplement lectures. (DR:2*) 4 units, Spr (Matisoff) not given 1987-88

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 is read in translation. (DR:2*) 4 units, Win (Matisoff) given 1988-89

195/295. Modern Intellectuals in Japanese Literature—A study of modern Japanese novels that deal with problems of a modern intellectual. The novels, in English translation, include Kawabata's Snow Country, Tanizaki's The Key, Mishima's Confessions of a Mask, etc. 3 units, Aut (Ueda) given 1988-89
255A. The Nature of Literature: Japanese and Western Views—The different attitudes toward literature in Japan and in the West. The books discussed include Soseki's *The Three-Cornered World*, Kawabata's *Beauty and Sadness*, Tanizaki's *Some Prefer Nettles*, and Mishima's *The Temple of the Golden Pavilion*.

5 units, Win (Ueda) given 1989-90

CHINESE

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 (Kao, Show) Section 1
   MTWThF 9; Section 2 MTWThF 10
   Section 3 MTWThF 1:15
2. 5 units, Win (Kao, Show) Section 1
   MTWThF 9; Section 2 MTWThF 10
   Section 3 MTWThF 1:15
3. 5 units, Spr (Kao, Show) Section 1
   MTWThF 9; Section 2 MTWThF 10
   Section 3 MTWThF 1:15

5. Intensive First-Year Modern Chinese—Equivalent to 1, 2, and 3 combined.
   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 (Show) TTh 11
28. 2 units, Win (Show) TTh 11
29. 2 units, Spr (Show) TTh 11

51. Chinese Calligraphy—Practice in writing Chinese characters with a brush and learning different scripts. Prerequisite: Chinese 3, Japanese 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 (Chuang) MTWThF 11
103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese—Equivalent to 101, 102, 103 combined. Prerequisite: 23 or equivalent.
   12 units, Sum (Staff) MTWThF 9-12

111, 112, 113. Third-Year Chinese (Classical)—Prerequisite: 23 or equivalent.

111. 5 units, Aut (Kao) TTh 2:15-4:05
112. 5 units, Win (Kao) TTh 2:15-4:05
113. 5 units, Spr (Kao) 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—Prerequisite: 23 or equivalent.

131. 2 units, Aut (Staff) by arrangement
132. 2 units, Win (Staff) by arrangement
133. 2 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, Aut (Dien) W 2:15-4:05
202. 5 units, Win (Dien) W 2:15-4:05

211, 212, 213. Fourth-Year Modern Chinese—Designed to help ambitious students make themselves into competent, active users of the language capable of writing articles and presenting papers in Chinese. Prerequisites: Third-year Chinese and consent of instructor.

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 (Nivison) 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 Classical Chinese Texts—(Same as Religious Studies 212.) The issue of interpretation in texts of early Confucianism and Taoism as they have been interpreted throughout Chinese history. The critical importance of historical and philosophical issues to interpretation. 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) not given 1987-88

242. Essay. 5 units, Win (Chuang) not given 1987-88

243. Novel. 5 units, Aut (Lyell) not given 1987-88

260. Chinese Poetry (I)—Selected readings from the Shihs-ching Ch'i'-ts' u. Prerequisite: 223 or consent of instructor. 4 units, Win (Van Zoeren) given 1988-89

261. Chinese Poetry (II)—Selected readings from the poetry of the Han through T'ang dynasties. Prerequisite: 223 or consent of instructor. 4 units, Win (Van Zoeren) MWF 11

262. Songs and san-ch'ü—Selected readings of songs (ts' u) and (san-ch'ü), T'ang through Ming. Prerequisite: 223 or consent of instructor. 4 units, Spr (Van Zoeren) MWF 10

271/272. Traditional Chinese Fiction—Selected readings in short stories and longer works of fiction from early times to late Ch'ing. Prerequisite: 113 or consent of instructor.

271. 4 units, Aut (Wang) given 1988-89

272. 4 units, Win (Wang) given 1988-89

273. Chinese Drama—Selected readings in dramatic works of the Yüan, Ming, and Ch'ing periods emphasizing literary, not theatrical qualities. Prerequisite: 113 or consent of instructor.

274. 4 units, Aut (Wang) TTh 11-12:15

291. The Structure of Modern Chinese—(Same as Linguistics 278.) Prerequisite: 23 or equivalent. Recommended: A general introductory course in linguistics.

292. The Chinese Language and Current Linguistic Theories—(Same as Linguistics 279.) Prerequisite: 103 or equivalent. Recommended: A general introductory course in linguistics.

298. Master's Thesis or Translation—A total of 5 units taken in one or more quarters.

331. Seminar in Confucian Ethics—(Same as Philosophy 331, Religious Studies 331.) Prerequisite: 223 or equivalent.

332. Seminar: The Bamboo Annals—Prerequisite: 223 or equivalent.

334. Seminar in Modern Chinese Literature—May be repeated for credit. Prerequisite: 243 or consent of instructor. 5 units, Win (Lyell) not given 1987-88

361. Seminar in Chinese Literary Criticism—Readings in traditional and modern texts concerning Chinese literature. Prerequisite: 223 or consent of instructor.

371. Seminar in Chinese Narrative—Thorough studies of individual texts emphasizing theoretical applications. May be repeated for credit. Prerequisite: 272 or consent of instructor.


JAPANESE

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, Staff) Sec 1 MTWThF 9; Sec 2 MTWThF 10; Sec 3 MTWThF 11; Sec 4 MTWThF 11; Sec 5 MTWThF 1:15

2. 5 units, Win (Sakamoto, Nebrig, Staff) Sec 1 MTWThF 9; Sec 2 MTWThF 10; Sec 3 MTWThF 11; Sec 4 MTWThF 11; Sec 5 MTWThF 1:15

3. 5 units, Spr (Sakamoto, Nebrig, Staff) Sec 1 MTWThF 9; Sec 2 MTWThF 10; Sec 3 MTWThF 11; Sec 4 MTWThF 11; Sec 5 MTWThF 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) MWF 10

8/108. 3 units, Win (Busbin) MWF 10

9/109. 3 units, Spr (Busbin) MWF 10

21, 22, 23. Second-Year Modern Japanese—Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 2 or equivalent. Section 1 is primarily for students who have completed first-year Japanese elsewhere; section 2 is for students who have completed first-year Japanese at Stanford.

21. 5 units, Aut (Kubota) section 1, MTWThF 9 (Busbin) section 2, MWF 11-12:20
22. 5 units, Win (Kubota) section 1, MTWThF 9
(Busbin) section 2, MWF 11-12:20
23. 5 units, Spr (Kubota) section 1, MTWThF 9
(Busbin) section 2, MWF 11-12:20

25. Intensive Second-Year Modern Japanese
—Equivalent to 21, 22, and 23 combined. Prerequisite: 3 or equivalent.
12 units, Sum (Staff) MTWThF 8-12

27, 28, 29. Conversation I—Prerequisite: 3 or consent of instructor.
27. 2 units, Aut (Nebrig) TTh 1:15
28. 2 units, Win (Nebrig) TTh 1:15
29. 2 units, Spr (Nebrig) TTh 1:15

ADVANCED
101, 102, 103. Modern Written Japanese —
Primarily reading using texts representative of various modern written styles. Prerequisite: 23 or equivalent.
101. 5 units, Aut (Kubota) MWF 11-12:15
102. 5 units, Win (Kubota) MWF 11-12:15
103. 5 units, Spr (Kubota) MWF 11-12:15

105. Intensive Modern Written Japanese —
Equivalent to 101, 102, and 103 combined. Prerequisite: 23 or equivalent.
12 units, Sum (Staff) MTWThF 9-12

111, 112, 113. Business Japanese—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 (Sakamoto) MWF 2:15
112. 3 units, Win (Sakamoto) MWF 2:15
113. 3 units, Spr (Sakamoto) MWF 2:15

121, 122, 123. Conversation II—Prerequisite: 23 or consent of instructor.
121. 2 units, Aut (Kubota) TTh 1:15
122. 2 units, Win (Kubota) TTh 1:15
123. 2 units, Spr (Kubota) TTh 1:15

199. Individual Reading in Japanese—(Asian Languages majors only.) Prerequisite: 103 or consent of instructor.
4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE
200. Directed Reading in Japanese—Prerequisite: 213 or consent of instructor.
units to be arranged, Aut, Win, Spr (Staff) by arrangement

201. 5 units, Win (Matisoff) Th 2:15-4:05
202. 5 units, Spr (Hare) by arrangement

211, 212, 213. Advanced Modern Japanese—
Readings in modern Japanese scholarly, jour-
include selections from major poets such as Kambara Ariake, Hagiwara Sakutaro, Miyazawa Kenji, and Nishiwaki Junzaburo. Prerequisite: 213 or consent of instructor. 4 units, Win (Levy) not given 1987-88

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) given 1988-89

286. The Structure of Japanese—Overview of Modern Japanese phonology, morphology, and syntax, with emphasis on topics of current theoretical interest. Some previous background in linguistics and knowledge of Japanese assumed. Prerequisite: Consent of instructor. 4 units, Aut (Poser) not given 1987-88

294. Major Haiku Poets — Reading and discussion of selected haiku by Bashô, Buson, Issa, and others. Prerequisite: 103 or equivalent. 4 units, Aut (Ueda) TTh 2:15-3:30

296. Readings in Modern Japanese Literature—Reading and discussion of works selected from contemporary authors. Prerequisite: 213 or equivalent. May be repeated for credit. 4 units, Win (Ueda) given 1989-90

298. Translation Workshop—Discussion of problems involved in translating Japanese into English. Each student produces an original translation of a literary or documentary work from his or her major field of interest. 4 units, Spr (Ueda) TTh 2:15-3:30

299. Master's Thesis or Translation—A total of 5 units, taken in one or more quarters. Aut, Win, Spr (Staff) by arrangement

396. Seminar in Japanese Literature —May be repeated for credit. 5 units, Spr (Ueda) W 2:15-4:05

Astronomy COURSE PROGRAM

Committee in Charge: (Chairman) Vahe Petrosian, Peter Banks, J. Richard Bond, Ronald N. Bracewell, Von R. Eshleman, John R. Spreiter, Peter A. Sturrock, Robert V. Wagoner, Arthur B.C. Walker, Jr.


Associate Professor: J. Richard Bond (Physics)

Professors (Research): 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. 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 Astronomy and Astronomy Laboratory; 106, Planetary Exploration; 110, Introduction to Stellar and Galactic Astrophysics; 111, Extragalactic Astrophysics and Cosmology. Students planning study in astronomy beyond the B.S. are urged to consider an undergraduate thesis (Astronomy 190).

**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 which is described in this bulletin.

The following courses are recommended for students planning to conduct research in astronomy and astrophysics: 292, Plasma Physics; 365, Astrophysics Laboratory; 360, Solar Physics; 362, Physical Processes in Stars; 364, Plasma Physics; 366, Cosmology and Extragalactic Astrophysics; 368, 369, Gravitation. A graduate seminar (Astronomy 380) is given from time to time on a topic of current interest in astronomy or astrophysics.

Students interested in the research programs involving spacecraft studies of the planets, their satellites, and their near-space environments should consider the following courses: 195, Physics of Planetary Internals; 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; 359, Remote Probing of Atmospheric Environment; 392, Magnetospheric Physics.

**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 are advised against taking 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, planets, to the development of life. Also, exotic astronomical objects, quasars, pulsars, and black holes. Some algebra is used. (DR:7)

3 units, Spr (Susskind)

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 such as planets, stars, galaxies and the universe at large emphasizing modern development both in astronomy and elementary particle physics relevant to the subject matter. Also, the development of life and position of intelligent beings in the universe. Algebra is used. Recommended: Knowledge at the level of high school physics and calculus.

3 units, Aut (Petrosian) MWF 11

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 discus-
sions 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 Astronomy and Astronomy Laboratory — (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 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; consent of instructor. (DR:7)

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

106. Planetary Exploration — Consideration of the other worlds of our solar system as revealed by recent space missions. Comparative properties of the terrestrial and Jovian planets; planetary atmospheres, surfaces, interiors; rings of Saturn; planetary and satellite orbits and spacecraft trajectories, orbital perturbations; properties of the interplanetary gas, dust, comets, and meteorites. 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, infra-red, light, and ultraviolet wavelengths. U.S. and Soviet space programs and their comparative engineering and scientific aspects. Prerequisite: One year of college engineering, mathematics, or physics.

3 units, Spr (Eshleman) MWF 9

110. Introduction to Stellar and Galactic Astrophysics — (Enroll in Applied Physics 110.) 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 (Sturrock) MW 2:15-3:30

111. Extragalactic Astrophysics and Cosmology — (Enroll in Applied Physics 111.) 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) TTh 2:15-3:30

190A,B,C. Independent Study in Astrophysics and Honors Thesis — A detailed study of a selected problem in astrophysics with an individual faculty member or with several faculty members. While not all projects will require 3 quarters, the sequence below is intended to suggest a format which most projects are expected to follow. Projects may commence in any quarter.

190A. Selection of the Problem — Student selects the problem to be studied and develops the theoretical apparatus or initial interpretation of observational data required for the study of the selected problem. Preparation of a detailed description of the problem and its background and a comprehensive discussion of the work planned in the subsequent two quarters.

1-9 units, Aut (Staff) by arrangement

190B. Continuation of Project — The student should substantially complete the required computations or data analysis for the research project selected.

1-9 units, Win (Staff) by arrangement

190C. Completion of the Project — The student should complete the research project and write a detailed paper presenting the methods used and results of the research program.

1-9 units, Spr (Staff) by arrangement

195. Physics of Planetary Interiors — (Enroll in Geophysics 195.)

3 units, Spr (Sleep) TTh 10-11:30

227. Atmospheric and Space Physics — (Enroll in Aeronautics and Astronautics 227.)

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

249. Introduction to Space, Telecommunications, and Radioscience — (Enroll in Electrical Engineering 249.)

3 units, Aut (Bracewell) given 1988-89

256. Elementary Plasma Physics — (Enroll in Electrical Engineering 256.)

3 units, Spr (Storey) MWF 3:15

279A. Space Mechanics — (Enroll in Aeronautics and Astronautics 279A.)

3 units, Win (Powell) TTh 9:30-10:45

279B. Advanced Space Mechanics — (Enroll in Aeronautics and Astronautics 279B.)

3 units, Spr (Breakwell) given 1988-89
279C. Optimal Space Trajectories—(Enroll in Aeronautics and Astronautics 279C.)
3 units, Spr (Breakwell)
alternate years, not given 1988-89

348. Ionospheric and Magnetospheric Processes—(Enroll in Electrical Engineering 348.)
3 units, Spr (Banks) TTh 2:45-4

350. STAR Laboratory Seminar in Radioscience—(Enroll in Electrical Engineering 350.)
1 unit, Aut, Win, Spr (Vesecky) M 4:15

352. Electromagnetic Waves in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)
3 units, given 1988-89

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
3 units, not given 1988-89

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

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

3 units, Win, Spr (Sturrock) MW 2:15-3:30
alternate years, given 1988-89

365. Astrophysics Laboratory—(Enroll in Applied Physics 365.)
3 units, Sum (Walker) given 1988-89

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)
3 units, Spr (Petrosian)
alternate years, given 1988-89

368. Gravitation—(Enroll in Physics 368, 369.)
3 units, Win (Dimopoulos)
369. 3 units, Spr (Dimopoulos)
Dennis Huston (Basketball, men), Larry Kerr (Football), Otto Koessler (Football), Louis Lubick (Football), Dick Mannini (Football), Kirk Mason (Baseball), Ruben Nieves (Volleyball), Doug Oliver (Basketball, men), Julie Plank (Basketball, women), Sherry Posthumus (Fencing, women), Samie Shaw (Gymnastics), Dean Stotz (Baseball), Amy Tucker (Basketball, women), James Walsh (Football), John Whiting (Tennis, men), David Wollman (Track and Field), Jiri Zapletal (Crew, men)

Teaching Specialists: Blake Middleton (Sailing), Joe Petrucci (Sailing), Standley Scott (Athletic Training)

From its founding in 1891, Stanford's leaders have believed physical activity is valuable for its own sake, and that it is complementary to the educational purpose of the University. The mission of Stanford's Department of Athletics, Physical Education and Recreation is to offer the widest possible range of quality programs which will allow all participants to realize the opportunities for athletic participation and physical fitness at all levels of skill and interest. Within the limitations of its resources, the department is expected to provide a broad range of instructional, recreational, and competitive programs for all who wish to participate. The intrinsic value to the participant is the primary criterion by which the worth of the programs should be judged.

The goals of the instructional programs are to promote understanding of the value and role of physical activity as an important dimension of the human condition, to develop performance skills in dance and sport, to develop the participation habit, and to provide leadership opportunities in aquatics, dance, sports and other physical activities. To this end, the program encompasses a diversity of learning and participating opportunities which extend from informal recreation through organized intramural competition, basic instructional classes, and theoretical study to, and including, intercollegiate athletic competition and dance performance.

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 in 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.
jectives 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 SPORT AND MARTIAL ARTS PROGRAMS

The Stanford Club 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 Curriculum Coordinator, 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 quarter, 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 at 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 Physical Education Curriculum Coordinator, Elizabeth Weeks, or Susan Cashion for enrollment advice.
**Academic Credit**—Activity classes carry one 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**—Students, faculty, and staff may audit any class or course with permission of the respective instructors, only on a "space-available" basis after enrollment of the "credit-enrollees" is completed. (Exception: No faculty, staff, or graduate students on intercollegiate JV or Varsity teams.) Students have first priority for auditing and must record this enrollment on their Official Study Lists. Enrollment and the grade received will be reflected on the End-Quarter Grade Reports and student transcripts.

**Class Fees**—Fees are charged for enrollment in badminton, equitation, fencing, golf, sailing, SCUBA, windsurfing and the Club Program 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), frisbee, 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.

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)

71. **Ballet Technique For Modern Dance I**—Focus 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)

81. **Jazz Dance I**—Jazz dance styles. Emphasis on rhythmic variation, coordination, isolation of body parts, and movement combinations.

1 unit, Aut, Win, Spr (Staff)

91. **International Folk Dance**—Movement class which 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, Aut, Win, Spr (Arkin)

96. **Ballroom Dance**—Selected social dance styles including swing, fox trot, waltz, and cha-cha.

1 unit, Aut, Spr (Arkin)

157. **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)

175. **Mexican Dance and Folklore I**—Three forms of Mexican Dance: regional, popular...
cial and religious. Taught for technical and cultural understanding. Designed for the novice dancer. (PE:C)
2 units, Aut (Cashion)

177. 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, Spr (Cashion)
alternate years, not given 1988-89

183. Musical Theatre Workshop—(Same as Drama 26.) Dance performance skills and choreography appropriate for musical theater productions. Extensive dance background not required. (PE:X)
2 units, Win (Cashion)

INTERMEDIATE

62. 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)
1 unit, Aut, Win, Spr (Staff)

63. Modern Dance III—Reinforcing and extending of concepts developed in 61 and 62. Emphasis on clarity of style, rhythmic versatility, and phrasing. Prerequisite: 62 or equivalent. (PE:X)
1 unit, Aut, Win, Spr (Staff)

72. 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, Win, Spr (Limpert)

73. 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: 72 or equivalent.
1 unit, Win, Spr (Limpert)

82. Jazz Dance II—Beginning-intermediate level emphasizing control, rhythmic coordination, and the learning of movement combinations. Prerequisite: 72 or equivalent.
1 unit, Aut, Win, Spr (Staff)

83. Jazz Dance III—Jazz technique. Prerequisite: Consent of instructor.
1 unit, Win (Osumare)

85. African-Caribbean Roots of American Jazz Dance—Traditional African and Caribbean dance forms and their influence on contemporar-
folk dances taught in rehearsal-like format to prepare for several performances each quarter.
2 units, Aut, Win, Spr (Arkin)

262. Performance Workshop: Public Performance—A workshop designed to explore and develop performance skills. Includes public performances in faculty and/or student-directed productions.
1 unit, by arrangement (Staff)

264. Faculty Choreography—Rehearsal and performance of faculty choreography. Selection by audition.
1 unit, by arrangement (Staff)

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, not given 1987-88

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, ethnic, dance in education, contemporary problems and current trends. Lectures amplified by readings, films, and discussion. (PE:X)
3 units, Aut (Cashion, Kramer)

363. Dance Production Management—Analytical and practical experience in producing Dance Division dance events under the supervision of the faculty coordinator. Focus is on the areas of finances, publicity, booking, technical production, and artistic direction of a dance performance. (PE:X)
3 units, Win (Limpert)

364. 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)

365. 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), alternate years, given 1988-89

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)
1-3 units, Aut, Win, Spr (Strathairn) by arrangement

110. Classical Athletics—(Same as Classics 17)
The origins and history of competitive sport in the ancient world, from the funeral games for Peneclus (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)
3 units, Spr (Raubitschek) given 1988-89
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.
(P.E.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 backstroke. Additional strokes introduced as ability warrants.
1 unit, Aut, Win, Spr (Weeks, Donovan)

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 sidestroke and breaststroke. Work to better skills and increase time and distance of swim. Pre-

49. Swimming: Intermediate—Continued work on crawl, elementary backstroke, sidestroke, 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, Spr, Aut (Petrucci, Middleton)

56. Windsurfing—Theory and techniques of windsurfing safely and confidently. Fee.
1 unit, Spr (Petrucci, Middleton)

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. American Red Cross certification for successful course completion. Prerequisites: Current Red Cross Ad-
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, Spr (Weeks, Donovan)

153. Skin and SCUBA Diving—Lectures, skill sessions and three field trips. National certification upon successful completion. Fee. Student supplies mask, fins, snorkel, boots, gloves, depth gauge, underwater watch, and compass (to be discussed in class). Priority to students accepted for study at Hopkins Marine Station. Prerequisites: Swim test, medical clearance, consent of instructor. (PE:X)

3 units, Aut, Win, Spr (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. Fee. Student must provide gear for dives including depth gauge, compass, watch, power inflator, and alternate air source. 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 (Diaz, 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 (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 (S. Johnson, Donovan, Hamada)

15. Gymnastics: Beginning—Fundamental gymnastics movements 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. Beginning Horsemanship: 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, Schaaf)

25. **Badminton: Beginning/Intermediate**—Introduction/review of all fundamental strokes and rules; introduction of round-the-head shot, net shot, and utilization of strategy and tactics of game playing. Fee. 1 unit, Aut, Win, Spr (Staff)

30. **Fencing: Beginning**—Basic footwork and foil techniques. Practice in drilling and boutings. Fee. 1 unit, Aut, Win, Spr (Posthumus)

31. **Fencing: Intermediate**—Improvement in technique, speed, control, coordination, and timing. New moves, psychology of fencing introduced. Fee. Prerequisite: 30 or equivalent. 1 unit, Aut, Win, Spr (Hurst)

32. **Tennis: Beginning**—Fundamental strokes (forehand, backhand, service, and net play), rules and scoring. 1 unit, Aut, Win, Spr (A. Gould, D. Gould, S. Johnson)

33. **Tennis: Intermediate**—Review of fundamental strokes, introduction to the lob and overhead strokes, and utilization of strategy and tactics in game playing. Prerequisites: Knowledge of rules and scoring, average ability in fundamental strokes. 1 unit, Aut, Win, Spr (A. Gould, S. Johnson, Schavone, Horpel)

34. **Wrestling: Beginning**—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)

103. **Weight Training: Advanced**—Designed around Olympic style lifting (cleans, jerks, matches, high pulls) and power lifts. Prerequisites: Intermediate/advanced weight training or equivalent and consent of instructor. 1 unit, Win (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. **Advanced Horsemanship: Riding**—Has 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 (Diaz, Schaaf)

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 (Staff)

131. **Fencing: Advanced**—Emphasis on the techniques of attack and defense. Introduction to combat tactics. Fee. Prerequisite: Intermediate fencing or equivalent. 1 unit, Aut, Win, Spr (Hurst)

131A. **Fencing: Sabre and Epee**—Concentration on moves of each of the weapons for offense and defense. Fee. Prerequisite: 31 or equivalent. 1 unit, Spr (Hurst)

131W. **Fencing Officiating.** 1 unit, Aut, Win, Spr (Hurst) by arrangement

132. **Tennis: Advanced**—Review of fundamental strokes. Drills to emphasize footwork, service and return, approach shot and volley, lob, and overhead. Strategy for competition in singles and doubles. Prerequisite: Well above average stroking and game playing ability. 1 unit, Aut, Win, Spr (Brennan, A. Gould, Horpel, Schavone)

132A. **Tennis: Tournament**—Advanced drills and practice sessions for tournament-experienced players of near varsity level ability. 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

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.

116V. Gymnastics: Varsity (men’s and women’s teams).

1-2 units, Aut, Win, Spr (Hamada) MTWThF 2:30-5:30 S 10-12 (men)
1 unit, Aut, Win, Spr (Sardina) MTWThF 2-6 (women)

117V. Track and Field: Varsity (men’s and women’s teams).

1-2 units, Aut, Win, Spr (B. Johnson, Staff) MTWThF 2:30 MTWThF 3:30 Spr (Johnson, Staff) MTWThF 2

118V. Cross Country: Varsity (men’s and women’s teams).

1-2 units, Aut (B. Johnson, Staff) MTWThF 3:30

123V. Golf: Varsity (men’s and women’s teams).

1 unit, Aut, Win, Spr (Schaaf, Baldwin) MTWThF by arrangement

131V. Fencing: Varsity—Men’s foil, epee, and saber teams and women’s foil team.

1-2 units, Aut, Win (Hurst, Posthumus) MTWThF 3:30-5:30 and T 7-9 p.m.
Spr MW 3:30-5:30 (Hurst, Posthumus) and T 7:30-10 p.m.

133V. Tennis: Varsity (men’s and women’s teams).

1-2 units, Aut, Win, Spr (Gould, Brennan) MTWThF 2-5:15 (men) MTWThF 2:30-5 (women)

134V. Wrestling: Varsity.

1-2 units, Aut, Win (Horpel) MTWThF 3:15-5:30 Spr MTWThF 4-5:30

135V. Baseball: Varsity.

1-2 units, Aut, Win, Spr (Marquess, Stotz) MTWThF 1:30-4

136V. Basketball: Varsity.

1-2 units, Aut, Win (Montgomery, Staff) men’s team MTWThF 3:30-6 (VanDerveer, Staff) women’s team Aut, Win, MTWThF 12:45-3:30 Spr, MTWThF 12:45-3:30

137J. Field Hockey: Junior Varsity (women’s team).

1-2 units, Aut (S. Johnson) MWTh 2-3:15 Win T 3:30-5:30, Th 7:30-8:45 p.m.
Spr, MWTh 3-5:30

137V. Field Hockey: Varsity (women’s team).

1-2 units, Aut (S. Johnson) MTWThF 3-5:30 Win T 3:30-5:30 Th 7:30-8:45 p.m.
Spr MWTh 3-5:30

138V. Football: Varsity.

1-2 units, Aut (Elway, Staff) MTWThF 2:30 and Spr, TWTh 2:30-5, S 9-12

140J. Soccer: Junior Varsity (men’s team).

1 unit, 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, MTWThF 3:15-5:30 Win, MWF 3:30-5:30 Spr, MTWThF 3:30-5:30

141V. Volleyball: Varsity (men’s and women’s teams).

1 unit (Sturm) men’s team Aut, Win, Spr, MTWThF 6-8:30
1 unit (Shaw) women’s team Aut, Win, Spr, MTWThF 6-8:30
149V. Swimming: Varsity (men's and women's teams).
   1 unit, Aut, Win, Spr (Kenney, Haines)
   MTWThF 6-8, 3-5, and S 8-10
150V. Diving: Varsity (men's and women's teams).
   1 unit, Aut, Win, Spr (Schavone)
   by arrangement
151V. Water Polo: Varsity.
   1 unit, Aut (Dettamanti) MTWThF 2:30-5
   Win, TF 3-5, Spr MTWThF 2:30-5
152V. Sailing: Varsity (men's and women's teams).
   1 unit, Aut, Win, Spr (Middleton)
   TWThF 2:30-6
156V. Crew: Varsity (men's and women's teams).
   1 unit (Dreyfuss) men's team
   Aut, MTWThF 3:30-5:30
   Win, MTWThF 3:30-5:30, S 7-9
   Spr, MTWThF 5:30-7
   1 unit (Davies) women's team
   Aut, MTWThF 3:20-5:55 (women)
   Win, MTWThF 3:20-5:55, S 7-9:30
   Spr, MTWThF 6-8

CLUB SPORTS AND MARTIAL ARTS

All classes listed below are subject to the 12-unit limitation policy.
The Stanford Club Program is a student initiated, organized, and conducted sports and martial arts 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 Program Director, Shirley Schoof.

6C. Self Defense.
   1 unit, Aut, Win, Spr, Sum MW 6:30-8 p.m.
7C. Aikido.
   1 unit, Aut, Win, Spr, Sum
   MF or TTh 11:30-12:30
8C. Shotokan Karate.
   1 unit, Aut, Win, Spr TTh 7-9 p.m.
   and by arrangement
   1 unit, Aut, Win, Spr TTh 6-7:30 p.m.
   and by arrangement
10C. Kenpo Karate.
   1 unit, Aut, Win, Spr, Sum MW 7-8:30 p.m.
   and by arrangement
13C. Tae Kwon Do.
   1 unit, Aut, Win, Spr (evenings)
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

Chairman: Philip C. Hanawalt
Associate Chairman: Allan M. Campbell (Autumn); Robert D. Simoni (Winter, Spring, Summer)


Associate Professors: William F. Gilly, Corey S. Goodman (Autumn), Patricia P. Jones, Sharon R. Long, Richard Scheller, Stuart H. Thompson, Peter Vitousek, Virginia Wal bot
Assistant Professors: Mark W. Denny, Ron R. Kopito, Robert Sapolsky. By Courtesy: Christopher Field, Arthur Grossman
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 biology 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. A booklet entitled “The Bachelor of Science Handbook,” which delineates policies and requirements, is available at the Student Services Office. Academic advising is provided by members of the faculty on such matters as choice of courses and career plans. The Biology Bridge, 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 at the Student Services Office (Herrin R-211).

Each declared major in biology is expected to select a regular advisor at an early date. The resultant continuity of academic advice is likely to be particularly advantageous to students who anticipate applying to medical school or graduate school, enrolling in the honors or terminal program, taking courses at Hopkins Marine Station, or attending one of the overseas campuses.

COURSE REQUIREMENTS

Candidates for the degree of Bachelor of Science must complete:

1. Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>Biology 31</td>
<td>3</td>
</tr>
<tr>
<td>Biology 32</td>
<td>3</td>
</tr>
<tr>
<td>Biology 33</td>
<td>3</td>
</tr>
<tr>
<td>Biology 44X (may be replaced by 3 units of 175H)</td>
<td>3</td>
</tr>
</tbody>
</table>

Total: 15

2. Elective Courses

Electives: 9

Total Core and Electives: 24

3. Cognate Courses

Required courses in cognate fields include:

a) Introductory, organic, and physical chemistry with laboratory: Chemistry 31, 33, 35, 36, 130 or 132, 135
b) General Physics: Physics 21, 22, 23, 24, or 53, 55

Total: 15

Total: 54
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 and from a 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 10 units from a single faculty member or in a single in-depth course, such as 155H, 175H, or 199, may be applied toward the total number (39) 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 2-3 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 yearlong 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 (175H) Quarter, 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 10 biology elective units and may also substitute for 44Y. Careful schedule planning will guarantee free quarters during junior and senior years for those courses.

**TYPICAL SCHEDULE FOR A FOUR-YEAR MINIMUM PROGRAM**

**FIRST YEAR**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Otr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31, 33, 35, 36</td>
<td>A 4 W 4</td>
</tr>
<tr>
<td>Math 19, 20, 21, Calculus and Analytic Geometry</td>
<td>3 3</td>
</tr>
<tr>
<td>Writing &amp; Distribution Requirements or Electives</td>
<td>B 8</td>
</tr>
<tr>
<td>Totals</td>
<td>15</td>
</tr>
</tbody>
</table>

**SECOND YEAR**

| Biology 31. Principles of Biology | 5 |
| Biology 32. Principles of Biology | 5 |
| Biology 33. Principles of Biology | 5 |
| Biology 44. Core Experimental Laboratory | 3 |
| Chem. 131, 130 or 132, 135, Organic & Physical Chemistry | 8 |
| Totals | 16 |

**THIRD YEAR**

| Physics 21, 22, 23, 24 Introductory Physics | 4 |
| Distribution Requirements or Electives | 11 |
| Totals | 15 |

**FOURTH YEAR**

| Electives | 15 |
| Totals | 15 |

**TRANSFER STUDENTS**

Due to differences between Stanford undergraduate courses and prerequisites and those of many other institutions, transfer students may face problems not encountered by entering freshmen. They are strongly urged to visit the Student Services Office at Herrin R-211 during Transfer Orientation Week to get credit evaluations and a course program outlined. Course catalogs, syllabi, and/or lecture notes from the former institution are very helpful in the evaluation process. Transfer students are encouraged to find an advisor soon after arrival.

All transfer courses intended to fulfill department requirements must be evaluated on Course Equivalence forms (available in the Student Services Office) which will be kept in the student's file. This is a departmental procedure that is separate from the process of having units taken at other institutions transferred for credit to appear on the Stanford transcript.

**HONORS**

In order to graduate with departmental Honors a student must: (1) complete at least 10 units of an approved 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 biology: 31, 32, 33, 44XY, 110, 110L and (for those students applying to medical schools which explicitly require a course in embryology or developmental biology) 107 or 108, and such additions or substitutes as may be recommended by Stanford's Premedical Advising Office (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, at least 24 units 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 funds.
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 in 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.

Courses Required of all Ph.D. Candidates —
Each student must take at least three 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 eight units, usually during the first two years in residence. At least four of the required eight 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**

11. **Biology for Humanists**—Intended for majors in the humanities and social sciences. Topics include 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

31, 32, 33. **Principles of Biology**—A comprehensive study of the principles of modern biological science. These should be taken in sequence, preferably in the sophomore year. Prerequisites: Chemistry 31, 33, 35, Mathematics 19, 20, and 21; or 41 and 42.

The following guidelines are for students who did not complete the Biology 40 series (last offered 1985-86):

- If 40 not taken, complete Bio. 33. If 41 not taken, complete Bio. 31. If 42 not taken, complete Bio. 31 (Bio. 108 is also a suggested elective to obtain background in developmental biology). If 43 not taken, complete Bio. 32.
- If any two of 41, 42, or 43 not taken, Bio. 31 and 32 must be completed. If 40 only was taken Bio. 31, 32, and 33 must be completed. In the latter instance the 5 units of Bio. 40 may be counted toward the 18 units of biology electives.

31. **Molecular and Cellular Biology**—Core lecture dealing with the biochemical and structural basis of cell function, emphasizing macromolecules (including proteins, lipids, carbohydrates and nucleic acids) and how their structure relates to function and to higher order assembly. Topics: enzyme structure, activity and kinetics, metabolism, hormone control, organelles and cellular compartmentation, cell motility, and the molecular basis of heredity including nucleic acid and chromosome structure and function, mutagenesis and repair of DNA, and regulation of gene expression. Prerequisites: See above.

5 units, Aut (Long, Kopito, Baker, Schimke) MTWThF 10 plus optional discussion sections

32. **Developmental and Organismal Biology**—Core lecture covering development, physiology, and organismal biology. Topics: basic concepts in determination, differentiation, and morphogenesis; the principles underlying the exchanges of mass and energy between organisms and their environments, and organ and organ system specialization which utilize these principles in adapting organisms to different environments. A major theme is the mechanisms by which the functions of each system are controlled and regulated. Prerequisites: See above.

5 units, Win (Sapolsky, Scheller, Jones, Epell) MTWThF 10 plus optional discussion sections

33. **Evolutionary Biology and Ecology**—Core lecture covering biological diversity, evolution, and ecology. Topics: the control and transmission of variation; evolutionary genetics; physiological, population, community, and ecosystem ecology; and evolution over long time scales. Prerequisites: See above.

5 units, Spr (Vitousek, Walbot, Watt) MTWThF 10 plus optional discussion sections

44. **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. 3 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. 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 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. A nominal field-trip fee is charged. Enrollment limited to 40.

4 units, Win (Baxter, Denny, Epel, Gilly, Mazia, Roughgarden, Thompson, and visiting lecturers) TTh alternate years, not given 1988-89

50B. Lectures only.
3 units, Win (Baxter, Denny, Epel, Gilly, Mazia, Roughgarden, Thompson, and visiting lecturers) TTh alternate years, not given 1988-89

ADVANCED UNDERGRADUATE

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, given 1988-89

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 both the oscillator and its blue light photoreceptor. Learning how organisms track time. Prerequisites: Biology or Human Biology core.
3 units, Spr (Woodward) TTh 11 alternate years, given 1988-89

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. Biophysics 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, Win (Green) MWF 2:15

108. Organismal Development—The processes responsible for development of multicellular organisms. Morphogenesis, cytodifferentiation, growth control, and regulatory phenomena. Prerequisite: Biology or Human Biology core.
3 units, Spr (Porzig, Wessells) MWF 9

110. Vertebrate Biology—Structure, function, behavior, and evolution of vertebrates. Prerequisite: Biology or Human Biology core.
4 units, Aut (Wessells) TTh 9-11

110L. Vertebrate Biology Laboratory — Dissection of selected vertebrates. Pass/No Credit only. Prerequisite: Same as for 110.
3 units, Aut (Porzig, Wessells) T or W or Th 1:15-5:05

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. Prerequisite: 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

120. General Botany—The diversity of plant groups plus an introduction to the structure, development, physiology, and ecology of higher plants. Prerequisite: 33 or 40, or equivalent.

5 units, Aut (Fultz, Holm, Mooney, Ray, J. Thomas) MWF 11; lab T 2:15-5:05

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

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.

4 units, Spr (Mooney) TTh 11

128. Systematics and Ecology of Vascular Plants—Lectures, laboratory, field studies. Prerequisite: Consent 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 T 2:15-5:05

131. Mosses and Ferns—Structure, development, evolutionary relationships of mosses and ferns. Lectures, laboratories, field trips. Prerequisite: 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, given 1988-89

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, Spr (Holm) TTh 1:15-2:05 lab TTh 2:15-5:05, alternate years, not given 1988-89

133. Plants and Civilization—The economic uses of plants and plant substances. Food, fiber, medicinal, and structural uses from a biological and ecological point of view. Lectures and demonstrations. Prerequisite: Biology or Human Biology core, or consent of instructor.

4 units, Win (Holm, J. Thomas) MWF 11 demonstrations W 2:15-4:05, Th 10-12, or 2:15-4:05

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: 31 or 41 and/or consent of instructor.

3 units, Spr (Hanawalt) T 4:15-5:30 alternate years, not given 1988-89

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, given 1988-89

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 cell, including the 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 c
trolling 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.

13H1. 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, algaeology or intertidal ecology. Also basic physics and calculus. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Denny) alternate years, not given 1987-88

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 lecture series.

3 units, Win (Hanawalt, Briggs) by arrangement, given 1988-89

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 — Course takes advantage of the rich marine environments at Hopkins Marine Station to 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 course considers the mechanisms by which cells alter their activity in response to extracellular stimuli. Emphasis on cell-cell signalling, 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, given 1988-89

151. Plant-Microbe Interactions — The genetics and biochemistry of important microbial interactions with plants. The basics of plant pathology. Unifying theories, the gene-for-gene hypothesis, and experimental methods being used in molecular studies of pathogenicity and resistance. The Agrobacterium-Rhizobium group of pathogens and symbionts. The use of genetics and molecular techniques to analyze plant-bacterial interactions.

3 units, Win (Long) TTh 11-12:15 alternate years, given 1988-89

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

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, Win (Scheller) MWF 10 plus required discussion section by arrangement, alternate years, not given 1988-89

156. Plant Physiology — Physiological functions of land plants, considered from analytical and quantitative points of view: photosynthetic energy and gas exchange; water and photosynthetic long-distance transport; mineral nutrient uptake and transport; growth at cellular and organismal levels, and its hormonal regulation; responses to light; gravity; temperature, etc.

4 units, Win (Ray, Briggs) lecture MWF 10; discussion TTh 10, alternate years, not given 1988-89

157. Plant Biochemistry — Biochemical basis of plant structure and function: mechanisms of photosynthesis and plant respiration; mineral metabolism, including N₂ 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, given 1988-89

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)

162. Biogeography—Survey of major principles of ecological and historical geography of plants and animals. Prerequisite: 33 or 40.

3 units, Spr (Holm) TTh 11
alternate years, given 1988-89

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, Spr (Sapolsky) MWF plus optional discussion section

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, Win (Fernald) TTh 1:15-2:30
alternate years, not given 1988-89


3 units, Aut (Heller) MWF 11
alternate years, given 1988-89

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 (Regnery) MWF 11

167. Genetics (Prokaryotes)—Continuation of 166 with emphasis on prokaryotes. Basic genetic principles applied to bacteria and viruses. Methods of genetic mapping; correlation of genetic and physical structure; mechanism of recombination. Prerequisite: 166.

3 units, Spr (Campbell) MWF 11

168. Vegetation and Fire—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, Aut (J. Thomas) W 2:15-4:05 plus field trips by arrangement alternate years, not given 1988-89

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 holo...
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) MWF 1:15 alternate years, given 1988-89

180. Conservation Biology—(Same as Human Biology 119.) An introduction to the science of preserving biological diversity and its applications to conservation practice and policy. Covers biological theory relevant to the processes of extinction, small population dynamics, minimum viable population analysis, island biogeography and habitat fragmentation, and preserve design and management. Prerequisites: 33 or 40 or equivalent, and consent of instructor.

3 units, Spr (Wilcox) TTh

182. Empirical Population Genetics—The results of experimental field and human population genetics studies. Relationship to theory introduced.

3 units, Aut (Feldman) TTh 9-10:30 alternate years, not given 1988-89

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 (Arthur, 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, Spr (Watt) MWF 11 lab T 1:15-5:05 alternate years, not given 1988-89

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, Spr (Ehrlich, Holm) M 2:15-4:05 alternate years, given 1988-89

186. Advanced Topics in Geographical Ecology—The biogeography and ecology of specific regions or special habitats, in depth. The subject matter varies each year and the course may be repeated for credit. Prerequisites: 33 or 40 or Human Biology 2A, and consent of instructor.

3 units, Spr (Ehrlich, Holm) M 2:15-4:05 given 1989-90

187. Topics in Epizootiology—Lectures, discussions, and readings on the effects of particular diseases on infra-human animal populations. Prerequisite: 33 or 40, or consent of instructor.

3 units, Spr (Regnery) TTh 10

188. Ecosystems of the Tropics—Diverse tropical ecosystems ranging from lowland rainforest to savanna, from shifting cultivation to high-elevation ecosystems. Emphasis on production, nutrient cycling, and regulation of ecosystem structure and function; the specific content depends in part upon student participation in this seminar.

2-4 units, Win (Vitousek) TTh 2:15-4:05 alternate years, not given 1988-89

189. Biology of Birds—The ways birds interact with their environments and with 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. Two sessions per week: a one-hour lecture and a three-hour lecture/field trip. 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, given 1988-89

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. Prerequisites: 33 or 40, and consent of instructor.

3-5 units, Spr (Ehrlich) T 1:15-3:05 plus lab by arrangement

195. Applied Ecology—Independent studies at the Jasper Ridge Biological Preserve. Directed research on the application of ecological principles to the management of natural systems. Prerequisite: Consent of instructor.

1-3 units, Win, Spr (Ehrlich, Feldman, Holm, Mooney, J. Thomas, Vitousek) by arrangement
196A, 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. Prerequisite: Consent of the Jasper Ridge Program Coordinator. Pass/No credit only.
   2 units, Win, Spr (Holm) Th 1:30-4:30

199H. Special Problems—Research done under supervision of Hopkins Marine Station faculty. See 1990 for more information on research work.

1990. Special Problems—Individual research or directed reading taken by arrangement with biology department instructors. Completion of a minimum 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 on Undergraduate Studies upon written recommendation by the instructor to the Committee on a form provided. An essay based on the research in each course taken for Honors must be presented to and accepted by both the research director and the department. The essay, submitted in duplicate, is deposited in the departmental Library and 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 Biology majors only. By petition only, forms available at Student Services Office, Herrin Hall T-333.

GRADUATE

205. DNA Repair and Mutagenesis—(Same as Therapeutic Radiology 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 1988-89

208. Advanced Topics in Genetics—Deals in depth with topics of current interest. Subject matter varies each year, and the course may be repeated for credit. Prerequisites: 166 or 167 or equivalent, and consent of instructor.
   2 units, Aut (Perkins) by arrangement

211. Advanced Topics in Membrane Biochemistry—Structure, function, and biosynthesis of cellular membranes and organelles. Based on the current literature. Required extensive student participation. Prerequisites: Biochemistry 200-201 or equivalent experience in biochemistry and molecular biology, and consent of instructors.
   4 units (Rothman, Simoni) TTh 10-12 not given 1987-88

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.
   3 units, Spr (Kopito) TTh 11-12:30 plus discussion section to be arranged alternate years, not given 1988-89

213. Viruses—Principles of virus growth, genetics, architecture, and assembly. Relation of temperate viruses and other epidemics 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 include: 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, etc. 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)
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, Holm) 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, Aut (Jones) MWF 10 plus required discussion, section by arrangement

   4 units, Win (Schimke) TTh 4 plus 1 hour by arrangement

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 and Th 1:15-3:05, given 1988-89

252. Gene Action—Lectures and student seminars on various aspects of gene structure and function, and regulation of gene expression in microorganisms. Prerequisites: Biochemistry 201 and consent of instructor.
   3 units, Spr (Yanofsky) TTh 9-10:30 alternate years, not given 1988-89

283. Theoretical Population Genetics—A detailed survey of models in population genetics to include aspects of selection, random drift, gene linkage, migration, and inbreeding. The influence of these on evolution of gene frequencies and chromosome structure is analyzed and some data evaluated. Prerequisite: Consent of instructor.
   3 units, Aut (Feldman) MWF 9-10:30 alternate years, given 1988-89

286. Theoretical Ecology—Lectures on contemporary issues in theoretical population ecology, including the theory of co-evolution, population dynamics in fluctuating environments, niche theory, and the theory of nonlinear oscillations in population models.
   3 units, Win (Roughgarden) TTh 1:15-3:05 alternate years, not given 1988-89

286H. 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. Taught at Hopkins Marine Station. Apply to Hopkins.
   6 units, Sum (Roughgarden) alternate years, given 1988-89

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 Biology 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 (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. Advanced Seminar in Plant Biology—A six-quarter rotating curriculum emphasizing experimental approaches to plant biology. The general series include plant molecular biology; plant pathology; plant structure and biochemistry; response of plants to stress; plant physiology; photobiology; genetics and development.
1-3 units, Aut, Win, Spr (Green, Long, Mooney, Ray, Vitousek, Walbot, Briggs, Bjorkman, Berry, Grossman) T 5

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 electe topics in eukaryote regulatory biology. Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Schimke) T 12

349. Seminar in Population Ecology of Insects—Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Ehrlich, Holm) by arrangement

350. Seminar in Biophysics.
1 unit, Aut, Win, Spr (Staff) by arrangement

354. Seminar in Population Biology—Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Ehrlich, Feldman, Holm, 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 Blinks, Arthur C. Giese, Daniel Mazia, John H. Phillips, Jr., Colin S. Pittendrigh

Acting Director: David Epel
Associate Director: Stuart H. Thompson
Professors: David Epel, Jonathan Roughgarden
Associate Professor: Stuart H. Thompson
Assistant Professors: Mark W. Denny, William F. Gilly
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 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 course 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.


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.  
1-3 units, Aut, Win, Spr (Baxter, Denny, Roughgarden) F 12

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, 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

Alternate years, given 1988-89

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, 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

Alternate years, given 1988-89

142H. Eco-physiology and Cell Biology of Marine Macrophytes—Course takes advantage
of the rich marine environments at Hopkins to introduce 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

199H. Special Problems (See above, Autumn, Winter, and Spring Quarters.)

300H. Research—(See above, Autumn, Winter, and Spring Quarters.)

SECOND TERM

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.

6 units (Staff) 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 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 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

286H. 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 (Roughgarden) by arrangement alternate years, given 1988-89

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 devising 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 United States 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)

29. Theater Performance: Crew—(Enroll in Drama 29A, 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)

71. Jazz Dance I (Enroll in Athletics 81.) Introduction to jazz dance styles. Emphasis on rhythmic variation, coordination, isolation of body parts, and movement combinations.
   1 unit, Aut, Win, Spr (Staff)

72. Jazz Dance II—(Enroll in Athletics 82.) Beginning-intermediate level emphasizing control, rhythmic coordination, and the learning of movement combinations. Prerequisite: 72 or equivalent.
   1 unit, Aut, Win, Spr (Staff)

73. Jazz Dance III—(Enroll in Athletics 83.) Intermediate jazz technique. Prerequisite: Consent of instructor.
   1 unit, Aut, Win, Spr (Osumare)

74. African-Caribbean Roots of American Jazz Dance—(Enroll in Athletics 85.) 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)

75. African-Caribbean Dance Techniques—(Enroll in Athletics 86.) 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)


Credit given for organizational service with written reports describing the progress of the quarter. Maximum of 10 units may be applied towards the AAAS major.

1-3 units, Aut, Win, Spr (Staff)

   4 units, given 1988-89

105. Introduction to African and Afro-American Studies—(Enroll in African and Afro-American Studies 105.) 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 (Wynter, Staff)

113. Western Culture and the Black Diaspora: The Semiotics of Self and Other—(Enroll in African and Afro-American Studies 113.) Seminar uses narrative analysis of selected texts to examine the significations accorded Africa, the "Negro," and the Black Diaspora in the signification system of Western culture. Analyzes the deconstruction of these significations both by some schools of modern Western scholarship and by counter-discourse of emancipatory movements in the Diaspora, itself.
   5 units (Wynter)

114. Africa and the Black Diaspora: An Introduction to its Literature, Thought, and Cultural Worlds—(Enroll in African and Afro-American Studies 114.) Introduction to the parallelisms and differences in the literature, thought, and cultural worlds, both of contemporary Africa and the African-descended communities in the New World, i.e., the USA, Brazil, Spanish-speaking Latin America, and the Caribbean. (DR:5*)
   5 units, Win (Wynter)

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) MWF 10
157N. Contemporary Black Playwrights—
(Enroll in Drama 157N.) The dramaturgy, i.e.,
thematic issues, styles, and aesthetics of con-
temporary 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, Spr (Richards) given 1988-89

161A. The Afro-American Novel—(Enroll in
English 161A.) A range of Afro-American novels
by men and women, in historical context exam-
ines ways in which Afro-American writers have
used and adapted the novel genre to interpret
various aspects of the Afro-American experi-
ence. (DR:2)
3 units, Aut (Drake)

241. Afro-Hispanic Cultural Worlds: An Intro-
duction—(Enroll in African and Afro-American
Studies 241, Spanish 241.) The literature and
thought of Black Latin American writers in the
Spanish-speaking Americas and Brazil. Intro-
duction to the popular syncretic cultures of
these interesting but as yet little known worlds.
Reading in Spanish/Portuguese, and in English
translations.
3-5 units, Spr (Wynter)

248. The Caribbean-Americas: An Introduc-
tion to Their Literature, Thought and Cultural
Worlds—(Enroll in African and Afro-American
Studies 248, 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 (Wynter)

CHEMISTRY*

Emeriti: (Professors) William A. Bonner, Rich-
ard H. Eastman, Eric Hutchinson, William
S. Johnson, J. Murray Luck, Harry S.
Mosher, Linus C. Pauling, Douglas A.
Skoog, Henry Taube, Eugene E. van
Tamelen
Chairman: John Ross
Professors: Hans C. Andersen, Steven G.
Boxer, John I. Brauman, James P. Collman,
Carl Djerassi, Michael D. Fayer, Keith O.
Hodgson, 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

Associate Professors: Wray H. Huestis, Nathan
S. Lewis
Assistant Professors: John W. Frost, Steven M.
George, Lisa A. McElwee-White, Michael
C. Furrung

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 trig-
onometry). Those who do not have entrance
credit or equivalent training in the foregoing
subjects, particularly mathematics, may experi-
ence 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 sec-
ondary school preparation in German is de-
sirable.

Advanced placement in chemistry course,
onsed on the College Board Advanced Place-
ent Examination, is not available.

MINIMUM REQUIREMENTS

University writing and distribution require-
ments: Mathematics 19, 20, 21, 22, 23, 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,
reading knowledge of scientific German i
strongly recommended. Chemistry 133 is offer-
ed 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. Pre-
medical students who declared a major in chem-
istry prior to September 24, 1984, may substi-
tute Physics 21, 22, 23, 24, 25, 26 for Physics
51-58 provided they also complete Biology 40,
41, 42, 43. All students declaring a major in
chemistry after September 24, 1984, must com-
plete Physics 51-58. Students interested in at-
tending 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.

* The curriculum leading to the B.S. degree in
Chemical Engineering is described in the School of
Engineering section in this bulletin.
### TYPICAL SCHEDULE FOR FOUR-YEAR PROGRAM

#### FIRST YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
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<tbody>
<tr>
<td>31</td>
<td>Chemical Principles</td>
<td>A</td>
</tr>
<tr>
<td>33</td>
<td>Structure and Reactivity</td>
<td>W</td>
</tr>
<tr>
<td>35</td>
<td>Monofunctional Compounds</td>
<td>S</td>
</tr>
<tr>
<td>36</td>
<td>Chemical Separations</td>
<td></td>
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<tr>
<td>19, 20, 21</td>
<td>Calculus and Analytic Geometry</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td>Distribution Requirements or Electives</td>
<td>(See Note below)</td>
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**Totals**

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<tr>
<th>Qtr.</th>
<th>Units</th>
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#### SECOND YEAR

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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
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<tbody>
<tr>
<td>131</td>
<td>Polyfunctional Compounds</td>
<td>A</td>
</tr>
<tr>
<td>132</td>
<td>Qualitative Organic Analysis</td>
<td>W</td>
</tr>
<tr>
<td>133</td>
<td>Special Topics in Organic Chemistry</td>
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<tr>
<td>134</td>
<td>Theory and Practice of Quantitative Chemistry</td>
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<tr>
<td>136</td>
<td>Synthesis Laboratory</td>
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<tr>
<td>22, 23</td>
<td>Analytic Geometry and Calculus</td>
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<td>51, 53-54</td>
<td>Mechanics, Sound, Electricity</td>
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<td>Electives</td>
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**Totals**

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#### THIRD YEAR

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<tbody>
<tr>
<td>151, 153</td>
<td>Inorganic Chemistry</td>
<td>A</td>
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<tr>
<td>171, 173, 175</td>
<td>Physical Chemistry</td>
<td>W</td>
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<td>174, 176</td>
<td>Physical Chemistry Laboratory</td>
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<tr>
<td>55-56, 57-58</td>
<td>Light, Heat, Atomic Physics</td>
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<td>Electives</td>
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#### FOURTH YEAR

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<td>Electives (see Note below)</td>
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**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. Har. 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, 152; Mat. Sci. & Engr. 50; Med. Micro. 101; Physics 119, 111, 112; 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 six units from Chemistry 136, 172, and/or 190; and at least three 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.

### HONORS 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 nine units of Chemistry 190 to be taken three units per quarter for three quarters; and nine additional units from Chemistry 221, 223, 225, 227, 251, 253, 255, 271, 273, 275, Biochemistry 200, 201, Mathematics 130, 131, 132, Physics lecture courses numbered 100 and higher, Geology 278, or other advanced courses approved by the student's advisor, and by the supervisor of his or her work Chemistry 190. An overall letter grade indicator of 3.3 in mathematics, physics, and chemistry is required for graduation with honors.

Students who wish to be admitted to the Honors Program should register in the department office at the beginning of their senior year. Those who do not meet all of the above formal requirements may petition the department for admission.

### 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 re-
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 thesis research. All prospective Ph.D. candidates, regardless of the source of their financial support, are required to gain teaching experience as an integral part of their graduate training. This requirement is satisfied by serving for at least two quarters as a Teaching Assistant (half-time). 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 25, 26, 1987 and all must be taken at this time.

MASTER OF SCIENCE

All applicants for the degree of Master of Science in Chemistry are required to complete, in addition to the requirements for the bachelor's degree, a minimum of 39 units of work. Of the 39 units, approximately two-thirds must be in the department and must include at least 12 units of advanced course work in chemistry exclusive of the thesis. Of the 12 units, at least three units must be from Chemistry 221, 223, 225, 251, 253, 255, 271, 273, or 275.

MASTER OF ARTS IN TEACHING

(Chemistry)

In cooperation with the School of Education, the department offers a program leading to 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 "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 six 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 223 in the second and third year (3 units); (4) take Chemistry 227 or an approved substitute; and (5) take two additional courses (at least six 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) six units of advanced lecture courses in physical chemistry, biophysical chemistry, or inorganic chemistry; (3) Chemistry 221, or 223, or 225; and (4) two additional courses (at least six units) of advanced lecture courses outside of the fields of biophysical chemistry, physical chemistry, and inorganic chemistry.

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 297, 298, 291, and 293; and (3) two additional courses (at least six units) of advanced lecture courses in fields appropriate to their research interests to be chosen in consultation with their research supervisors.

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. Mc Bain 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 Gard Scholarship 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 $30 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) 3 units, Spr (Zare) MWF 10

30. Introduction to Chemistry—For students with no high school chemistry preparation. Introduction to chemical principles: moles, valence, stoichiometry, definitions. 3 units, Aut (Hutchinson) MWF 9

31. Chemical Principles—Preparation for chemistry, chemical engineering, medicine, biochemistry, biology, and related fields. Atomic and molecular orbital theory, perio-
308 SCHOOL OF HUMANITIES AND SCIENCES

dicity, bonding properties of matter, stoichiometry. Prerequisite: High school algebra. Recommended: High school chemistry and physics. (DR:7)
4 units, Aut (Boxer, Lewis) lec (1) MWF 9; lec (2) MWF 11, one recitation by arrangement
Win (Solomon) MWF 1:15

33. Structure and Reactivity—Organic chemistry, functional groups, hydrocarbons, stereochemistry, thermochemistry, kinetics, chemical equilibria. Prerequisite: 31. Pre-register in Chemistry Department. (DR:7)
4 units, Win (Wender) lec (1) MWF 9; lec (2) MWF 11, one recitation by arrangement
Spr (Brauman) MWF 1:15

35. Organic Monofunctional Compounds—Organic chemistry of oxygen, nitrogen aliphatic and aromatic compounds. Prerequisite: 33. Pre-register in Chemistry Department.
4 units, Aut (Huestis) MWF 1:15
Spr (Staff) lec (1) MWF 9; lec (2) TTh 11-12:15
one recitation section by arrangement

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. Pre-register in Chemistry Department.
3 units, Spr (McElwee-White) lec T 1:15; lab T 2:15-6:05, or M,W,Th or F 1:15-5:05

130. Theory and Practice of Identification—Lectures on theory and interpretation of ultra violet, 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 Polymolecular Compounds—Aromatic compounds, polysaccharides, amino acids, proteins, natural products, dyes, purines, pyrimidines, nucleic acids and polymers. Prerequisite: 35.
3 units, Aut (Collman) 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 (Pirrung) lec (1) TTh 8
plus lab MW 1:15-5:05 or TTh 1:15-5:05

3 units, Win (Collman) MW 11

5 units, Win (Staff) 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) TTh 11-12:15
Spr (Boxer) TTh 1:15-2:30

136. Synthesis Laboratory—Advanced synthetic methods in organic and inorganic laboratory chemistry.
3 units, Spr (Frost) 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 involves legal, political, cultural, and economic factors in addition to purely biological ones. A critical evaluation of logistics 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 1987-88

151. Inorganic Chemistry I—Systematic introduction to theories of electronic structure, stereochemistry, and symmetry properties of inorganic and organometallic molecules. Topics include 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 (Lewis) 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 the
171. **Physical Chemistry**—Chemical thermodynamics: fundamental principles, Gibbssian equations, equilibrium conditions, phase rule, systematic deduction of equations, gases, solutions. Prerequisites: 35; Mathematics 19, 20, 21 (or equivalent); and Physics 51, 53, 54 and previous or concurrent registration in Physics 55 (or Physics 21, 23, 29 in the case of pre-medical students majoring in chemistry; see under "Minimum Requirements").

3 units, Spr (Hodgson) MW 1:15-2:30

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 (McConnell) 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 (Payer) 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 emphasized. Prerequisites: 134 and previous or concurrent enrollment in 173. Recommended: Familiarity with linear algebra on at least the level of Mathematics 1135.

3 units, Win (George) lec TTh 10 plus

lab MW 2:35-5:25 or TF 1:15-4:05


3 units, Spr (George) 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 (Staff) lec TTh 9;

lab T 1:15-4:05 or W 1:15-4:05

Chemistry and the Life Sciences in Historical and Philosophical Perspective—(Enroll in Values, Technology, Science, and Society 145.) Traces the development of some selected problems involving interrelations between chemically and biologically based sciences and society.

4 units, Win (Clayton)

**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.

221. **Advanced Organic Chemistry**—Molecular orbital theory and orbital symmetry. Thermochemistry and thermochemical kinetics. Unimolecular reaction rate theory. Methods of determining organic reaction mechanisms from a theoretical and experimental point of view. Prerequisites: 133 and 175.

3 units, Aut (McElwee-White) TTh 9-10:3

223. **Advanced Organic Chemistry**—Continuation of 221 with emphasis on physical methods. Prerequisite: 221 or consent of instructor.

3 units, Win (Trost) MWF 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 (Lewis) 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, Aut (Hodgson, Hedman) Spr (Solomon)


3 units, Spr (Staff) 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 (Fayer) MWF 11

273. Advanced Physical Chemistry—Molecular spectroscopy and molecular structure. The experimental and theoretical basis for various models of molecular structure; review of quantum theory of atomic and molecular structure. Born-Oppenheimer approximation: molecular energy levels; interaction of radiation with matter; microwave, infrared, and ultraviolet spectroscopy of molecules. Also, special topics to be chosen according to the interests of the students and instructor; e.g. scattering of light by fluids, correlation function methods, spectra of molecules in solution, Mossbauer spectroscopy, magnetic resonance, Raman spectroscopy. Prerequisite: 271.

3 units, Win (Zare) MWF 9

275. Advanced Physical Chemistry—Basic principles and methods of statistical mechanics from the ensemble point of view, statistical thermodynamics, heat capacities of solids and polyatomic gases, chemical equilibria, equations of state of fluids, phase transitions. Prerequisite: 271.

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

277. Selected Topics in Physical Chemistry—May be repeated for credit. Possible topics include structure elucidation using diffraction techniques, advanced statistical mechanics, crystal field theory, advanced quantum mechanics, magnetic relaxation, advanced thermodynamics, chemical applications of group theory. Prerequisite: 275 or consent of instructor.

3 units, Spr (Pecora) 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 or 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—Covers 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

289. Biophysical Chemistry—Experimental methods in biophysics. Emphasis on spectroscopic techniques including magnetic resonance and optical methods. Prerequisite: 287.

3 units, Win

291. Biophysical Chemistry—Special topics in biophysical chemistry. Prerequisites: Previous or concurrent registration in 171 and 173, or the equivalent.

3 units, Win (Staff) TTh 10
293. Structural Inorganic Chemistry—Structural biophysical chemistry. X-ray crystallography and related techniques as used in biophysical research. Other topics include electron and optical microscopy and neutron diffraction. Prerequisite: 291 or consent of instructor. 3 units, Spr (Staff) TTh 10

297. Biophysical Chemistry—Physical-inorganic and bioinorganic chemistry for inorganic chemists. Introduction to metallo-enzymes 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 (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 for this course. 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

RESEARCH AND SPECIAL ADVANCED WORK

190. Introduction to Methods of Investigation—For general character and scope, see 200, below. Limited to undergraduate students admitted under the Honors Program or by special arrangement with a member of the teaching staff. Concurrent attendance in 300 required. (Staff) by arrangement

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 mem-

CHICANO FELLOWS PROGRAM

(UNDERGRADUATE STUDIES ON MEXICAN SOCIETY AND CULTURE IN THE UNITED STATES)

Visiting Associate Professor: Richard R. Valencia
Teaching Fellows: Sophia Aburto, Ricardo Stanton-Salazar

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 Chicano society and culture 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 Chicano 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 graduate fellows in various disciplines. These offerings are often innovative and experimental; they are usually given as seminars rather than as lecture courses.

In 1987-88, as in the five 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 Chicano society and culture 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 (415) 725-2747.
COURSES
PROGRAM

For the 1987-88 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, History 64.) 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, Aut (Camarillo, Cuellar)

191. Minorities in the Schooling Process—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 academic underachievement." Topics: schooling outcomes, ideology, structural considerations (segregation; curriculum differentiation; testing), psychological and sociocultural considerations, and reform efforts. Lecture/seminar.

4 units, Aut (Valencia) TTh 3:15-4:45

192. Educational Testing and Minority Students—How and why intelligence and achievement testing have impacted on Chicano and Black students, particularly the former. Topics: overview of educational testing, development and evolution of the intelligence testing movement, testing and curriculum differentiation, controversy of test bias, testing and special education issues (underrepresentation of Chicanos in gifted classes), psychological and sociocultural correlates of test performance, contemporary testing issues (high school minimum competency tests). Lecture/seminar.

4 units, Win (Valencia)


4 units, Spr (Valencia)

197. Latino Adolescents, Social Networks, and Academic Mobility—How socio-economic contexts operate to condition the structure and contents of adolescents' networks, and thus their knowledge of, and access to, opportunities and resources for academic mobility and achievement. Emphasis on how Latino youth cope with conditions of social stratification given the resources and social supports provided via their social networks. Also, issues of acculturation and intergenerational differences.

3 units, Spr (Stanton-Salazar)

DEPARTMENTAL

For (DR) information, see the respective departments.

ENGLISH

162. Chicano Literature: Creative Writing for Bilingual Students.
5 units, Aut (Islas)

HISTORY

64. Introduction to Chicano Life and Culture.
5 units, Aut (Camarillo, Cuellar)

5 units, Aut (Camarillo)

LATIN-AMERICAN STUDIES

153. Undergraduate Independent Research.
5 units, Aut (Cuellar)

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, Win (Staff)

12B. Second-Year Spanish for Bilingual Students—Introduction to various Hispanic dialects, with emphasis on Chicano Spanish and bilingualism in speech and literature.
4-5 units, Win (Staff)

4-5 units, Spr (Staff)

130B. Mexican and Chicano Cultural Readings—Includes selected grammatical problems and emphasis on oral expression.
3-5 units, Aut (Staff)

162. Chicano Literature: Creative Writing for Bilingual Students.
5 units, Aut (Islas)
CLASSICS

Emeriti: (Professors) Lionel Pearson, Antony E. Raubitschek
Chairman: Susan M. Treggiari
Professors: 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 Moravesik (Philosophy and, by courtesy, Classics), Susan Treggiari (Classics and, by courtesy, History)
Associate Professors: Wilbur Knorr (History of Science), Sabine G. MacCormack (Classics and History), Susan A. Stephens, Michael Wigodsky, John J. Winkler
Assistant Professors: Jody Maxmin (Art History and Classics), Mark H. Munn, Bruce B. Rosenstock
Professor (Teaching): Edward W. Spofford
Lecturers: Robert Hamerton-Kelly (Classics and Religious Studies), Mary-Lou Munn
Acting Assistant Professor: David A. Cherry
Webster Visiting Professor: Anna Morpugo Davies (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 such other departments 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 depart-

ment 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. In some cases courses in other departments may satisfy one or more of the above groups with permission of the Undergraduate Advisor.

If for sound reasons of time or scheduling a student will not be able to reach the 55 unit requirement, a minor consisting of not less than 12 or more than 15 units in a relevant field outside the department may be counted towards the 55 units. Such a relevant field might include not only other humanities subjects but also anthropology, psychology, sociology, political science, or some combination of approved courses. Any proposed minor must be approved by 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 "Humanities Special Programs."

ROME CLASSICAL CENTER

Classics majors are strongly urged to attend the Intercollegiate Classical Center at Rome. The center is managed by Stanford University for about 50 constituent colleges and universities including Stanford. It is open to Stanford majors in classics, history, and art history (see the center brochure). All courses given in the center receive full credit at Stanford and may be applied to the respective major.

All students interested in this program should consult the chairman of the department.

STANFORD IN GREECE

The Classics Department prepares and assists qualified students to study in Greece in the summer, both at the American School of Classical Studies and in a program operated by Stanford. Students who are not classics majors are eligible, and all students should take preparatory courses in the fields of Greek archaeology, art, history, and language (including modern Greek). Those interested should see the Chairman of the Classics Department early in the academic year.

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). 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.

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 attaining areas, to be defined in consultation with the candidate.

   e) 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 section "Humanities Special Programs" in this bulletin.

COMPARATIVE LITERATURE

The Classics Department cooperates closely with the Graduate Program in Comparative Literature. Interested students should consult the chairman of the department.

COURSES

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, MTWThF 10-12

51. First-Year Greek—Accelerated course.
   6 units, Win (Raubitschek) MTWThF 1:15

52. First-Year Greek—Continuation of 51.
   6 units, Spr (Raubitschek) MTWThF 1:15

INTERMEDIATE

101. Second-Year Greek—Reading of selections from Plato.
   5 units, Aut (Stephens) MWF 10
   with review session by arrangement

102. Second-Year Greek — Euripides, one play.
   5 units, Win (Knorr)

103. Second-Year Greek—Homer, Odyssey.
   5 units, Spr (Staff)

   2-3 units, Win (Hamerton-Kelly)

111. Sophocles—One play.
   4 units, Aut (Staff)

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.

160. Individual Work—For department majors only.
   by arrangement

163. Plato.
   4 units, Spr (McCall)

166. Aristophanes.
   4 units, Win (Munn)

176. Senior Seminar.
   4-5 units, by arrangement

199. Undergraduate Thesis.
   by arrangement

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 (Stephens)
   2 units, Win (Stephens)

201. Introduction to Classical Scholarship.
   1 unit, Aut, Win, Spr (Wigodsky, Staff)

202. Tutorial in Greek Poetry.
   3 units, Aut, Win (Jameson, Dover)

205A,B. Greek Language and Style.
   2 units, Win (Edwards)
   4 units, Spr (Edwards)

The above courses are offered every year. Other courses alternate or vary each year. In 1986-87 there were literary seminars in the following authors or topics: Classical Conventions in European Lyric, Menander, Greek Epigrams. The following courses and seminars will be offered in 1987-88. (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

325. Aeschylus.
   4 units, Aut (McCall)

344. Development of Greek Prose Style.
   4 units, Win (Dover)

352A,B. Homer.
   2 units, Win (Edwards)
   5 units, Spr (Edwards)
**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 (Staff) MTWF 9

2. First-Year Latin—Continuation of 1.

5 units, Win (Staff) MTWF 9

3. First-Year Latin—Continuation of 2.

5 units, Spr (Staff) MTWF 9

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, 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) MWF 11


5 units, Win (Stephens)

103. Second-Year Latin—Selections from Virgil, Aeneid.

5 units, Spr (Staff) with review session by arrangement

111. Horace, Odes.

4 units, given 1988-89

113. Latin Elegy.

4 units, Aut (Staff)

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, Win (Wigodsky)

**ADVANCED**


4 units, Spr (Staff)

144. Lucretius.

4 units, Win (Wigodsky)

160. Individual Work—For department majors only.

by arrangement

176. Senior Seminar.

4-5 units, by arrangement

199. Undergraduate Thesis.

by arrangement

The sequence of authors in undergraduate courses is intended to provide an initial acquaintance with the best of classical literature, and to meet each student’s level of competence in the language. Modifications may be made to suit the needs and interest of each class.
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 (Davis)
2 units, Win (Davis)

GRADUATE

201. Introduction to Classical Scholarship.
1 unit, Aut, Win, Spr (Wigodsky, Staff)

3 units, Aut, Win (Wigodsky, Winkler)

205A,B. Latin Language and Style.
2 units, Win (Wigodsky)
4 units, Spr (Wigodsky)

The above courses are offered every year. Other courses alternate or vary each year. In 1986-87 there were literary seminars in the following authors or topics: Editing of Latin Texts, Tacitus Annals I-VI, Augustine De Civitate Dei, Classical Conventions in European Lyric. The following courses and seminars will be offered in 1987-88. (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 Elegues and Pastoral Poetry.
5 units, Aut (Davis)
2 units, Win (Davis)

1-15 units, any quarter (Staff)
by arrangement

363. Roman Novel
4 units, Spr (Winkler)

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.

LITERATURE

11. Age of Heroes—The heroic epics of Greece (Homer), Mesopotamia (Gilgamesh), England (Beowulf) and France (Roland) and their common features, the oral techniques used in composition, the narrative style, and the ethical values presented. Comparisons with written epics such as Virgil’s Aeneid and later works. (DR:2)
3-4 units, given 1988-89

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, Spr (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, 212.

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, given 1988-89

8. Classical Politics—Lectures on the political philosophy of Plato and Aristotle and on their impact on political theory and practice in antiquity and in modern times. Reading of Plato’s Republic, Aristotle’s Politics, and related texts. (DR:3)
3 units, Aut (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)
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 (Jameson) 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 (Staff)

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 (Staff)

107. Art, Religion, and Society in Late Antiquity (254-717 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, given 1988-89

131. Ancient Travel in Fact and Fiction—(Same as VTSS 139.) Reading a culture through its modes and perceptions of travel. The technologies of transport and communication in the Graeco-Roman world. Motivations for and purposes of travel: distribution of commodities, warfare and colonization, awareness of and interest in foreign cultures, imperialism. The attitudes revealed in the structures of travel and in travel literature. The interrelation of realities and fantasies in regard to travel. The journey as metaphor. Readings from ancient authors in translation and secondary sources.
   4 units, Spr (Comparini)

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, Spr (Treggiari)

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

334. The Roman Family.
   4 units, Aut (Treggiari)

   1-15 units, any quarter (Staff)
   by arrangement

374. Attic Cults.
   5 units, Spr (Jameson)

RELIGION AND MYTHOLOGY

18. Greek Mythology—Cosmology, the Hercules 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, Spr (Jameson)

ART AND ARCHAEOLOGY

See also Art 5, 100 A.B.

14. Classical Athletics—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)
   3 units, given 1988-89

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 (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)

109. The City of Athens—The history and
archaeology of ancient Athens from the Bronze
Age to the Roman period, focusing on the city in
the time of Pericles and Socrates.
3-4 units, given 1988-89

110. The Evolution of Civilization and Land-
scape in the Aegean—The relationship be-
tween cultural history and physical environ-
ment in Greece and the Aegean from prehistory
to present, focusing on the Bronze Age and
Classical period. The influence of land and land-
scape on economic, social, and political orders.
Environmental factors conducive to cultural
change and cultural continuity. Geological and
archaeological evidence in the light of classical
authors and contemporary practices.
3 units, given 1988-89

111. The City of Athens—The history and
archaeology of ancient Athens from the Bronze
Age to the Roman period, focusing on the city in
the time of Pericles and Socrates.
3-4 units, given 1988-89

112. Greek Vase-Painting.—(Same as Art 102.)
A survey of Greek vases and their painters from
the Protogeometric period onwards. Emphasis
to the masters of Athenian black-figure and
red-figure painting, and to the problems in-
volved in distinguishing individual hands.
4 units, Aut (Maxmin)

117. Archaeological Practicum.
2 units, Aut, Win, Spr (M. L. Munn)
F 2:15-4:05

119. 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.)
A three-quarter sequence on the history of the exact
sciences, emphasizing cosmology. Technical
aspect 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, Win (Knorr)
138B. Middle Ages to Newton—(DR:3; also
satisfies Area 6 when taken in sequence with
138A.)
4 units, given 1988-89
138C. Newton to Einstein—(DR:3)
4 units, Spr (Knorr)

140. Topics in the History of Mathematics:
From Antiquity to the 17th Century—(Enroll
in History of Science 140, Math 181, same as
Philosophy 140.)
3 units, Spr (Knorr)

COMMUNICATION

Emeriti: (Professors) Nathan Maccoby, Lyle M.
Nelson, Wilbur Schramm, (Adjunct Professor)
Julian Blaustein, (Lecturer) Jules Dundes
Chairman: Steven H. Chaffee
Director, Institute for Communication Re-
search: Donald F. Roberts
Director, John S. Knight Fellowships for Profes-
sional Journalists: James V. Risser. Managing
Director: Harry N. Press
Director, Mass Media Institute: Jules Dundes
Professors: Elie Abel, Henry S. Breitrose,
Steven H. Chaffee, Byron B. Reeves, Wil-
liam L. Rivers (on leave, Winter, Spring),
Donald F. Roberts (on leave, Autumn). By
Courtesy: Richard A. Brody, Michael L. Ray,
Eugene J. Webb
Assistant Professors: Jeremy Cohen, June
Flora, Clifford Nass
Professors (Teaching): Ronald Alexander,
Marion Lewenstein (on leave Autumn),
James V. Risser
Associate Professor (Teaching): Kristine
Samuelson (on leave, Spring)
Lecturers: Jules Dundes, Jim Mitchell, Harry
Press, Susan Sutton, 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 John J. McCloy Fund, and others.

ADMISSION

All prospective undergraduate students should write the University's Office of Admissions, Stanford University, Stanford, California 94305. All prospective graduate students should 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).

UNDERGRADUATE PROGRAM

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:
   - Communication 1, Mass Communication and Society (core course)
   - and have completed, or be enrolled in:
     - Psychology 60, or Statistics 60, or Statistics 70, or equivalent course
     - 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) Editorial Techniques 100 (prerequisite: 1; Statistics; Computer Science)
   - Mass Communication Theory 108 (prerequisite: 1; Statistics; Computer Science)
   - Research Methods 106 (prerequisite: 1; Statistics; Computer Science)
   - Introduction to Film and Video 114 (prerequisite: 1 and 100, or consent of instructor)
   - History of Journalism 140; or History of Film 141 (prerequisite: 1)
   - Communication Media and the Law 110 (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. The candidate 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. 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 200, 207, 208, 235, 252, 275, and 290. Students with journalism training or media experience should check with their advisors to determine if any of the above departmental courses can be replaced with electives.

DOCTOR OF PHILOSOPHY

The department offers the Doctor of Philosophy in Communication Theory and Research. Since the program's goal is to train communication scientists, the program is quantitative and behavioral in nature. All students are required to complete a core program in communication theory and research, research methodology, and statistics. Subsequent to completion of the core program, students may emphasize such areas as attitude formation and change, communication and children, public opinion and political communication, communication and development, or communication and health. 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. Have at least one year of work experience in the mass media or in another activity relevant to the area of specialization, prior to writing the dissertation.

7. Complete a dissertation satisfactory to an advisory committee of three or more faculty members and to the University Committee on the Graduate Division.

8. 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 course requirements:

1. Communication 311A, Theory of Communication I
2. Communication 311B, Theory of Communication II
3. Communication 313, Computer Analysis of Communication Research Data
4. Communication 317, Doctoral Research Methods I
5. Communication 318, Doctoral Research Methods II
6. Communication 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
   Psychology 151, Statistical Methodology
2. Statistics 160, Introduction to Statistical Methods I
   Statistics 161, Introduction to Statistical Methods II
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 320 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 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 8-weeklong 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.

   *(DR:5)*

   *5 units, Aut (Abel, Flora)

   Sections by arrangement

100. **Editorial Techniques I**—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 (Risser)

   Win, Spr, Sum (Staff)

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)

   3 units, 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: 1; Statistics, Computer Science.

   *4 units, Aut (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, Spr (Reeves)

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 100, or consent of instructor.

   *5 units, Aut, Win (Alexander, Samuelson)

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) not given 1987-88

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, Spr (Alexander)

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.

   *5 units, Spr (Gibbs)
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, Spr (Staff)

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)

131. Media Ethics and Responsibilities — (Graduate students register for 231.) The performance of the various media of mass communication in the light of ethical standards, employing case studies, text, and discussion sessions. Current media problems, the dwindling of the journalistic channels, the changing roles of the media, media accountability, and the relationships between government and the media.

4 units (Rivers) not given 1987-88

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 (Cohen)

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, Win (Lewenstein) not given 1987-88

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, Win (Breitrose) plus evening films


4 units, Win (Breitrose)

150. Magazine Writing—(Graduate students register for 250.) Practice in writing magazine articles, with emphasis on marketing manuscripts. Conferences. Prerequisite: 100.

4 units, Aut (Rivers)

3 units, Sum (Staff)

151. Communication and Development— (Graduate students register for 251.) The causes of underdevelopment, the nature of development planning, and the potential and practice of mass media in Third World countries as a tool of transformation.

3-5 units, Aut (Storey)

157. Public Information Programs— (Graduate students register for 257.) Emphasis on 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, Spr (Flora)

162. Seminar: Media and Politics—The link between mass media and government, and between media and the individual citizen. Via the relevant literature, questions of the role of the organization of the media in the formation of news, biases, and the effects of media on individual "agenda," attitudes and behaviors are explored.

5 units, Spr (Brody) not given 1987-88

169. Communication, Technology, and Society—(Same as 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? What people can do (their technology) is related to psychological, social, economic, cultural, and political systems. Topics: technologies in the U.S. since 1850 emphasizing the post-industrial society and computer technology.

4 units, Spr (Nass)

170. Communication and Children I—(Graduate students register for 270.) A developmental 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 or equivalent. (DR:4)

4 units, Win (Roberts)

171. Communication and Children II—(Graduate students register for 271.) Continuation of 170. Limited enrollment; consent of instructor.

3 units, Spr (Roberts)
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)

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, Spr (Abel)

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: 100, and 101 or 141.

4 units, Spr (Breitrose) not given 1987-88

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

200. Editorial Techniques I—A reporting and writing course emphasizing various forms of journalism: news, interpretation, features. Detailed criticism of writing. For graduate students.

5 units, Aut (Mitchell, Sutton)

205S. Basic Film Production—Introduction to film writing and production techniques, covering the basics of cinematography, sound, and editing.

9 units, Sum (Alexander)

201. Film Aesthetics—(Graduate section. See 101.)


9 units, Sum (Staff)

206. Communication Research Methods—(Graduate A.M. section. See 106.)

207. Editorial Techniques II—Copy editing, headline writing, news display, and picture cropping. Laboratory includes editing copy, Associated Press, news evaluation, and page make-up.

4 units, Aut (Voakes)

208. Mass Communication Theory—(Graduate Section. See 108.)

209S. Broadcasting News Workshop—Production and direction of news and documentary television programs. Prerequisite: Consent of instructor.

9 units, Sum (Staff)

210. Media Law—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 both 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 224B. 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 (Staff)

224A. Film Production I—First of a three quarter sequence leading to professional training in motion picture production. Super 8 exercises and a short 16 mm non-synchronous film with sound track comprising narration, music, and sound effects. Prerequisite: Concurrent registration in 223A.

5 units, Aut (Alexander)

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 (Alexander)

224C. Film Production III—Final quarter of professional training in motion picture production. A five minute, 16 mm film utilizing all skills acquired in 224A and 224B. Prerequisites: Successful completion of 224B and concurrent registration in 223C.

5 units, Spr (Alexander)

231. Media Ethics and Responsibilities — (Graduate section. See 131.)

232. Current Progress in Worldwide Telecommunications—(Same as Engineering 213.) A seminar survey of trends in worldwide standardized services. Integrated Services Digital Networks (ISDN), use of fiber optics for broadband services, broadcasting satellites in competition with video cable. Based on ITU (International Telecommunication 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 directed reading under Engineering-Economic Systems 292.

3 units, Sum (Wallenstein)

235. Inquiry in Journalism—Introduction to theories and methods for research of mass media and related issues. Development of the conceptual and research skills necessary to conduct the master's project and as an overview of the field upon which the student projects are based.

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 (Lewenstein)

251. Communication and Development—(Graduate section. See 151.)

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.)

275. Reporting of Public Affairs—Coverage of traditional news beats, such as police, city hall, education and courts as well as issue-oriented coverage of policy area beats. For graduate students. Prerequisite: 200.

5 units, Win (Abel)

276. International Communication: Structures and Issues — (Graduate section. See 176.)

277. Specialized Workshops — (Graduate sections. See 177.)

277A. Opinion Writing.

278. Media Management—(Graduate section. See 178.)
Film Criticism — (Graduate section. See 180.)

A.M. Project.
4-8 units, any quarter (Staff)
by arrangement

Thesis.
6-10 units (Staff) by arrangement

Individual Work.
1-4 units, any quarter (Staff) by arrangement

PRIMARILY FOR Ph.D. STUDENTS

31A. 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)

31B. Theory of Communication—Continuation of 31A with emphasis on communication theory. Prerequisite: 31A.
4-5 units, Win (Reeves)

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 (Chaffee, Flora)

319. Doctoral Research Methods III—Continuation of 318. Selected multivariate models of importance to communication research, nonexperimental causal inference, other 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 (Nass)

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 (Reeves) by arrangement

372. Advanced Communication Theory and Method Seminar III—May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.
3 units, Spr (Chaffee) by arrangement

375. Communication Theory Review Seminar—Limited to Ph.D. students. Prerequisites: 311A, 311B.
3 units, Spr (Roberts) 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

Committee in Charge: John Bender, David Wellbery (Co-Chairmen), Russell Berman, N. Gregson Davis, Joseph Frank, John Freccero, René Girard, Herbert Lindenerberger, Mary Pratt, William Todd

Professors: John Bender (English and Comparative Literature), N. Gregson Davis (Classics and Comparative Literature), Joseph Frank (Comparative Literature and Slavic), Gerald Gillespie (German Studies and Comparative Literature), David G. Halliburton (English, Comparative Literature, and Modern Thought and Literature), Herbert Lindenerberger (Comparative Literature and English), Charles R. Lyons (Drama and Comparative Literature), Marjorie Perloff (Comparative Literature and English), William M. Todd III (Comparative Literature and Slavic), Makoto Ueda (Japanese and Comparative Literature)

Associate Professors: Sandra E. Drake (English and Comparative Literature), Mary Pratt (Spanish and Portuguese, and Comparative Literature), David Wellbery (German Studies 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 concen-
tation in comparative literature for undergraduates.

UNDERGRADUATE PROGRAM

HONORS PROGRAM

The undergraduate program is designed for students who combine a strong commitment to literary study with the drive and the ability to master foreign languages. Students planning to concentrate in comparative literature must apply for admission to the Humanities Honors Program and for graduation with Honors in Humanities.

Freshmen and sophomores interested in the program must first consult with the Chairman of the Humanities Honors Program. Because of the rigorous language requirements the consultation should take place at the earliest opportunity, preferably during the freshman year. Students who have not started their second foreign language by the sophomore year have little chance of fulfilling the program requirements on schedule. No student may declare a major later than two weeks after the start of the junior year. After admission to the program, the student will be assigned an advisor representing the Committee on Comparative Literature.

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, 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 the 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 the
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 time-table for the completion of requirements allows students to spread their work over five years. Students in the fifth year ordinarily apply for outside fellowships or for part-time teaching positions in the various language and literature departments at Stanford.

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 1988. Completed applications are due January 1, 1988. 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.

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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 language.
3. A sufficient number of courses in the student’s primary field to assure his or her knowledge of the basic works in one national literature from its beginnings until the present day.

Minimum course requirements must be completed before the student is scheduled to take the University oral examination. These requirements are kept to a minimum so that students will have sufficient opportunity to seek out new areas of interest.

Examination—The 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 Literature will take place during the quarter that the student takes the first section of the Ph.D. examination. Ordinarily this will be the beginning of the second year, but students who enter with a year of graduate work elsewhere must take the examination no later than the third quarter of the first year. Any student may elect to take the examination during the third quarter of the first year.

Students are judged qualified to proceed to the Ph.D. on the basis of this section of the Ph.D. examination as well as those other aspects of their work—for example, performance in courses, ability to do original research—their potential to develop 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 Committee on Comparative Literature for entrance to the minor after they have completed
their first quarter of graduate work at Stanford. Requirements are as follows:

1. A knowledge of at least two foreign languages, one of them sufficient for the student to qualify for graduate-level courses in that language, the second sufficient for the student to read a major author in the original.

2. A minimum of six graduate courses, of which three must be in the department of the second literature and three in Comparative Literature, the latter to include a seminar in literary theory or criticism. 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.

11. The Age of Heroes — (Enroll in Classics 11.) The heroic epics of Greece (Homer), Mesopotamia (Gilgamesh), England (Beowulf), and France (Roland) and their common features, the oral techniques used in composition, the narrative style, and the ethical values presented. Comparisons with written epics such as Virgil's Aeneid and later works.

3-4 units, given 1988-89

12. Greek Tragedy: Aeschylus, Sophocles, Euripides — (Enroll in Classics 12.)

3-4 units, Spr (McCall)

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)

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 (Andersson) given 1988-89

61, 62, 63. Western Thought and Literature — An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.


5 units, Aut (McCall, Staff)


5 units, Win (Ryan, Staff)

63. From the Enlightenment to the Present — (Enroll in Humanities 63.) Voltaire, Darwin, Marx, Freud, Dostoevsky, Rousseau, Shelley, Emerson, Goethe, Musil, and selected 19th and 20th century poems.

5 units, Spr (Harvey, Staff)

64. Introduction to Chicano Life and Culture — (Enroll in Anthropology 110, History 64.)

5 units, Aut (Camarillo, Cuellar)

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 disciplines. Prerequisites: Completion of the Western Culture requirement and enrollment in the Humanities Honors Program.

5 units, Aut (Mueller-Vollmer)

104. Language and Literary Theory — (Enroll in English 104, Linguistics 78.)

5 units, Win (Heath)

110. Japanese-Western Literary and Cultural Interaction — (Enroll in Asian Languages 110.) Discussion of cross-literary and cross-cultural topics, such as haiku in English, Marxism in Japanese prose fiction, and Zen in American literature.

3 units (Ueda) given 1988-89


4 units, Spr (Cohn)

136A. European Thought in the 19th Century — (Enroll in History 136A.)

5 units, Win (Robinson)

150. Major Dramatic Tests I: Greek to Renaissance — (Enroll in Drama 150.) 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, Molliere, Eycherley, Congreve, Sheridan, Goldsmith, Goethe, Schiller, Kleist, Buechner.
4 units, Win (Rayner)

152. 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 (Esslin)

157. 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, Spr (Richards) given 1988-89

161. Spanish American Literature I—(Enroll in Spanish 161.) Reading major works of Latin American literature.
3-5 units, Win (Ybarra-Frausto)

161A. The Afro-American Novel—(Enroll in English 161A.)
5 units, Aut (Drake)

164B. Arthurian Literature—(Enroll in English 164B.)
5 units, Win (Wack)

165A. Literature of the Holocaust—(Enroll in English 165A.) How has the literary imagination envisioned the destruction of European Jewry? The Holocaust and American responses, seen through documentation, diaries, fiction, poetry by Applefeld, Borowski, Delbo, Wiesel, Kosinski, Celan, Roth, Malamud, and through visual art. Survivors address the class.
5 units, Spr (Felstiner)

166A. Literature and Politics in South Africa—(Same as German Studies 168A.) The impact of political and social conflict in South Africa on writing and literary life. With reference to the historical context, the changing literary articulations of politics, the status of the political novel and essay, the transformation of the stage and the role of the author in political controversies.
Texts: Biko, Breitenbach, Brink, Brutus, Gordimer, Head, La Guma, Mtwa, Ndebele. All readings in English.
4 units, Win (Berman)

169A. 19th-Century Narrative—(Enroll in English 169A.) 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, Spr (Parker)

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 will prepare performances of a wide variety of lyric texts for class. Readings include poems by Sappho, Tu Fu, Zeami, Keats, Whitman, and Apollinaire. Recommended: A reading knowledge of a foreign language (classical or modern). Upperclass students have priority. Enrollment limited to 15.
3 units (Hare) given 1988-89

181A. The Development of the Heroic Epic in Medieval Narrative: 750-1400—(Enroll in English 181A.)
5 units, Win (Steidle)

189B. The Practice of Criticism—(Enroll in English 189B.)
5 units, Win (Perloff)

194. Literature and the Humanities—(Enroll in Humanities 194.)
5 units, Aut (Robinson) Spr (Brooks)

210. Lyric Poetry in the Renaissance and the Baroque—(Enroll in Spanish 210.) Major Spanish poets of the 16th and 17th centuries with attention to popular tradition and the emergence and development of new poetic genres. The poetry of love, metaphysics and humor: Garcielaso, Boscan, Cervantes, Fray Luis de Leon, Lope de Vega, Gongora, Quevedo, and Sor Juana.
3-5 units, Spr (Martin)

212A. Medieval to Renaissance: The Development of Literary Forms—(Enroll in English 212A.) Shows the adaptation of established emerging literary genres and conventions to changing moral and intellectual attitudes toward the arts during late antiquity, the Middle Ages and the Renaissance by means of a central distinction and its corollaries. Elucidates certain literary works by accounting, in the light of these distinctions, for their choice of genre, their procedure of organization, and their style.
5 units, Aut (Trimpi)

212B. Medieval to Renaissance: The Development of Literary Forms—(Enroll in English 212B.) See 212A.
5 units, Win (Trimpi)
The Sonnet in Hispanic Literature—(Enroll in Spanish 216.) The structure of the sonnet and its history since Santillana in the 15th century. The Golden Age in Spain and Spanish America and the innovations of the Modernista period, and of the 20th century.

3-5 units, Aut (Gicovate)

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.

4 units (Brown) not given 1987-88


3-5 units, Spr (Wynter)

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 (Wilke)

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 (Wilke)

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 (Mueller-Vollmer)


3-5 units, Aut (Wynter)

Comparative Grammar of Greek and Latin—(Enroll in Classics 253.)

5 units, Win (Devine)

The Nature of Literature: Japanese and Western Views—(Enroll in Asian Languages 255A.) Attitudes toward literature in Japan and in the West. Books discussed include Soseki’s The Three-Cornered World, Kawabata’s Beauty and Sadness, Tanizaki’s Some Prefer Nettles, and Mishima’s The Temple of the Golden Pavilion.

5 units (Ueda) given 1989-90

Theater of the Absurd—(Enroll in Drama 258.)

4 units, Win (Esslin)

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)

Writings of Thomas Mann—(Enroll in German Studies 265.) Readings in translation from selected stories, essays, and novels (Buddenbrooks, Dr. Faustus, Felix Krull); Mann’s major themes and artistic legacy; his participation in the political and intellectual life of the first half of the 20th century. Open to non-majors.

3-5 units, Win (Gillespie)

Mimesis in Literature—(Enroll in French 281.) The history of mimesis and its literary uses. Mimesis and imitation in aesthetics and human relationships. Readings from Plato, Aristotle, Shakespeare (A Midsummer Night’s Dream, Troilus, and Cressida), Thomas Mann (Mario and the Magician), Freud (Beyond the Pleasure Principle).

4 units, Win (Girard)
283A. Literature and Science—(Enroll in French 283A.) Qu’est-ce qu’un algorithme? La fable et la pensée algorithmique. La tradition grecque et l’origine des mathématiques. La tradition classique: Pascal, Leibniz, La Fontaine.

2 units, Spr (Serres)

254. Joyce, Proust, Mann I—(Enroll in German Studies 284A.) 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, etc.), forms of consciousness (Bergson, Nietzsche, Freud, Jung) and artistic expressions (opera, painting, etc.) of their age.

3-5 units (Gillespie) given 1988-89


4 units, Aut (Girard)

284B. Literature and Philosophy: The Logic of Specularity in the Humanities—(Enroll in French 284B.) Undecidability, infinite deferment, structural incompleteness, bifurcation and structural stability, the text as a machine. Interdisciplinary approach is of interest to students in the humanities and sciences exploring the conceptual foundations of modern critical theory. Topics include: deconstruction of structuralism, the logic of mimetic desire. Readings from Lacan, Derrida, Levi-Strauss, Girard.

4 units, Win (Dupuy)


2 units, Aut (Serres)

294A. Feminism in France: Contemporary French Women Poets—(Enroll in French 294A.) Readings of Andree Chedid, Annie Salager, Yvonne Caroutech, etc. in the light of contemporary feminist theory.

4 units, Spr (Newman-Gordon)

300. Graduate Seminar: Theory of Narrative—(Enroll in Slavic Languages and Literature 300.)

4-5 units, Spr (Todd)

301. Colloquium: Medieval Romance—Backgrounds and Influence—(Same as French 319A.) A comparative study of medieval romance in relation to Greek and Latin antecedents and its later legacy. Texts selections from Chretien de Troyes and the Roman de la rose as well as major English romances up to Malory.

5 units, Spr (Parker)

304A. Colloquium: Theories of Romanticism—(Enroll in English 304A.) Major statements on Romanticism from Arnold to the present and readings of major Romantic texts. Changing attitudes to the period are treated as representative of the development of modern criticism as a whole.

5 units, Spr (Lindenberger)

306. Afro-American Women Novelists—(Enroll in English 306.) The emergence and development of Afro-American women’s fiction emphasizing the modern period in historical context. Issues include how the position in U.S. society of the Afro-American women has affected thematic and stylistic characteristics of Afro-American women’s fiction; how the Afro-American tradition of literary criticism, and that of the dominant society, functioned to validate and invalidate literature by Afro-American women; and how the Civil Rights and Feminist movements of the last 25 years affected Afro-American women’s fiction. Novelists include Zora Neale Hurston, Toni Morrison, Alice Walker, and Gloria Brewster.

5 units, Win (Drake)

307A. Colloquium: Subjectivity and Value—(Enroll in English 307A.) Graduate seminar on cross-class and gendered subjectivity, and literary value. Primary texts are 19th- and early 20th-century British, primarily autobiography, as contemporary critical theory.

5 units, Win (Gagnier)


5 units, Win (B. Gelpi)

313. Research Seminar: Methods and Materials for the Study of Modern Literature—(Enroll in English 313.)

5 units, Spr (McPheron)

and cultural forces of the European Renaissance.
3-5 units, Win (Zahareas)

4 units, Aut (Freccero)

338. Dante's Minor Works—(Enroll in Italian 338.)
4 units, Win (Harrison)

340. Boccaccio's Decameron—(Enroll in Italian 340.)
4 units, Aut (Harrison)

345. Petrarch and Petrarchism—(Enroll in Italian 345.) Readings from the Canzoniere, Epistole, De Vita Solitaria and Secretum, in relation to later developments in Petrarchan poetry 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, Spr (Freccero)

347. Poetics II: Theory and Analysis of the Lyric—(Enroll in German Studies 347.) Major questions in the theory and analysis of lyric poetry in terms of works from several periods in German literary history. Issues: problems in the definition of the lyric; lyrical forms; the levels of the poetic text (sound patterns, rhythm, meter, syntax, strophic forms); trope, figure, symbol; types of affectivity; reader response. Major poems from the German tradition and a wide spectrum of theoretical positions (from Jakobson to Adorno.)
3-5 units, Spr (Wellbery)

349. Literatura latinoamericana del exilio—(Enroll in Spanish 349.) A critical study of testimonial literature (Garcia-Marquez, Galeano, Angueta).
3-5 units, Win (Alegria)

349R. Seminar: Romantic Archetypes—(Enroll in German Studies 349R.) Formation of Romantic concepts of "archetype"; their importance for modern literature and thought; the rise of a "neomythological" approach in art, psychology, and the philosophy of history. Topics in literary reinterpretations of ancient myths (Prometheus, Oedipus, Dionysus, Venus). Synchronizing of the Biblical and Christian past and the Renaissance (Cain, Satan, Mary, Christ; Faust, Hamlet, Don Juan). Dominant archetypes in contemporaneous Romantic fictions.
3-5 units, Aut (Gillespie)

350. The Italian Renaissance—(Enroll in Italian 350.)
4 units, Win (Freccero)

3-5 units, Spr (Ybarra-Fruasto)

352. Seminar: Epic and Romance Transformations—(Enroll in Italian 352.) Ariosto's Orlando Furioso and Tasso's Gerusalemme liberata as transformations of ancient epic and romance models, and as influences on Renaissance epic-romance. Topics: epic and romance structures, poetic influence, poetry and politics. Also selections from Homer's Odyssey, Virgil's Aeneid, Ovid's Metamorphoses and Spencer's Faerie Queene.
4 units, Aut (Parker) T 3:15-6:05

360. 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, Spr (Harrison) alternate years, not given 1988-89

360C. Neoclassicism, Aestheticism, and Modern Criticism—(Enroll in English 360C.) Emphasizes the degree the Neoplatonic reconstruction of classical literary and aesthetic theory has provided the intellectual foundations for the development of criticism since the Renaissance.
5 units, Spr (Trimpi)

5 units, Aut (Berman)

362. Seminar: Avant-Garde Poetics—The Intersection of Poetry and Theory—(Enroll in English 362.) For those who have a basic background in later 20th-century poetry and want to explore "poetheory": the interface of poetry and theory in Derrida's La Carte Postale, Barthes' The Empire of Signs and Lover's Discourse, Michel Serres' The Parasite, John Cage's
Silence, M, For the Birds, and Roaratorio, Laurie Anderson's United States; "language poets" Clark Coolidge, Lyn Hejinian, Ron Silliman, and Charles Bernstein "performance" and "visual" poets, Steve McCaffery, Johanna Drucker, and David Antin. The relationship of these writers to "official verse culture." Avant-garde in the late 20th-century, or is the avant-garde always already co-opted by the establishment? Recommended: 307B or equivalent.

5 units, Win (Perloff)

363. Seminar: Ethnic/Feminist Autobiography—(Enroll in English 363.) Baldwin, Rivera, Rich, Hellman, Hong Kingston, Capote, Moraga, Momaday, and others. Does autobiography serve the causes of the disadvantaged and disenfranchised? Does autobiography change when it is written from a non-mainstream perspective? Have women writing about themselves and members of ethnic minorities writing about their experiences from within contributed to understanding North American life and myths?

5 units, Spr (Islas)

364. La Novela del Dictador—(Enroll in Spanish 364.) In the context of contemporary Latin American history, Augusto Roa Bastos, Alejo Carpentier and G. García Márquez focused on the theme of the dictator. Empasizes a close reading and discussion of this theme in Latin American literature in the 20th century.

3-5 units, Win (Ruffinelli)

365. Autobiographia hispanoamericana del siglo XX: Dario, Gonzalez Martinez, Pablo Neruda, and Matilde Neruda—(Enroll in Spanish 365.) Memory as a creative instrument in four autobiographies that describe decisive moments in the literary and social history of Latin America.

3-5 units, Win (Alegria)

366. Nietzsche and Contemporary Theory(Enroll in German 366.)

3-5 units, Aut (Wellbery)

366A. Seminar: The Idea of a Theater in the Renaissance—(Enroll in English 366A, B.) The theater between 1550 and 1670: what ends it served, what function its mimesis was, what social and political reality it had; was it an institution and a concept? Two quarter seminar relates to playhouses, theories of drama, attacks on and defenses of the stage, and the texts of plays. Open-ended, students with other interests are encouraged to pursue them. Discussions are more theoretical and conceptual than historical or critical. 366A: readings, methodology, and questions of evidence. 366B: project initiated by 366A, participants eventuating in the preparation of a scholarly paper of publishable quality. Readings and class work are determined by and based on those papers, providing a forum in progress and a critique of it. With consent of instructor, relevant projects may be admitted to 366B without taking 366A.

366A. 5 units, Win (Orgel)

366B. 5 units, Spr (Orgel)

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 (Bender, Wellbery)

TTh 1:15-3:05

371. Pier Paolo Pasolini: The Poetics of Heresy—(Enroll in Italian 371.)

4 units, Win (Allen)

375. European Novel in the 19th Century French and Others—(Same as French 359A, The main types of European fiction beginning with the Gothic and historical novel. The rise of Realism and Naturalism in the works of Stendhal, Balzac, Flaubert, Dickens, Dostoevsky, Zola.

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

380. Theory, Feminism, and the Third World—The relationship between feminism and post-structuralism focusing on theoretical texts. The question of Marxism in this field. The transformations demanded by the insertion of this theoretical material into the situation of Third-World feminism, drawing on personal experience in India to sharpen the details of this final move. Enrollment limited to 25. No auditors.

5 units, Spr (Spivak) W 3:15-6:05

381. Novels into Film—(Enroll in Italian 381.) A comparative analysis of five contemporary Italian novels and their film adaptations. Considers broad theoretical interest (narrative structure in fiction and film, point of view, the language of cinema, the limits of cinematic expression) and the social and historical context of these exemplary 20th century narratives. Films are in Italian with English subtitles. Open to all including freshmen.

4 units, Win (Springer)


5 units, Win (Parker, Patricia) W 3:15-6:05
Metodología de la investigación y de la crítica—(Enroll in Spanish 395.) 3-5 units, Aut (Osorio, Ruffinelli)

Vanguardia literaria y cambio social en América Latina—(Enroll in Spanish 398.) The literature of the avant-garde in Latin America and its implications with the economical, political, and social changes in the decade of the 20's. 3-5 units, Aut (Osorio)

DRAMA

Emeriti: (Professor) Wendell Cole, Eleanor Prosser, (Associate Professors) Elisabeth Buckingham, Helen W. Schrader, H. Donald Winbigler, (Adjunct Professor) Evelyn M. Draper, (Assistant Professor) Naomi Wrage

Chairman: Charles R. Lyons

Professors: Martin Esslin, 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 Ramsey

Senior Lecturers: Patricia Ryan, Sheila Weber

Lecturer: Alexander Stewart

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:

1. Acting—Drama 120A, Fundamentals of Acting

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 major advisor.

Two years of a foreign language at college level are strongly recommended.

HONORS PROGRAMS

DRAMA

For a limited number of students, the department offers a special program leading to Honors in Drama. Students accepted for this program, in addition to fulfilling the requirements for the major, will complete a special 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 a letter grade indicator 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.

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 a letter grade indicator (LCI) 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 four units of Drama 29 or 39 thereby participating in some aspect of at least two departmental productions.
   c) The student must have 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
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 a production 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—One 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 honor 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 11, 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 section "Humanities Special Programs" 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 (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. Four seminars, 20th Century Visual Aesthetics (354A); two seminars in dramatic literature, one to be taken outside the department (e.g., a seminar in Art or German Studies). Graduate Design Workshop sequence: Design Tutorials (330); 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, 1870-1918
- Contemporary, 1918 to the present

Students in the criticism/directing program will be required to take the examinations in Classical, Medieval and Renaissance, and Modern drama. The fourth examination will be 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 1870-1918
- Contemporary, 1918 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, the departmental oral examination should be completed by the end of the second year, before Application for Candidacy (see below).

A University oral examination is to be taken during Autumn Quarter of the fourth year. This examination will cover (1) the field of concentration, as defined by the candidate and his or her advisor, and (2) a dissertation prospectus. Both the field of concentration and a rough draft of the prospectus must be approved by the candidate's advisor and by the departmental Graduate Study Committee by the end of Spring Quarter of the third year.

APPLICATION FOR CANDIDACY

By the end of the second year of residence, the following requirements must be completed:

1. The course sequence in research and criticism, 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 graduate students in the Ph.D. program. Procedures for applying for financial aid are included in the admission packet. The appropriate financial aid application must be filed by January 15.

COURSES

SUMMER SESSION

A special brochure is available, with full details of courses given in the summer by the Department of Drama.
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 11:15

4. *Introduction to Black American Drama*—The development of Black drama in the United States from 1858 to the present.  
4 units, Spr (Richards) MWF 11:15

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

26. *Musical Theater Workshop*—(Same as Athletics 263.) Dance performance skills and choreography appropriate for musical theater productions. Extensive dance background not required. (PE:X)  
2 units, Win (Cashion)

27A,B,C. *Movement for Actors*—Basic movement knowledge and skills for the actor. Improvisation stressed.  
3 units, all quarters, MW 4:15-6:05

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 who participate in departmental productions may receive credit for their participation as actors; one unit for Graduate Directing Workshop projects and 1-3 units for major production (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 Theatrical Design*—A lecture-laboratory introducing basic skills of visual communication used in producing stage scenery. Covers both 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 both a technical and an aesthetic viewpoint.  
3 units, Spr (Ramsaur) TTh 10-12

32. *Introduction to Costume Design and Construction*—  
3 units, Win (Cleveland, Russell) TTh 10-12

33. *Drafting for the Theater*—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) TTh 9

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, Spr (Stewart) TTh 3:15-5:05

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, Spr (Cleveland) W 2:15-4:05

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 (Cleveland) 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.  
given 1988-89

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, two units for working on the running crew of a show that runs two weeks, and one 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

59. Shakespeare—(DR:2)
5 units, Win (Lyons) 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, Win (Ramsaur) TTh 10-12

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 2:15-4:05
120C. —Prerequisite: 120B or consent of instructor 4 units, Spr (Ryan, Weber) TTh 10-12 or MW 2:15-4:05

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—Designed to explore and develop the creative imagination; games and exercises are taught which foster spontaneity and cooperation.
4 units, Win (Ryan) MW 10-12
121B. Advances Scene Study.
4 units, Spr (Ryan, Weber) MW 2:15-4:05, TTh 1:15-3:05
121C. Acting Shakespeare—A practical study of acting Shakespeare, vocal technique, sound, and delivery.
4 units, Spr (Lyons) TTh 2:15-4:05

123. Audition Techniques—For the advanced actor. Prerequisite: 120A, B, C or the equivalent.
4 units, Aut (Ryan) M 2:15-5:05

124. Identity and Role: A Practicum—(Same as Psychology 170.) After initial conferences, instructions, and introductions, there will be exercises in role-playing with critique and evaluation of their impact. Each student undertakes a personal project on some aspect of behavior modification of goal achievement using role-playing as an aid. Class open to Psychology and Drama majors. Limited enrollment. Prerequisite: Consent of instructors.
4 units, Win (Ryan, Zimbardo) given 1988-89

125. Advanced Voice Workshop—Exercises in vocal characterization, advanced work in breathing, relaxation, and diction.
4 units, Spr (Ryan) MW 10-12

127A, B, C. Advanced Movement.
3 units
127A. 4 units, Aut, TTh 4:15-6:05
127B. Win, TTh 4:15-6:05
127C. Spr, TTh 4:15-6:05

130A, B, C. Scenic Design—A series of hands-on courses concerned with the basic processes in designing scenery.
130A. Scenery for Proscenium Stages—Visual concepts appropriate to a proscenium stage of a musical comedy, a box set, and one other project. Drafting and model-building are 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. Scenery for Alternative Stages—Thrust, arena, and environmental staging techniques in models and freehand sketches supported by drafting. Interaction with graduate directors. Prerequisite: 130A.
4 units, Spr (Wilson) T 1:15-4:05

play lab by arrangement
130C. Advanced Scenic Design—Individually structured projects in flat-surface communication techniques involving mechanical perspective and color rendering. Prerequisites: 130A and 130B.
3-4 units, any quarter (Wilson) by arrangement
31A. Stage Lighting Mechanics—Lecture-lab dealing with all practical aspects of lighting: electricity, light sources, instrumentation, control, drafting, plotting, and the basic design process. Prerequisite: 31.
4 units, Aut (Ramsaur) TTh 10-12
alternate years, given 1988-89

31B. Stage Lighting Aesthetics—Laboratory discussion on the aesthetic principles of lighting design; interpretation, concept, color, angle and placement. Various design styles are introduced: dance, rock and roll, opera, musical comedy, thrust, and arena. Lighting designers for departmental projects are assigned from this class. Prerequisite: 31A.
4 units, Aut (Ramsaur) TTh 10-12

31C. Advanced Stage Lighting Design—Projects in lighting mechanics and lighting design are resolved through experimentation, class discussions, and written report. Design projects include dorm shows and other community productions. Lighting designers for major departmental productions are assigned from this class. Prerequisites: 31A and 31B.
1-4 units, any quarter (Ramsaur) by arrangement

32. Costume Design—Visual analysis of historical styles of costume design interpreted for the modern theater and developed by the student in various presentational media.
4 units, Aut (Russell) T 10-12

33A, B, C. Technical Production—Prerequisites: 31.

33A. Stagecraft—Lecture-lab in basic production practices. The opportunity to learn and practice the theory and use of standard tools and materials used in stage scenery construction.
4 units, Aut (Stewart) MW 10-12

33B. Technical Production.
4 units, Win (Stewart) by arrangement

33C. Advanced Technical Production—Projects in advanced technical production practices, resolved with experimentation, drawings, and written reports. Technical directors for major departmental productions are assigned from this class. Prerequisites: 33A and 33B, or consent of instructor.
1-4 units, any quarter (Staff) by arrangement

34. Stage Management Projects—A project course for students who are stage managing a Drama Department production. Prerequisites: 30, 31, 32, or 34.
1-5 units, any quarter (Stewart)

35. Project in Theatrical Production—Project in stage design, costume design, lighting design, or stage managing. Prerequisite: Consent of instructor.
1-5 units, any quarter (Staff) by arrangement

140. Workshop in Playwriting.
5 units (Lyons) alternate years, not given 1988-89

141. Drama and Gender—(Same as Feminist Studies 141.) Examines "male" and "female" in selected plays by women and men, and explores the possibility that both dramatic structure and content may be shaped differently by the author's gender. Students organize and participate in readings of the plays.
4 units, Win (Mathieson)

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, Kclist, Buechner. (DR:2)
4 units, Win (Ramsaur) 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 (Esslin) MWF 9

153. Greek Tragedy: Aeschylus, Sophocles, Euripides—(Same as Classics 12.) (DR:2)
4-5 units, Spr (McCall)

4 units, Win (McCall) MWF 1:15

155N. American Drama, 1960's 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, Aut (Richards) alternate years, given 1988-89

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 1988-89

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 (Richards) alternate years, given 1988-89

158. Theater of the Absurd.
4 units, Win (Esslin) MWF 11

159A,B,C.. Shakespeare—(Same as English
173A,B,C, see Drama 59.) (DR:2)

159A. 5 units, Aut (Friedlander)
159B. 5 units, Win (Ryan)
159C. 5 units, Spr (Orgel)

160. History of Theater: Classical Greece to the 18th Century—A lecture on 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, Spr (Eddelman) MWF 9

161. History of the Theater: 19th and 20th Centuries—A lecture on 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, Win (Russell) MWF 1:15

170. Introduction to Directing—Prerequisites: 120A,B,C or consent of instructor.

4 units, Win (Weber) MTh 2:15-4:05

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 Committee on Academic Affairs 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) W 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, Win (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. Projects in Design and Technical Production.

1-5 units, any quarter (Staff)

240. Workshop in Playwriting.

5 units (Lyons) alternate years, not given 1988-89

250. Major Dramatic Texts I: Greek to Renaissance—(See Drama 150.)

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 (Esslin) MWF 9

254. American Drama (1920's-1950's)—(See Drama 154.)

4 units, Win (Richards) MWF 1:15

255. American Drama (1960's-Present)—(See Drama 155N.)

4 units, Aut (Richards) alternate years, given 1988-89

256. American Women Playwrights—(See Drama 156.)

4 units (Richards) alternate years, given 1988-89

257. Contemporary Black Playwrights—(See Drama 15N.)

4 units (Richards) alternate years, given 1988-89

258. Theater of the Absurd—(See Drama 151)

4 units, Win (Esslin) MWF 11
260. History of Theater: Classical Greece to the 18th Century—(See Drama 160.)
4 units, Spr (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, Win (Russell) MWF 1:15

270. Independent Project in Directing—Prerequisites: 170 and approval of Department of Drama Curriculum and Academic Policy Committee.
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 (Raynor) MW 2:15-4:05

330. Design Workshop — Advanced course in design for the theater.
5 units, Win (Eddelman, Ramsaur, Russell, Wilson) by arrangement

331A,B,C. Design Project—Design of a full-length production in conjunction with directing project (372).
5 units, Aut, Win, Spr (Eddelman, Ramsaur, Russell, Wilson) by arrangement

332A,B. Design Project.
5 units (Eddelman, Ramsaur, Russell, Wilson)

332A. Setting Design.
332B. Costume or Lighting Design.

350. Seminar in Greek Drama.
5 units (Lyons) alternate years, not given 1988-89

353. Topics in Renaissance Drama.
5 units, Spr (Raynor) MW 10-12

353A. Colloquium: Restoration and 18th Century Drama—(Same as English 303C.)
5 units, Spr (Donohue) MW 3:15-5:05

354A. 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 United States and Asia. A conceptual approach is taken in analyzing contemporary theater.
5 units, Aut (Eddelman) MW 10-12

354B. Representation—Dramatic realism and the problems of Mimesis.
5 units, Aut (Lyons) MW 2:15-4:05

354C. Semiotics of Drama.
5 units, Win (Esslin) MW 2:15-4:05

360. Theater History and Research Methods: Classical Greece to the 18th Century.
5 units, Spr (Eddelman) MWF 9

361. Theater History and Research Methods: 19th to 20th Century.
5 units, Aut (Eddelman) MWF 9

370A,B,P. Directing Workshop I—The director's approach to works in the realistic tradition. Investigation of basic directional 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

371A,B,C,P. Directing Workshop II—Exploration of dramaturgic and directorial methods in working on plays from the classic, Elizabethan, Epic, or Post-Naturalistic theater. Investigation of basic directorial problems in shorter plays or act units working in a variety of styles, using a multiformal theater space. Public performances.
371A. 3 units, Aut (Weber) by arrangement
371B. 3 units, Win (Weber) by arrangement
371C. 3 units, Spr (Weber) by arrangement
371P. Projects.
3 units, any quarter (Weber) by arrangement

6 units, any quarter (Weber) by arrangement

390. Tutorial.
1-4 units, any quarter (Staff) by arrangement

399. Dissertation Research.
any quarter (Staff) by arrangement
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; (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), preferably 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.) 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)
   - History 92A, 92B, 92C (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, preferably 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 coterminal 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 1988-89 is January 1, 1988.

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 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.

**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...
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 (HSR) 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 Family, Community, and Preventive Medicine in Stanford's School of Medicine. The degree may be pursued concurrently with the second and subsequent years of graduate study and is awarded upon completion of 45 units of course work. This course work is to be split approximately equally between research workshops and formal courses relevant to the health sector. Each student's program is planned to meet individual interests in health services in addition to fulfilling HSR core requirements. For more information, address inquiries to the Program Administrator, Division of Health Services Research.

**DOCTORAL PROGRAMS**

Stanford does not offer a Ph.D. in East Asian Studies. However, there are more than a hundred doctoral students in various departments and schools of the University with a specialization on China or Japan. The departments which offer an East Asian concentration are: Anthropology, Art, Asian Languages, Comparative Literature, Economics, History, Linguistics, Philosophy, Political Science, and Religious Studies. It is also possible to specialize in East Asia within some of the doctoral programs of the professional Schools of Business, Education, and Law, and the Food Research Institute. Inquiries about these doctoral programs should be directed to the individual department or school concerned.

**FINANCIAL AID**

Graduate students specializing in East Asia may apply for University Fellowships at the time of their initial applications for admission. Students in A.M. or Ph.D. programs who plan to do work in Chinese or Japanese language, or language-related area courses, may be eligible for Foreign Language and Area Studies (FLAS) Fellowships and are encouraged to apply for these fellowships at the time of their application to Stanford. For further information about FLAS Fellowships, contact Center for Research in International Studies, Room 200, Lou Henry Hoover Building, Stanford University, Stanford, California 94305.

**COURSES**

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**

8. *Introduction to China*. 5 units (Wolf) not given 1987-88
21. *The World Outside the West: Change and Tradition Before the Age of European Imperialism*. 5 units, Win (Rick, Roberts, Van Slyke)
22. *The World Outside the West in the Age of European Imperialism*. 5 units, Spr (Varese, Abernathy, Van Slyke)
118. *Communist Chinese Society*. 5 units, Spr (Skinner) given 1988-89
121. *Japanese Society and Culture*. 5 units, Win (Befu)
123. *Japanese Economic Organization*. 5 units, Spr (Befu)
125. *Japanese Culture through Novels and Films*—(Same as Asian Languages 125.) 5 units (Befu) given 1988-89
126. *Japanese Culture through Novels and Films*—(Same as Asian Languages 125.) 5 units (Befu) given 1988-89
131. *Kinship and Family in a Changing World*. 5 units, Spr (Befu)
149. *Political Anthropology*. 5 units, Spr (Textor)
219. *Comparative Social Organization of China and Japan*. 5 units (Skinner) not given 1987-88
222. *Japanese Political Economy*. 5 units, Win (Okimato, Rohlen)
242. *Comparative Family Systems*. 5 units, Spr (Wolf)
### ART

267. Spatial Systems and Social Process. 5 units, Spr (Hockberg, Skinner)

### ASIAN LANGUAGES

NOT REQUIRING KNOWLEDGE OF AN ASIAN LANGUAGE

46. Introduction to Chinese Philosophy — (Same as Philosophy 46, Religious Studies 55.) Enrollment limited to 80. 4 units, Aut (Ivanhoe) MWF 10

91. Traditional East Asian Civilization: China. 5 units, Aut (Van Zoeren) MTWThF 10

92/192. Traditional East Asian Civilization: Japan. 5 units, Win (Hare) MTWThF 10

110. Japanese-Western Literary and Cultural Interaction. 3 units, Aut (Ueda) given 1988-89

114. Haiku. 3 units, Aut (Ueda) given 1989-90

131. Chinese Poetry in Translation. 4 units, Aut (Van Zoeren) MWF 11

132. Chinese Fiction and Drama in Translation. 4 units, Win (Wang) MWF 11

133. Modern Chinese Literature in Translation. 4 units, Spr (Staff) MWF 1:15

136. Classics of Japanese Literature in Translation I. 4 units, Aut (Staff) MWF 1:15

137. Classics of Japanese Literature in Translation II. 4 units, Win (Matisoff) TTh 12:50-2:05

138. Modern Japanese Literature in Translation. 4 units, Spr (Ueda) MWF 1:15

152. Nomad Empires of Inner Asia—(Same as History 195.) 5 units, Spr (Dien) given 1988-89

153. Science, Technology, and Material Culture in Traditional China. 5 units, Spr (Dien) TTh 2:15-4:05

156. China from Earliest Times to the 9th Century — (Same as History 192A.) 5 units, Aut (Dien, Kahn) MTWThF 11

176. Chinese Myths, Legends, and Folktales. 4 units, Spr (Wang) given 1988-89

178. Performance of Lyric Poetry. 3 units, Spr (Hare) given 1988-89

179. Classical Japanese Drama. 4 units (Matisoff) not given 1987-88

181. Japanese Women Writers. 4 units, Win (Matisoff) given 1988-89

195. Modern Intellectuals in Japanese Literature. 3 units, Win (Ueda) given 1988-89

197. Images of Women in Modern Japanese Literature. 3 units, Win (Ueda) given 1989-90

255A. The Nature of Literature: Japanese and Western Views. 5 units, Win (Ueda) given 1989-90

### CHINESE

1,2,3. First-Year Modern Chinese.

1. 5 units, Aut (Kao, Shou) Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 1:15

2. 5 units, Win (Kao, Shou) Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 1:15

3. 5 units, Spr (Kao, Shou) Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 1:15

5. Intensive First-Year Modern Chinese. 12 units, Sum (Staff) MTWThF 8-12

21,22,23. Second-Year Modern Chinese.

21. 5 units, Aut (Chuang) MTWThF 9

22. 5 units, Win (Chuang) MTWThF 9

23. 5 units, Spr (Chuang) MTWThF 9

25. Intensive Second-Year Modern Chinese. 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

101, 102, 103. Third-Year Chinese (Modern).
   101. 5 units, Aut (Chuang) MTWThF 11
   102. 5 units, Win (Chuang) MTWThF 11
   103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese.
   12 units, Sum (Staff) MTWThF 9-12

   111. 5 units, Aut (Kao) TTh 2:15-4:05
   112. 5 units, Win (Kao) TTh 2:15-4:05
   113. 5 units, Spr (Kao) 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. 2 units, Aut (Staff) by arrangement
   132. 2 units, Win (Staff) by arrangement
   133. 2 units, Spr (Staff) by arrangement

200. Directed Reading in Chinese.
   units to be arranged, Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar.
   201. 5 units, Aut (Dien) W 2:15-4:05
   202. 5 units, Win (Dien) W 2:15-4:05

211, 212, 213. Fourth-Year 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 (Nivison) MWF 1:15
   222. Historical Narration.
      5 units, Win (Dien) MWF 1:15
   223. Literary Essays.
      5 units, Spr (Van Zoeren) MWF 11

   5 units, Win (Icanhoe) TTh 4:15

   241. Short Story.
      5 units, Aut (Lyell) not given 1987-88
      5 units, Win (Chuang) not given 1987-88
      5 units, Aut (Lyell) not given 1987-88

261. Chinese Poetry (II).
      4 units, Win (Van Zoeren) MWF 11

262. Songs and San-ch’ü.
      4 units, Spr (Van Zoeren) MWF 10

      4 units, Aut, Win (Wang) given 1988-89

273. Chinese Drama.
      4 units, Aut (Wang) TTh 11-12:15

291. The Structure of Modern Chinese.
      4 units, Spr (Kao) by arrangement

      4 units, Spr (Kao) given 1988-89

331. Seminar in Confucian Ethics—(Same as Religious Studies 238, Philosophy 331.)
      4 units, Spr (Nivison) TTh 2:15

332. Seminar: The Bamboo Annals.
      5 units, Aut (Nivison) W 4:15-6:05

334. Seminar in Modern Chinese Literature.
      5 units, Win (Lyell) not given 1987-88

361. Seminar in Chinese Literary Criticism.
      5 units, Spr (Van Zoeren) not given 1987-88

      5 units, Spr (Wang) W 2:15-4:05

1, 2, 3. First-Year Modern Japanese.
   1. 5 units, Aut (Sakamoto, Nebrig, Staff); Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 11; Section 5 MTWThF 1:15

2. 5 units, Win (Sakamoto, Nebrig, Staff); Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 11; Section 5 MTWThF 1:15

3. 5 units, Spr (Sakamoto, Nebrig, Staff); Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 11; Section 5 MTWThF 1:15

   12 units, Sum (Staff) MTWThF 8-12

   7/107. 3 units, Aut (Busbin) MWF 10
   8/108. 3 units, Win (Busbin) MWF 10
   9/109. 3 units, Spr (Busbin) MWF 10

   21. 5 units, Aut (Kubota) MTWThF 9 Section 2 (Busbin) MWF 11-12:20
22. 5 units, Win (Kubota) MTWThF 9
   Section 2 (Busbin) MWF 11-12:20
23. 5 units, Spr (Kubota) MTWThF 9
   Section 2 (Busbin) MWF 11-12:20
   12 units, Sum (Staff) MTWThF 8-12
27, 28, 29. Conversation I.
   27. 2 units, Aut (Nebrig) TTh 1:15
   28. 2 units, Win (Nebrig) TTh 1:15
   29. 2 units, Spr (Nebrig) TTh 1:15
ADVANCED
101, 102, 103. Modern Written Japanese.
   101. 5 units, Aut (Kubota) MWF 11-12:15
   102. 5 units, Win (Kubota) MWF 11-12:15
   103. 5 units, Spr (Kubota) MWF 11-12:15
   12 units, Sum (Staff) MTWThF 9-12
   111. 3 units, Aut (Sakamoto) MWF 2:15
   112. 3 units, Win (Sakamoto) MWF 2:15
   113. 3 units, Spr (Sakamoto) MWF 2:15
121, 122, 123. Conversation II.
   121. 2 units, Aut (Kubota) TTh 1:15
   122. 2 units, Win (Kubota) TTh 1:15
   123. 2 units, Spr (Kubota) TTh 1:15
GRADUATE
   units to be arranged, Aut, Win, Spr
   (Staff) by arrangement
201, 202. Proseminar.
   201. 5 units, Win (Matisoff) Th 2:15-4:05
   202. 5 units, Spr (Hare) by arrangement
211, 212, 213. Advanced Modern Japanese.
   211. Essays and Scholarly Articles.
   5 units, Aut (Staff) TTh 2:15-3:30
   212. Newspaper Articles.
   5 units, Win (Ueda) TTh 2:15-3:30
   213. Fiction.
   5 units, Spr (Matisoff) TTh 11-12:15
   246. 5 units, Aut (Hare) by arrangement
   247. 5 units, Win (Hare) by arrangement
   248. 5 units, Spr (Hare) by arrangement
250. Introduction to Kambun.
   4 units, Spr (Ueda) given 1989-90
251. Graduate Seminar: Japanese Historical Texts.
   5 units, Spr (Mass) not given 1987-88
   4 units, Spr (Ueda) given 1989-90
277. Classic Japan — (Same as 177 with additional work requiring knowledge of the language.)
   4 units, Aut (Hare) not given 1987-88
   4 units, Win (Levy) not given 1987-88
   4 units, Win (Levy) not given 1987-88
   4 units, Spr (Matisoff) given 1988-89
286. The Structure of Japanese.
   4 units, Aut (Poser) not given 1987-88
294. Major Haiku Poets.
   4 units, Aut (Ueda) TTh 2:15-3:30
296. Readings in Modern Japanese Literature.
   4 units, Win (Ueda) MW 2:15-3:30
298. Translation Workshop.
   4 units, Spr (Ueda) given 1988-89
   5 units, Spr (Ueda) W 2:15-4:05
KOREAN
1, 2, 3. First-Year Modern Korean.
   5 units, Aut, Win, Spr (Staff) MTWThF 1:15
   5 units, Aut, Win, Spr (Staff) MTWThF 2:15
101, 102, 103. Third-Year Modern Korean.
   3 units, Aut, Win, Spr (Staff) by arrangement
ECONOMICS
121/221. Economic Development in China—
   (Same as Food Research Institute 148.)
   5 units, Aut (Staff)
124. The Contemporary Japanese Economy.
   5 units, Win (Horioke)
   Spr (Miyazaki)
   5 units, Spr (Horioke)
EDUCATION
161. Introduction to Teaching and Learning in Asia.
   3 units, Spr (Herring) by arrangement
217X. Teaching a Global Perspective: Cross-
   Cultural Approaches.
   4 units, Aut (Grossman) MW 3:15-5:05
5 units (Sicular) given 1988-89

3 units, Aut (Reynolds, Yotopoulos)  
T 3:15-5:05

HISTORY
21. The World Outside the West: Change and Tradition Before the Age of European Imperialism.  
5 units, Win (Roberts, Rick, Van Slyke)
22. The World Outside the West in the Age of European Imperialism.  
5 units, Spr (Abernethy, Varese, Van Slyke)
192A. China from Earliest Times to the 8th Century—(Same as Asian Languages 156.)  
5 units, Aut (Dien, Kahn)
192B. China from the 9th to the 19th Century.  
5 units, Win (Kahn)
192C. Modern China: 19th and 20th Century.  
5 units, Spr (Van Slyke)
194. Early and Medieval Japan to 1336.  
5 units, Aut (Mass)
5 units, Win (Duus)
5 units (Dien) given 1988-89
290. Undergraduate Colloquium: Japan and America—Conflict and Cooperation.  
5 units, Aut (Dien)

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)
395B. Graduate Colloquium: Medieval and Early Modern Japan—1600-1800.  
5 units, Aut (Mass)
395C. Graduate Colloquium: Modern Japan.  
5 units, Win (Duus)
493A. Graduate Seminar: Late Traditional China.  
5 units, Win (Kahn)
493B. Graduate Seminar: Late Traditional China.  
5 units, Spr (Kahn)
495. Graduate Seminar: Modern Japan.  
5 units, Spr (Duus)
5 units, Win (Mass)

LAW
316. Law in Radically Different Cultures—(Same as Anthropology 157/257.)  
2 units, Win plus 3 units, Spr (Gibbs, Barton, Foster-Simons)

PHILOSOPHY
46. Introduction to Chinese Philosophy — (Same as Asian Languages 46, Religious Studies 55.)  
4 units, Aut (Nivison) MWF 10 sections by arrangement
194F. The Golden Rule.  
3 units, Spr (Nivison) 1:15-3:05
331. Seminar in Confucian Ethics — (Same as Asian Languages 331.)  
3-5 units, Win (Nivison) TTh 2:15-4:05

POLITICAL SCIENCE
20. Introduction to Comparative Politics.  
5 units, Spr (Halpern)
5 units, Win (Halpern)
139. Seminar: Chinese Foreign Policy.  
5 units, Spr (Halpern)
139A. Japanese Foreign Policy.  
5 units, Win (Okimoto)
5 units, Win (Okimoto, Rohlen)
225. Seminar: The Political Economy of Reform in Socialist Countries.  
5 units, Win (Halpern)

RELIGIOUS STUDIES
3-5 units, Aut (Klein) MWF 1:15 plus section
18. Zen Buddhism.  
3-4 units, Win (Bielefeldt) MWF 1:15 plus section
55. Introduction to Chinese Philosophy — (Same as Philosophy 46, Asian Languages 46.)  
4 units, Aut (Nivison) MWF 10
5 units, Spr (Bielefeldt)
158A. Buddhism and the Feminine.  
5 units, Aut (Klein) MW 4:15-6:05
230. Topics in Cha' n and Zen.  
5 units, Win (Bielefeldt) MW 4:15-6:05
236. Buddhist Meditation Texts.  
5 units, Spr (Bielefeldt) MW 1:15-3:05
236A. Buddhism and the Play of Wisdom.  
5 units, Win (Klein) TTh 2:15-4:05
356  SCHOOL OF HUMANITIES
AND SCIENCES

239. The Golden Rule.
3-5 units, Spr (Nivison) MW 3:15-5:05
331. Confucian Ethics.
5 units, Win (Nivison) TTh 2:15-4:05

ECONOMICS

Chairman: John B. Shoven
Vice Chairman: Gavin Wright
Associate Professors: B. Douglas Bernheim, Timothy F. Bresnahan,
Assistant Professors: Julie L. Anderson, Gregory Clark, Steven N. Durlauf, John M. Litwack, Michael H. Riordan, 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, Robert Wilson (Graduate School of Business)
Courtesy Assistant Professor: Alan Garber (Medical School)
Affiliated Professors: Bruce F. Johnston, Timothy E. Josling (Food Research Institute), 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, Anne E. Peck (Food Research Institute)
Affiliated Assistant Professor: James E. Hodder (Industrial Engineering)
Visiting Professors: Jonathan Eaton, Frank Hahn, Hajime Miyazaki, Jurgen Schroeder
Visiting Associate Professors: Russell Cooper, John Kennan
Visiting Assistant Professors: Joyce Cooper, Lawrence Goulder, Charles Horioke, Hafiz Pasha, Geoffrey Rothwell

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. Associated with the department are the Research Center in Economic Growth in Encina Hall, for research and graduate training in problems of economic growth in both industrialized and developing countries, and comparable facilities in Encina Hall for mathematical economics and econometrics.

The University Library is well supplied with literature in all fields of economics. The Hopkins Transportation Library holds invaluable material on transportation problems, and there are special collections on the institutions and commerce of Latin America, the Orient, and Pacific Coast development. Advanced students have access to the Hoover Institution, with its comprehensive collections of original and secondary materials on many foreign nations. The Food Research Library in Encina Hall is particularly valuable for International Trade and Economic Development.

Qualified graduate students in economics are given the opportunity for training and research in the special fields of the Food Research Institute. A few undergraduate courses are also conducted by the Institute.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The department made changes in the requirements for the Economics major on July 1, 1983 and further changes effective on July 1, 1984. Students declaring Economics as a major after July 1, 1984 will be under one of two new programs described below. Students declaring Economics as a major before July 1, 1984 may remain under the old requirements or may elect to take part in one of the new programs if they wish to do so and have the appropriate preparation.

OLD REQUIREMENTS

To be recommended by the Department of Economics for the degree of Bachelor of Arts in Economics, a student who declared Economics as a major after July 1, 1983 and before July 1, 1984 must (1) have completed the course work requirements listed below and (2) upon declaring an Economics major, have submitted to the
Economics Department office a prospective graduate Colloquium program form signed by the student's advisor.

Course work requirements for students declaring economics as a major before July 1, 1983, remain unchanged and are listed on pages 337-338 of Courses and Degrees, 1982-83.

COURSE WORK REQUIREMENTS

1. Economics 1, 51, and 52 or their equivalents. Economics 51 and 52 should, wherever possible, be completed by the end of the sophomore year.

2. 30 units in courses numbered 100 or above, of which 15 units must be taken at Stanford in California.
   a) Two courses must be selected from the following list and taken at Stanford in California: 102, 111, 118, 141, 145, 148, 157, 165.
   b) Any of the following courses may be used as additional economics courses to meet the 30 unit requirement:
      1) Any economics course numbered above 99 and below 300 except 151, 152, 190, 191, and 199D. A maximum of 10 units of directed reading (139D and Food Research Institute directed reading) may be used.
      2) Courses 212A-B and 214 in Engineering-Economic Systems and courses numbered 205 and above in the Food Research Institute may be used.
      3) Each year several overseas courses are approved as economics courses in satisfying these requirements, but not all overseas economics courses count. Check 119 Encina Commons for a list of approved courses.

3. 15 units of quantitative course work. All courses taken to satisfy this requirement must be approved in writing by the student’s Economics Department advisor. Advisors will automatically approve courses from among the following: Economics 90, 91, 102, 169, 170, 171, 180, 181; any Mathematics courses numbered 19 or above; Advanced Placement mathematics credit (equivalent to Math 41 and 42); any operations research courses; any statistics courses numbered 60 or above; Psychology 60, Computer Science 103, 104, 105, 106. Advisors may approve Industrial Engineering 133 (same as Economics 92 in Summer Quarter) or Computer Science courses above 106. No more than 10 units of accounting courses (Economics 90, 91, Industrial Engineering 133) may be used towards this requirement or towards the 180 unit university requirement for graduation.

OTHER REQUIREMENTS

4. Courses taken at other universities may be given credit for as many as 35 of the required 60 units. At least 15 units towards requirement (2) must be taken at Stanford in California, including as least two courses from the list in (2a). At least 25 units towards requirements (1) and (2) combined must be taken at Stanford in California. To use transfer credit (or any course not expressly listed) to satisfy requirements (1), (2), or (3) the student must obtain written permission from the Director of Undergraduate Studies for the Economics Department who will establish the amount of credit to be granted toward completion of the department requirements. Students who have taken a year’s elementary economics course at another university will normally be required to take Economics 51 and 52.

5. No courses receiving Economics Department credit under headings (1) and (2) above may be taken pass/no credit. No more than 10 units of course work for Economics Department credit under heading (3) above may be taken pass/no credit.

6. A letter grade indicator of "C" or better shall have been received for all units completed at Stanford in economics.

7. No course may be counted more than once in satisfying these requirements.

8. Courses taken by declared majors without the listed prerequisites will not be given credit toward the A.B. in Economics, unless approved in writing by the Director of Undergraduate Studies for the Economics Department.

9. Students are responsible for seeing that all grades of "incomplete" are cleared within one year after the grade was given. If the "incomplete" grade is not cleared within that time, no credit will be given for the course toward the A.B. in Economics.

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 major in Quantitative Economics is strongly recommended.

NEW REQUIREMENTS

A student declaring Economics as a major after July 1, 1984 will choose between two programs.

The program in Quantitative Economics requires a higher level of quantitative proficiency and includes two new courses (103 and 104) using quantitative tools to analyze a selected set of applied problems. Its general aim is to bring students up to a level of quantitative proficiency necessary to do master’s level work.
The program in Economic Perspectives and Policies retains the same quantitative requirement as listed in (3) above under the old requirements and includes a new course (101) on Economic Policy Analysis and a new requirement for a senior research paper. Its general objective is to teach students to think and write about important economic problems and issues using the basic tools of economic analysis with only minimal use of mathematics.

QUANTITATIVE ECONOMICS

Course Work Requirements
1. Quantitative requirements—Mathematics 43 and Economics 102 plus Mathematics and Statistics prerequisites for these courses. Economics 180 may be substituted for Mathematics 43.
2. Core requirement—Economics 1, 51Q, 52, 103, 104.
3. Upper division requirement—15 units from economics courses numbered between 100 and 167, excluding 101-104 and 151-152. Economics 185 may be included in the 15 units.

ECONOMIC PERSPECTIVES AND POLICIES

Course Work Requirements
1. Quantitative requirement—Same as under old requirements, item (3).
3. Upper division requirement—25 units; 10 units must be selected from the courses listed in item (2a) and 15 units from those listed under item (2b) of the old requirements, excluding 101 and 103-104.
4. Economics 188. Senior Research Paper (3 units). This will be a substantial paper to be written after the quantitative and core requirements and most of the upper division course requirements have been completed. This requirement will be waived for students successfully completing Honors I.

HONORS PROGRAMS

Two programs are offered which lead to a Bachelor of Arts with Honors in Economics. Both programs are designed to encourage a more intensive study of economics than is required for the normal major, with course and research work of exceptional distinction.

The Honors Program I entails an in-depth study of an appropriate question and completion of a thesis of very high quality. The Honors Program II requires an especially high grade average sustained through more than the usual number of units of economics, and also calls for the submission of two term papers of very high quality, in economics, written at any point in the student's course work. A student should always save graded term papers for possible use in the Honors Program II.

Honors Program II will not be offered to students declaring an Economics major after July 1, 1984.

Both programs require completion of all requirements of the Bachelor of Arts in Economics.

Additional requirements of the Honors Program I are:
1. A letter grade indicator in economics courses of at least 3.5.
2. Submission of an honors thesis of very high quality. This thesis will normally be written under the direction of a member of the Economics Department (or a member of some closely related department). Honors students may take up to 10 units of Directed Reading (199D) for purposes of completing their thesis project. Units of 199D do not count towards the 65 units for the basic economics major.

Additional requirements for the Honors Program II are:
1. Completion of 15 units of economics courses numbered 100 or above, in addition to the units ordinarily required for the Bachelor of Arts in Economics.
2. Letter grade indicator in economics of at least 3.7.
3. Submission of two term papers of very high quality. These will ordinarily have been written in economics courses. They must have been read and graded by a faculty member in economics before being submitted. The original papers must be submitted.

Prospective candidates of Honors Program I should advise the Departmental Director of the Honors Program of their interest and plans at least three quarters before their graduation. At that time, or subsequently, the Director will assist students, if necessary, in finding appropriate thesis advisors. Admission to this program is not automatic and may have to be restricted if there are too many applicants.

Prospective candidates for Honors Program II are also encouraged to inform the Departmental Director of the Honors Program before the end of the junior year. Applications for Honors under this program may be made at any time up to the end of the second full week of the quarter preceding the quarter in which the student will graduate. Potential applicants are responsible for saving copies of high-quality term papers for submission with the applications.
COTERMINAL
A.B./A.M. PROGRAM

For admission, a student must have a letter grade indicator in economics courses of approximately one "A" grade for every two "B" grades or better. For intelligent program planning, students are strongly urged to seek admission to the program prior to the end of the third quarter of their junior year and must apply prior to the end of the second quarter of their 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 Honors Program I, he or she may submit his or her Honors thesis as one of the alternative two term papers. A student admitted to the coterminal A.M. program is expected to initiate the study plan immediately. A student's coterminal status will be terminated if the student elects to receive the A.B. degree prior to completion of all requirements for the A.M. degree.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin or address inquiry to the Credential Administrator, School of Education.

GRADUATE PROGRAMS

Graduate programs in economics are designed to provide students with a sound basis in modern theory, with a broad background in applied fields as well as specialization within fields of interest, with needed analytic and empirical tools, and with the perspective on the current state and uses of their discipline that is obtained by studying the development of economic thought and the economies of other cultures or other times. The department considers each of these objectives to be essential in the development of qualified researchers, teachers, and practitioners in economics. While departmental requirements for advanced degrees have been structured to secure these objectives, the final analysis it is the responsibility of students to plan their studies so that these objectives are served.

A student who has been admitted to graduate standing in economics does not automatically become a candidate for a graduate degree. Rather, admission carries with it the expectation that students are preparing themselves for the Doctor of Philosophy degree. Admission to candidacy and recommendation for the degree (and for the Master of Arts degree) occur subsequently, upon satisfaction of departmental requirements outlined below. Recommendations for the degree and, especially, admission to candidacy are departmental procedures separate from the formal procedures of the University Committee on Graduate Studies. The University's basic requirements for advanced degrees (residence, dissertation, etc.) are set forth in the section "Degrees" in this bulletin and must be satisfied along with the departmental requirements listed here.

An undergraduate major in economics or its equivalent is not required for admission to graduate standing, but is desirable and, in any event, some preparation in the social sciences is essential. Students admitted to graduate standing are expected to be prepared in mathematics at least to the level of one year's intensive study of calculus. Advanced calculus, linear algebra, differential equations, analysis, and mathematical statistics are useful preparations separately or collectively, and students are encouraged to continue the development of such analytic tools during their graduate study. Narrowly specialized undergraduate programs are not recommended.

Well prepared students proceeding toward the Doctor of Philosophy degree may expect to spend approximately two years in course work and another two years in seminars, independent study, and dissertation research, with some overlap in each direction. Exceptional progress may make a three-year program feasible and, occasionally, ambitious dissertation research can be completed within a four-year program.

Questions and petitions concerning admission to the program or the program itself should be addressed to the Director of Graduate Studies, who together with his administrative assistants and the Graduate Studies Committee, of which he is chairman, has departmental responsibility for administering the graduate program. Students approaching their dissertation research are obliged to seek among the regular members of the Economics Department faculty a principal advisor who will supervise that research. Officers and members of the Graduate Economics Society actively participate in advising entering students and, in addition, provide an important channel through which student interests within the department are represented.

MASTER OF ARTS

The Department of Economics does not admit students who plan to terminate their graduate study with a Master of Arts degree. Students may (but need not) elect this degree in preparation for their Doctor of Philosophy degree in economics. Students who have been
advanced to Ph.D. candidacy in other departments of the University may, however, be admitted to the A.M. program in economics. Students terminating their graduate study in other departments of the University with an A.M., M.S. or M.B.A. degree are not admitted to the A.M. program in Economics. The following are departmental requirements for the Master of Arts degree:

**Admission**—Completion of the Stanford requirements for a Bachelor of Arts degree in Economics, or approximately equivalent training, and mathematical competence equivalent to one year of college calculus is required of students who undertake a program of study for the degree of Master of Arts in Economics. Admission to candidacy for the degree will be restricted to students whose record bears promise of successful graduate work. All programs must be approved by the Director of Graduate Study at least four quarters before expected completion of the degree. Programs lacking strength or coherence will not be approved.

**Recommendation for the Degree**—Students completing programs consistent with the departmental objectives listed in the introductory paragraph above will be recommended to the University Committee on Graduate Studies for the degree of Master of Arts in Economics, provided the following standards are satisfied:

1. Completion of a program of study at Stanford amounting to not less than 45 units of credit. Courses numbered below 100 may not be counted toward the 45 units required. The program must include at least 40 units of economics taken in the Department of Economics, including one course in the series Economics 202, 203, 204 (usually 202), one course in the series Economics 210, 211, 212, and at least one additional graduate level course. Courses which are listed simultaneously with two numbers (e.g., 51 and 151, 121 and 221) may count towards the 45 units only at the level of the lower number. Courses in subjects closely related to economics may be included with the approval of the Director of Graduate Studies. Economics 1, 51, and 52, which are required for the A.B. degree in economics, cannot be used to satisfy the basic 45 units. Likewise, no more than three courses from among 102, 111, 118, 141, 145, 148, 155, and 165 can be used to satisfy the basic 45 units. No seminar courses numbered 300 or above can be counted.

2. Training in statistics equivalent to the level of Economics 170 is required.

3. Completion of a thesis acceptable to the department or of two term papers of acceptable quality at least one of which is for a course numbered 200 or over. Credit will be allowed for the thesis to a maximum of 10 units, toward the 45 units required for the degree.

4. A letter grade indicator (LGI) of “B” or better shall have been received for the first 45 units of course work completed and for additional units approved by the department. An LGI of “B” or better is required for Economics 202 and for the course selected from Economics 210, 211, 212. All courses must be taken for letter grades.

**DOCTOR OF PHILOSOPHY**

Programs of study leading to the Doctor of Philosophy degree are designed by the student, in consultation with his or her advisors and the Director of Graduate Study, to serve his or her particular interests as well as to achieve the general departmental objectives outlined above. Simple satisfaction of a set of requirements is necessary but not sufficient for Admission to Candidacy or Recommendation for the Degree. Rather, programs of study will be weighed individually according to the following departmental standards or requirements:

**Recommendation for the Degree**—The Departmental Graduate Studies Committee will recommend to the University Committee on Graduate Studies that a student be granted the degree of Doctor of Philosophy in Economics when the student submits, and the Graduate Studies Committee accepts, a completed program of study which will satisfy the following set of standards. This summary list is elaborated upon below:

1. Qualification established by comprehensive examination, or by alternative course examinations, papers, or course work in four fields of study (if no minor subject is offered) or in three fields and a minor subject.

2. Proficiency in either at least two other areas within economics or the minor subject.

3. Qualification in Mathematics.

4. Qualification in Econometrics.

5. Qualification in Economic History.

6. Distinction requirement.

7. Research paper to qualify for admission to candidacy.

8. Teaching experience.

9. Research training and specialized study in seminars.

10. University oral examination.


It should be noted that the fourth and fifth standards need not involve course work in addi-
tion to that offered in satisfying the first and second. More detailed discussion follows:

1. Qualification in four fields of study (if no minor subject is offered) or in three fields and a minor subject. All candidates will be expected to qualify by comprehensive field examinations in “Price and Allocation Theory” and “Theory of Income and Economic Fluctuations.” Comprehensive field examinations will be scheduled annually, usually at the close of the sequence designed to prepare for them. The minimal standard of qualification in each field will be a letter grade indicator of “B” on the appropriate examination. Successful candidates are expected to show distinction in at least one field of economics. Comprehensive examination papers become a part of each student’s permanent file. Evidence of competence in each field shall be at least equivalent to passing comprehensive examinations.

In addition to the two theory fields, students may select remaining fields according to the following options, or students may also choose to qualify in one extra field. This additional field may include suitable Ph.D. courses from outside the department (in areas not listed below) related to economics, subject to approval by the Director of Graduate Studies.

a) Option A: Without a Minor Subject—Consistent with the objectives of their program, students may choose to prepare themselves in two of the following fields of study:
- Alternative Approaches to Economic Analysis
- Econometrics
- Economic Development and Planning
- Economic History
- International Economics
- Labor Economics
- Mathematical 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 described under (2) below. Students should complete at least four comprehensives by the end of their second year in residence. Many complete all five. Normally students exercise Option A unless there are strong reasons leading them to take a program with a minor.

b) Option B: With a Minor Subject—Consistent with the objectives of their program and advance consent of the Director of Graduate Studies, students may choose to prepare themselves in a minor field. They will also prepare themselves in at least one of the fields of study listed under Option A. Additional credit elsewhere in the economics part of the program for the minor may be obtained by consent of the Director of Graduate Studies. It is also possible to arrange a special minor in fields where no formal minor program is offered by the relevant department.

2. Distribution Requirement—To achieve a balanced program, students without a minor subject are required to show proficiency in at least two fields other than those in which they qualify under option A, or one field in which they qualify under option B. To satisfy this distribution requirement, students selecting two fields from Econometrics, Mathematical Economics, or the Theory of Choice under option A, or selecting one of these three fields under option B, together with a minor in a mathematical subject, must take at least two courses in fields other than Econometrics, Mathematical Economics, or Theory of Choice.

Normally, under option A a total of four, and under option B a total of two, five-unit graduate lecture courses offered exclusively at the 200 or above level by the Economics Department, approved by the Director of Graduate Studies, and passed by a letter grade indicator (LGI) of “B” or better, will be regarded as evidence of such proficiency.

3. The student demonstrates competence in mathematics at least to the level of successful completion of Mathematics 23 or 43 with an LGI of “C” or better or its equivalent (as judged by an examination administered by the department upon entrance). This standard should be satisfied as soon as possible after first graduate registration and those with little previous mathematical background are advised to register their first Autumn Quarter for Mathematics 41. Those who have more background but are not quite up to the level of Mathematics 23 or 43 may either complete Mathematics 23 or 43, or complete Economics 180, depending upon their level. Additional preparation in mathematics is strongly suggested, and students should consult with their advisors in choosing courses beyond the level of Mathematics 23 or 43.
4. Students shall submit evidence of competence in econometrics at least by completing Economics 271 and 272 with an LGI of "B" or better. Electing econometrics as a comprehensive field automatically satisfies this standard.

5. Students shall submit evidence of competence in economic history either by electing to take the comprehensive exam in the field or by taking a course at the 200 level for five units.

6. Distinction Requirement—A student is expected to have shown "distinction" in some important aspect of his or her graduate program. The Graduate Studies Committee will determine what constitutes "distinction." In the past an LGI of "A-" or better in one or more of the comprehensive examinations has been accepted as an indicator. This does not preclude a student from demonstrating "distinction" in some other way, e.g., writing and publishing an article in a scholarly journal.

7. Students will be required to complete a research paper, with an LGI of "B" or better, by the end of the Spring Quarter of their second year, written under the supervision of an advisor. This candidacy paper is a necessary step toward demonstrating research ability of a standard required for a Ph.D. dissertation.

8. Candidates for the Ph.D. in Economics are required to serve as a teaching assistant in the department for at least one quarter. The department considers teaching experience an essential part of the Ph.D. program. It is not recommended that the teaching-assistant requirement be satisfied during the candidate's first year of graduate study, and it will normally be satisfied by the end of the third year of residence.

9. Seminar studies are designed to develop independent research skills, to permit specialized study, and to foster dissertation research. Students are expected to participate in at least two seminars by the end of their third year in residence. Presentation of a well developed proposal for dissertation research should take place in one of these seminars or, alternatively, in a departmental workshop. A dissertation prospectus and two research papers must be submitted as part of each student's permanent file. Students in the process of dissertation research and in residence shall continue to participate in at least one seminar.

10. When these standards have been satisfied, and upon a recommendation from the student's dissertation advisor, the Director of Graduate Studies will request that a University oral examination committee and time be set. The examination is based on the dissertation and on the field or fields of economics within which it lies.

11. Completion of a dissertation accepted by a departmental reading committee will be the final standard set in preparation for the Ph.D. degree.

Admission to Candidacy for Ph.D. —Current University regulations require that each department shall establish procedures for qualifying students for the Ph.D. As a result of the qualification procedure, a student shall be either (1) qualified for admission to candidacy, or (2) explicitly terminated from the Ph.D. program. If adjudged by the department to be qualified he or she will be recommended by his or her department for admission to candidacy for the Ph.D. Thus "Qualification for the Ph.D." should be considered synonymous with "Recommendation for Admission to Candidacy for the Ph.D." The University further requires such qualification procedure for a graduate student to take place no later than at the end of six quarters of graduate work at Stanford (quarters of nine units or more, excluding the summer quarters). There may be occasional exceptions to this rule, e.g., a graduate student who changes department after his or her first year, but all such exceptions must be approved in advance by the Dean of Graduate Studies.

The qualification procedure of the Department of Economics normally takes place at the end of the Spring Quarter of the graduate student's second year. Based on the student's performance in the program up to that time, the Graduate Studies Committee will make a judgment as to his or her qualifications to complete the Ph.D. program successfully. If adjudged to be so qualified, the department will recommend the student for admission to candidacy for the Ph.D. The student should then complete the University form "Application for Candidacy for Degree of Doctor of Philosophy" which has to be signed by him or her, by the Director of Graduate Studies, and by the principal dissertation advisor, if one has been selected by that time. If the Graduate Studies Committee judges the student not qualified to complete the Ph.D. program successfully, the student will normally be terminated from the Ph.D. program, unless extenuating circumstances are shown to exist.

Admission to candidacy for the degree of Doctor of Philosophy is granted by the University Committee on Graduate Studies. Candidacy, once approved by the University Committee on Graduate Studies, remains valid for five years from date of approval (if it has not been terminated earlier by the department because of unsatisfactory progress) and may be renewed.
by the submission and approval of a new application, or extended upon the recommendation of the department. Admission to candidacy does not imply that the student has completed all requirements for the Ph.D. except the dissertation. Rather, it implies that the department has made a careful review of the progress of the student and has decided that he or she is qualified to complete the Ph.D. program.

The Department of Economics recognizes that there will be differences in academic programs of the students and not all students will have proceeded in the same order or at the same rate. A minimum program on which the Graduate Studies Committee can make a judgment regarding qualification at the end of the Spring Quarter of the student's second year is outlined below. Most students should expect to exceed this standard. A student who cannot meet this standard because of exceptional circumstances should consult the Director of Graduate Studies as early as possible during his second year.

Minimum Program for Qualification:


2. For students without a minor subject, successful completion of at least two other fields of study; for students with a minor subject, successful completion of at least one other field of study and fulfillment of most of the minor requirements.

3. Completion of the econometrics or economics history requirement may be substituted for completion of one field in item 2 above.

4. Qualification in mathematics.

5. Completion of the research paper required to qualify for admission to candidacy.

The Dissertation—By the end of the student's third year, normally encompassing the two dissertation seminars and remaining coursework, students will have selected an advisor and a dissertation subject or area. A short dissertation prospectus written by the student and signed by the advisor will be placed on file with the Director of Graduate Studies. The prospectus is not binding on either party, but advisors should be informed of major changes in research directions.

As soon as a firm thesis proposal is agreed on between student and advisor, the second and third members of a reading committee are to be selected with the advisor's approval. The principal advisor and one other member of the reading committee must be from the Department of Economics.

When either a first draft of the dissertation is completed, or core theoretical and/or empirical aspects of the dissertation have been developed, a student may petition for an oral exam with the advisor's approval. The oral committee will normally consist of the three dissertation readers, a chairman drawn from outside the department, and one additional examiner nominated by the department. At least three out of these five examiners must be from the Economics Department.

For the candidate to pass the oral exam, the examining committee must be convinced that (1) the student has mastered the existing literature and professional techniques in the dissertation area, and (2) that no major conceptual or empirical problems remain to be overcome in making a significant contribution.

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

Attention is called to a joint 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.

In the above case, the student's program objectives must clearly justify such a joint program; decisions by the Departmental Graduate Studies Committee will govern. 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. Current students under these grants range up to $7,000 for an academic year in addition to tuition allowance. Students whose record justifies continuation in the program may be assured of favorable consideration for further support for a period of up to three additional years.

Such support for subsequent years may take the form of employment as research assistants or as teaching assistants. The salary scale in each case depends upon experience and ability. In the case of research assistants, students are currently receiving $8160 plus an allowance for tuition. In the case of teaching assistants, students are currently receiving $8160 per academic year, in addition to a tuition allowance. In each case, the appointments are for half-time. Entering students are not normally considered for research or teaching assistantships.

Information for applying for financial aid is included with the admissions packet.

COURSES

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 (Boskin, Wright, Fuchs) MTWThF
   4 units, Sum MTWThF

51Q. Economic Analysis I—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. Prerequisite: 1, Math 43, or equivalent. (DR:5)
   5 units, Aut (Litwack) MTWThF
   Win (Staff)
   Spr (Miyazaki)

51. Economic Analysis I—Same as 51Q except that calculus is not used. (DR:5)
   5 units, Aut (Rothwell) MTWThF
   Win (Tomlinson)
   Spr (Pasha)

52. Economic Analysis II—An analysis of equilibrium and instability in the economic system as a whole. National accounts and aggregate relationships among stocks and flows in markets for goods, services, and financial assets. (May be taken as 152 by graduate students.) Prerequisite: 51.
   5 units, Aut (Hall, Durlave) MTWThF
   Win (Eaton, Cooper)
   Spr (Taylor)

90. Introduction to Accounting—(Graduate students register for 190.) An introduction to the principles and concepts underlying financial reports such as the income statement, statement of financial position, and the "funds" statement, and to the uses of such reports. No prior accounting is assumed. Students who have taken or are now taking a college-level accounting course may not enroll.
   5 units, Aut (Lundholm)
   Win (Zollinger)
   Spr (Baiman)

91. Introduction to Cost Accounting—(Graduate students register for 191.) The use of internal financial data for managerial decisionmaking. 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, Win (Feltham)
   Spr (Reichelstein)

100. Economic Theory in Historical Perspective—The historical development of economic theory from several perspectives. Emphasis 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 European political and social thought. Topics: Mercantilist thought and the Physiocratic model; the Classical school including Smith, Malthus, Ricardo, Mill, and Marx; the marginalist revolution and the development of partial and general equilibrium analysis; the Austrian theory, and capital and interest; Keynesian developments in macroeconomics and the revival of interest
growth models; and recent controversies in capital theory. Prerequisites: 51 and 52.

5 units, not given 1987-88


5 units, Aut (Cooper, Earle) Win (Cooper, Starrett) Spr (Horioka)

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. Prerequisite: Statistics 60 or the equivalent.

5 units, Aut (Lau) MTWThF Spr (Lau)

103. Applied Macroeconomic Analysis—Construction and use of econometric models for analysing macro-economic fluctuations, preparing and evaluating forecasts, and appraising quantitative 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 (Hahn) MTWThF Win (Hickman)

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 (Wolak) Win (Bresnahan) MTWThF Spr (Staff)

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, Co-determination, the Yugoslav version, the Kibutz, 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, Spr (Lecin) MTWThF

106. The World Food Economy—(Same as Food Research 103.) 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: I or equivalent understanding of economics.

3 units, Spr (Johnston) MWF 10

107. Commodity Futures Markets and Prices—(Same as Food Research 105.) The uses and functioning of commodity futures markets. Topics: business uses of the markets, the meaning of hedging, the evolution of hedging practice, determinants of the level of market use, and the relationships between level of use and market usefulness, market performance issues and measures, and the importance of speculation. Prerequisite: I for Economic majors.

5 units, Win (Peck) MW 10-11:50

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 (Gurley) MTWThF

112. Introduction to Financial Decisions—(Same as Industrial Engineering 235.) The models and techniques in financial decision-making under uncertainty. Topics include risk measurement, expected utility theory, decision trees, portfolio and capital market theories, and the effects of taxation and inflation. Prerequisites: 51, 181, Statistics 116; Economics 190, or equivalent required. Enrollment limited and at discretion of instructor.

3 units, Aut (Hodder) Win (Heeley) MWF 9

113. Technology and Modern Industrial Society—(Same as Values, Technology, Science, and Society 107.) The interrelationships between technology and the nature and form of industrial societies over the past 200 years. Technological change as a socio-economic process illuminating the history of industrial societies. Factors influencing the rate and direction of technological change and diffusion. Implications for economic structure and the growth of large-scale organizations. The impact of these changes on modern industrial man as producer and consumer. (DR:5)

4 units, Win (Rosenberg)

115. European Economic History—Growth and development in Western Europe from 1750 to World War II. Comparative approach, with emphasis on British, French, and German ex-
116. American Economic History—The history of American economy from colonial times to present, emphasizing the years between the Revolution and World War II. The application of economic analysis to historical issues. Topics: American growth record and its determinants; economics of slavery and the Civil War; industrialization in a land-abundant country; historical causes of the Great Depression; role of the family in American economic history. Term paper required. Prerequisites: 51 and 52.

5 units, Spr (Clark)

117. U.S. Economy in the 20th Century — Contemporary U.S. economy in historical perspective. Topics include: 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, given 1988-89

118. The Economics of Development—The state of underdevelopment and the dynamics of development in international (and within-country) conflicts between the rich and the poor. The process of economic development in an international perspective. Focal point is the experience of developing countries since World War II with reference to the historical perspective of both developed and less developed countries and evaluated to draw policy conclusions relating to strategies of economic development. Emphasis on the impact of certain aspects of development on societal values and institutions. Prerequisites: 51 and 52 for economics majors. Enrollment limited to 60.

5 units, Win (Anderson) 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, Win (Yotopoulos) TTh 1:15-3:05

120N. The Soviet Economy—The development and performance of the Soviet economy since 1917. The structure and operation of recent reforms and future prospects.

5 units, Win (Litwack)

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 economy legacy of the late Qing and Republican period; China’s development strategy; planning and resource allocation; labor, employment and population, income distribution, foreign trade, and recent reforms. Prerequisite: 1.

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

122. The Theory of Capitalist Development — The 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 labor supply, the role of international trade and investment, and the uneven character of the development process. Theoretical approaches to the analysis are examined: Classical, Schumpeterian, and Keynesian, with main focus on Marxian theory and recent elaborations and extensions of that theory. Relevant historical case studies. Prerequisites: 51 and 52.

5 units, not given 1987-88

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 with different economic and social structures, the U.S., Mexico, Brazil, Central America, and the Caribbean. Seminar with research papers. Prerequisites: 51 and 52 for economics majors.

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

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 (Horiike)

Spr (Miyazaki) MTWThF
128. Marketing, Consumption, and Price Analysis—(Same as Food Research 120.) Analysis of agricultural commodity prices and markets, including consumer demand, spatial and temporal aspects of prices, market structure considerations, and complete commodity models. Links to microeconomic theory are drawn emphasizing empirical analysis and policy contexts.

5 units, Aut (Williams) TTh 10-11:50

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 10-11:50

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 home work 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 1:15-3:05


5 units, Win (Wilson) MW 10-11:50

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 include savings and investment, capital formation, consumer behavior towards risk, financial effects of inflation, properties of various financial instruments, and government policy regarding securities markets. Both theoretical and institutional material included. Prerequisites: 51, Statistics 60, and at least one course in calculus.

5 units, Aut (Wolack) MTWThF

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, Aut, Spr (Pasha, Goulder) MTWThF

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. Prerequisites: 51, 52, and Food Research 144, or consent of instructor.

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

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 include the role of agriculture in American economic development, policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States agriculture. Emphasis on policy alternatives rather than on farm management. Prerequisite: 1 for Economics majors.

4-5 units, Aut (Falcon) MWF 9


5 units, Aut (Kennan) 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 1987-88

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, Spr (Riordan) MTWThF
on analyzing the ability of market mechanism to and renewable resources population. Emphasis on intertemporal considera-

151. Economic Analysis I—(See 51.)

152. Economic Analysis II—(See 52.)

154. Economics of Legal Rules and Institutions—(Same as Law 385D.) 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)

155. Economics of Natural Resources—Application of tools of economic analysis to the allocation of natural resources, including environmental resources, depletable mineral resources and renewable resources population. Emphasis on analyzing the ability of market mechanism to make socially rational decisions in the light of the importance on intertemporal considera-

156. Economics of Health and Medical Care—(Graduate students register for 256; same as Health Services Research 256.) Problems and institutions, analytical studies of policy issues. Topics: mortality and morbidity, physicians and other personnel, hospitals, the drug industry, national health insurance and health maintenance organizations. Open to graduate students, undergraduate economics majors (seniors and juniors), or by permission of instructor. Recommended: Preparation in micro theory and some statistics. Prerequisites: 51, some background in math or statistics.

5 units, Win (Fuchs) MT 10-11:50

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 include 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) MT 10-11:50

158. Social Control of Industry—Building on 157, considers the history, economics, and legal background of those industries under which U.S. industry is subject to government control. Topics are antitrust law and economics, and the economics and practice of public utility regulation in the communications, transportation, and energy sectors. The effects of licensing. Emphasis is on application of economic concepts in evaluating the performance and policies of government agencies.

5 units, Win (Riordan) MT 10-11:50

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, cooperatives 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. Concrete examples are used in analyzing oligopoly behavior, the power of the various members of the U.N. Security Council, union-management wage negotiations, disarmament models, taxation and public policy, and the distribution of power among coalitions in governing bodies. Pr-
requisites: 51 and one course in calculus, or the consent of instructor.
5 units (Staff) not given 1987-88

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, in addition 52 for economics majors.
5 units, Aut (Staiger) MTWThF
Spr (Staiger)

166. International Trade Policy — (Same as Food Research 166.) Formulation and 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. Multination commodity agreements and cartels, and special trade arrangements for developing countries. Prerequisite: 165.
5 units, Spr (Pearson) MW 11-12:50

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.
5 units, Spr (Pearson) MW 11-12:50

170. Intermediate Econometrics I—(Same as 270.)
5 units, Aut (Amemiya)

171. Intermediate Econometrics II—(Same as 271.)
5 units, Win (Durlauf)

172. Intermediate Econometrics III—(Same as 272.)
5 units, Spr (MaCurdy)

180. Mathematics for Economists—Training in areas of mathematics which have frequent applicability to economic problems. For students who have had some calculus but lack a strong mathematical background. Topics include functions of several variables; partial derivatives and differentials; mean value theorem and Taylor's theorem, integral calculus; elementary matrix algebra, determinants, and characteristic roots; quadratic forms; maximization of a function of several variables subject to equality constraints. Selected applications in economics. Prerequisites: 51, 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 aggregate planning and control. Prerequisites: 51, 180, or Mathematics 43 or equivalent.
5 units, Win (Hammond) MTWThF

185/285. The Distribution of Income and Wealth—Basic facts about the distribution of income and wealth in the United States, with some 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 distributions. Normative theories of just distribution and the limiting effects of incentives on the redistribution of income (May be taken as 262 by graduate students). Prerequisites: 51 (preferable Q), 102, and one course in calculus.
5 units, Spr (Arrow)

188. Senior Research Paper.
3 units, Aut, Win, Spr (Anderson, Bowen)

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 I.) Register for at least 1 unit for at least 1 quarter.
1-10 units, Aut, Win, Spr (Anderson, Bowen)

PRIMARILY FOR GRADUATE STUDENTS

by arrangement.

by arrangement

by arrangement.

A. CORE THEORY CURRICULUM

202. Price and Allocation Theory I—Consumer demand theory and the implications of

5 units, Aut (Lau)

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 (Bernheim)

5 units, Spr (Starrett)

5 units, Aut (Taylor)

5 units, Win (Durlauf, Hall)

212. Theory of Income and Economic Fluctuations III—Macroeconomic growth theory with applications to growth accounting, productivity analysis, and measurement of potential output. Uses 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 (Hickman)

301A,B,C. Seminar in Microeconomics.
10 units (Staff) by arrangement

310A,B,C. Seminar in Macroeconomics.
10 units (Staff) by arrangement

B. ALTERNATIVE APPROACHES TO ECONOMIC ANALYSIS

To receive credit for the Alternative Approaches 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 some of 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 (Staff)

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, given 1987-88

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. Recent elaborations, extensions, and applications of the theory.
5 units, given 1988-89

395 A,B,C. Seminar in Alternative Approaches to Economic Analysis.
10 units (Staff) by arrangement

C. ECONOMIC DEVELOPMENT AND PLANNING

To receive credit in the field of Economic Development and Planning 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.

5 units, Aut (Anderson)

216. Central Planning—Theory of central economic planning with applications to the experi-
ence of the Soviet Union. The construction and implementation of central plans in nonmarket economies. Incentive and coordination problems in informally-decentralized hierarchies. Prices vs. quantities and delegation. A discussion and analysis of problems and reforms in past Soviet planning procedures.

5 units, Spr (Litwack)

217. Money and Finance in Economic Development—Comparative studies of capital markets and banking systems in mature and less developed countries (LDCs). Impact of inflation on exchange rates and interest rates. Monetary stabilization, and the liberalization of foreign trade and domestic finance. The LDC debt crisis and the role of international banks in the world capital market.

5 units, Spr (McKinnon)

218. Japanese Economic Model—Theoretical, historical and empirical analysis of various Japanese economic institutions and mechanisms in comparative perspectives. Topics include: 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, Spr (Horioka)

10 units (Staff) by arrangement

D. ECONOMIC HISTORY

The requirements for the Field of Economic History are: (1) A comprehensive exam in Spring Quarter based on material from at least two courses chosen from 224, 225, 226, and 227 and (2) one research paper on a subject approved by one of the faculty teaching any of the following four 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 to 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 the diffusion of technological innovations in the economic history of the West from the 9th to the 19th centuries. Selected "clusters" of technical innovations are examined for the light they throw upon the determinants of the rate and bias of innova-
tive activity, economic and cultural conditions governing diffusion, and the problems of identifying and measuring the primary and second-order economic consequences of new modes of production and warfare. Innovation-clusters include the stirrup, horseshoe and horsecollar, the watermill, crank and gearing, the lateen rigged ship and nautical compass, gunpowder and the cannon, convertible husbandry and enclosures, the steam engine, Watt Rotary motion and steam railways.

5 units, not given 1987-88

226. Problems in American Economic History —The history of the American economy from colonial times to the present, with focus on the period 1790 to 1940. The role of economic history as a distinctive intellectual approach to the study of economics. Topics include slavery and the Southern economy, labor scarcity and technological progress, the emergence of oligopoly, and the coming of the great depression.

5 units, Spr (David, Wright)

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, Win (David)

325A,B,C. Seminar 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. 217 (Money and Finance in
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Economic Development) and 265 (International Finance) are recommended.

5 units, Win (Taylor)

5 units, Spr (Durlauf)

10 units (Staff) by arrangement

F. PUBLIC FINANCE

241, 242. Public Finance and Taxation I and II—Welfare criteria for optimal government expenditure, taxation and debt; positive analysis of the effects of taxation, expenditure, and debt on resource allocation and income distribution; project evaluation; pricing policies in government enterprise; the local public sector and intergovernmental fiscal relations.
241. 5 units, Win (Shoven)
242. 5 units, Spr (Bernheim)

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

345A,B,C. Workshop on Economics of Factor Markets.
10 units (Staff) by arrangement

G. ECONOMICS OF LABOR

To receive credit for the labor field, students must complete 246 and 247.

5 units, Aut (Pencavel)

5 units, Win (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, Spr (Arthur) TTh 9-10:50

345A,B,C. Workshop on Economics of Factor Markets.
10 units (Staff) by arrangement

H. ECONOMICS OF INDUSTRY

To receive industry 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 vertically 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 (Riordan)
258. 5 units, Win (Bresnahan, Noll)

259. Economics of the Firm—Advanced topics in the theory of the firm with reference to
internal structure of the modern firm. Topics include: 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 1987-88

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 on promising ways to attack them.

5 units, Spr (Noll, Bresnahan)


5 units, Aut (Arthur) not given 1987-88

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 about the methods of experimental research and the current state of research findings, and the individual research projects in which students design and run an experiment.

2 units, Win (Noll)

265. International Finance—Exchange rates and use of national monies in international trade. Hedging and speculation. Balance of payments adjustments. Monetary and fiscal policies in open economies. Prerequisites: 204 and 212, or consent of instructor.

5 units, Aut (McKinnon)


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. Seminar in International Economics.

J. ECONOMETRICS

Students not specializing in the field of econometrics 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 (Durlauf)

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—Recent developments in regression analysis; large sample theory; nonlinear estimation; generalized least squares. Prerequisites: 271, 272, Mathematics 113, Statistics 200.
5 units, Aut (Amemiya)

274. Advanced Econometrics II—Time series analysis, simultaneous equation models. Prerequisite: 273.
5 units, Win (Wolak)

275. Topics in Limited Dependent Variables—Advanced topics in discrete choice models: Tobit models; Markov chain and duration models. Prerequisite: 274.
5 units, Spr (Amemiya)

276. Topics in Time Series and Panel Data Analysis—(Same as Statistics 343.) Autoregressive-moving average models; random walk; stochastic control; prediction theory; vector autoregressions; error components schemes; actual analysis. Prerequisite: 274.
5 units, Aut (T. Anderson) TTh 1:15-3:05

370A,B,C. Seminar in Econometrics.
10 units (Staff) by arrangement

K. MATHEMATICAL ECONOMICS

Field I: Theory of Choice—Requirements are two of the following four courses.

5 units, Win (Hammond)

281. The Economics of Uncertainty—The implications of uncertainty on microeconomic behavior using axioms of choice under uncertainty and the expected utility theorem. Topics: optimal static and dynamic portfolio choices, insurance, the effect of uncertainty on savings and production decisions, stochastic stability of markets, and general equilibrium and welfare considerations under uncertainty. Prerequisites 181, Statistics 116, or equivalents.
5 units, Spr (Staff) not given 1987-88

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, Win (Milgrom)

Field II: General Theory—Requirements are two courses chosen from 284, 286, and 287.

5 units, Win (Staff) not given 1987-88

285. The Distribution of Income and Wealth—(See 185.)

5 units, Aut (Migrom)

5 units (Staff) not given 1987-88

290. Incentives—(Same as Business 418.) A workshop on the theory of incentives and decentralization. Topics include implementation of welfare criteria, revelation of preferences and information, decentralization of organizational control. Includes game-theoretic analysis of the effects of differences in information, limitation on observability and contracting, and the particular problems of adverse selection and moral hazard. Prerequisites: Two courses from 280-283, 287, Business 363, or consent of instructor.
5 units, Spr (Wilson)

385A, B, C. Seminar in Mathematical Economics.
10 units (Staff) by arrangement

386. Interdisciplinary Seminar in Decision Analysis—(Same as Business 694, Operations Research 366, Psychology 283.) A study of normative and descriptive decision making, particularly in the face of uncertainty. The way decisions are made and the problems arising in making decision analyses in applied policy contexts. Meets once every two or three weeks throughout the academic year. Prerequisite: Consent of instructor.
1-2 units, Win (Arrow, Tversky, Wilson) by arrangement

387. Interdisciplinary Seminar in Equity and Social Choice Theory.
3 units, Win (Ferejohn, Hammond, Suppes) by arrangement
Visiting Professors: Leonard Michaels, Patricia A. Parker
Visiting Assistant Professor: Richard H. Osberg
Andrew W. Mellon Fellows: David Cameron Miller, Gordon E. Thompson

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 four-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 a 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 are extremely various, it has approved several major programs of study in English. Each of these majors has different objectives and requirements; students will wish to consider carefully which major corresponds most closely to their own personal and professional objectives.

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 103, 104, 200A, 205, Linguistics 1, 70.
C) Renaissance: English 113, 182A, 182B, 213B.
E) Restoration and 18th Century: English 115, 131A, 131A, 152, 184A.
F) Romantic and Victorian: English 118, 132, 154A, 159B, 178, 185A, 185B.
G) American Literature before 1900: English 121, 125*, 179, 186A*, 187A*, 239*, 285B.

P) Poetry: English 92, 150.

*May be used to satisfy one area only.
In addition, students must elect two additional courses in English or American literature from those offered by the English Department (excluding only English 1-2-3 or advanced composition courses). In place of one of these courses, students may choose one upper division course in a foreign literature read in the original language.

A student who took one or more 3-unit sub-100 English courses while still a non-major may count retroactively one of them towards the major.

Students may apply as many as four English courses taken at other approved universities toward their major.

**Major in English with a Creative Writing Emphasis**—This major is designed for students who wish to gain a basic knowledge of the English literary tradition as a whole and at the same time develop skills in the writing of poetry or fiction. Students with this emphasis must take a total of 13 courses offered through the English Department. Like all English majors, they must choose one course from each of the nine areas A-H, P listed above. In addition, they must take four courses specifically designed for either the poetry or the fiction concentration. Fiction writers must take Fiction Writing (English 90), two quarters of Advanced Fiction Writing (English 190) or a more advanced fiction writing course, and Development of the Short Story (English 137). Poets must take Reading and Writing Poetry (English 92), two quarters of Intermediate Poetry Writing (English 192) or a more advanced poetry writing course, and one course in poetry (approved by the instructor in charge of the poetry program of creative writing). Courses taken to satisfy an area requirement cannot also satisfy the creative writing emphasis. Students with this major emphasis must receive letter grade indicators of “B” or better in Creative Writing classes.

**Major in English with Interdisciplinary Emphasis**—This major is intended for students who wish to combine the study of literature of one 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 (see Courses and Degrees on opportunities for advanced study).

**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 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 litera-
ture, totaling at least 20 units and read in the 
original. The program of each student must be 
approved by the departments involved as spec-
cified 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 depart-
ments involved as specified above.

HONORS PROGRAM

Students who wish to undertake a more exten-
sive program in English literature, including tu-
torials, 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 admis-
sion will be announced in early December. Per-
mission 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 be-
tween the following two options: (1) At Oxford, 
they may take two quarters of the seminar se-
quence offered by St. Catherine’s College, Ox-
ford, 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 De-
partment lecture courses, registering for three 
rather than five units. With each course they will 
also take a five-unit tutorial (196T) on the same or 
related material with an advanced graduate stu-
dent.

(Either the two St. Catherine’s seminars or the 
10 units of tutorial work taken at Oxford, 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 as stated in Courses 
and Degrees.)

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 five unit 
Senior Honors Seminar on Critical Approaches 
to Literature. In the Winter Quarter, they will 
take a three-unit Essay Workshop, normally 
taught by the Director of the Honors Program. 
The workshop will focus on the process of re-
searching 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 com-
plete the following Program:

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 equiv-
alent to that required of regular honors stu-
dents.

ADDITIONAL ADVANCED WORK

INDIVIDUAL RESEARCH

Students taking 100 or 200 level courses may, 
with the consent of the instructor, write a fol-
low-up 5 unit paper based on the course mater-
ial and due no later than the end of the succeed-
ning 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 submit-
ted 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 integrat-
ing 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” num-
ber “Honors Program in English”). Applicants 
should contact an advisor in the department.

HONORS PROGRAM IN HUMANITIES

An Honors Program in Humanities is avail-
able for majors of this department who wish
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 wishing to take the Comparative Literature option within the Honors Program in Humanities should see the section "Comparative Literature" 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 section "Degrees" in this bulletin.

Eligibility—A student may enter upon graduate work toward an advanced degree in English at Stanford if he or she received a bachelor’s degree of acceptable quality. (Formal application for candidacy is a separate step taken somewhat later.) Students whose previous preparation falls short of the requirements for the degree of Bachelor of Arts in English at Stanford will be expected to make up deficiencies. Credits for previous graduate work at Stanford or elsewhere more than five years old may be reevaluated or rejected.

Graduate students are admitted only as candidates in one of the following programs: the Ph.D., the Master of Arts in English and American Literature, the Master of Arts in 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 9 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 List for Doctoral Candidates. Normally, no more than two courses taken outside the department may be counted toward the degree, but the Graduate Studies Committee will consider exceptions.

Candidates who can demonstrate unusually strong preparation in the history of English literature may undertake a master’s essay, which will normally be about 40-60 pages in length. Such candidates should register for 15 units of English 398 with the faculty member who will supervise the work on the essay. Candidates who write a master’s essay may petition to be excused from up to 15 units of the requirements described above. The additional 30 units will normally consist of the courses chosen by the student and approved by the advisor and the Director of Graduate Studies.
2. Demonstration of a reading knowledge of one foreign language. (For the ways of fulfilling this requirement, see the section below on language requirements for the Ph.D.)

Candidates for a coterminal master's degree must fulfill all requirements for the Master of Arts in English (including the Language Requirement), as well as General Requirements and Major Requirements for the A.B. in English. A minimum LGI of 3.5 in the major is required of those applying for the co-terminal master's degree. See description of programs under the "Degrees" section of this bulletin.

Candidates for the Master of Arts in Teaching must complete a minimum of two-thirds of their specified work in the English Department.

Candidates for the master's degree in Creative Writing must submit a sample of their writing with their application. Should this sample be approved, the candidate will be provisionally admitted to the program, but will not be finally accepted until he or she has demonstrated ability through one quarter's work in an advanced writing course. A candidate may then earn the master's degree by passing satisfactorily 11 courses of specified work (including the qualifying graduate writing course) and one foreign language, and by submitting a piece of imaginative writing of substantial length and merit. This must be submitted at least four weeks before the close of the quarter in which the degree is to be granted.

Candidates for the master's degree in Creative Writing who, after a quarter's work, are not accepted as degree candidates in the writing program may earn the master's degree in English by completing satisfactorily nine courses of specified work and by passing one foreign language.

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 the teaching field and 12 units in the School of Education. Detailed requirements for the course are outlined in the "School of Education" section of this bulletin.

Candidates for the Master of Arts in Teaching may also qualify for the State of California Community College Instructor Credential by completing additional units of academic work at the graduate level. For further information consult the Credentials Administrator, Room 110, School of Education, early in the Autumn Quarter.

DOCTOR OF PHILOSOPHY

University regulations regarding this degree are discussed in the "Degrees" section of this bulletin. The following departmental requirements, dealing with such matters as residence, dissertation, and examinations, are in addition to the University's basic requirements for the doctorate.

A candidate for the Ph.D. degree must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the bachelor's degree. He or she will be expected to offer at least 97 units of graduate work in addition to the doctoral dissertation. At least three consecutive quarters of graduate work, and also the last course work in the doctoral program, must be taken at Stanford.

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 must take at least 70 units (normally 14 courses) of the 97 in classroom courses (that is, courses other than 396, 397, 398, and 399), of which no more than 15 units (normally 3 courses) may come from courses numbered 100-199.

Normally, this program should be completed in four years. The first year should be devoted to full-time graduate study; the second and third years to graduate study and teaching; the fourth year to writing the dissertation. Three and one-half quarters of supervised teaching are a required part of the Ph.D. program.

A candidate may take the Ph.D. degree in English Literature, in English and American Literature, in English and Comparative Literature, in English and Humanities, in English and Linguistics, in English Philology, or in English Medieval Literature.

ENGLISH LITERATURE

Requirements are as follows:

1. A five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.

2. A minimum of six courses for a letter grade from the graduate colloquia and graduate seminars, of which at least three must be graduate seminars. These colloquia and seminars should be from different genres and periods as approved by the advisor.

3. A two-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a five-unit course on teaching composition.
4. Students are encouraged to take an advanced course in literary theory or criticism.

5. A minimum of 60 additional units of graduate courses and seminars (excluding 396, 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 five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.

2. A minimum of 35 units of graduate courses in American literature and 35 units in English. Among these, a minimum of six courses for a letter grade from the graduate colloquia and graduate seminars, of which three must be in American literature, and of which at least three must be graduate seminars. The colloquia and seminars should be in different genres and periods as approved by the advisor.

3. A two-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a five-unit course on teaching composition.

4. Students are encouraged to take an advanced course in literary theory or criticism.

5. A student must have the consent of the advisor to have courses taken outside the English Department count toward the requirement of 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 two-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a five-unit course on teaching composition.

4. A knowledge of one foreign language comparable to that demanded under the basic program and an advanced reading knowledge of a second language.

5. A minimum of 45 units in the history, thought, and literature of one period, in two or more languages, one of which must be English and one foreign. Students will normally include at least two courses in a foreign literature read in the original language and two courses listed under Comparative Literature or Modern Thought and Literature. As much as 20 units of this requirement may be satisfied through courses in Reading and Research. A student may receive graduate credit for three courses numbered 101-199 in the offerings of the English Department.

6. A minimum of 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 five-unit course in Old English, a five-unit course in Middle English, and English 102 (History of the English Language) for five units.

2. A minimum of three seminars in different genres and periods as approved by the advisor. The student will normally take a total of six courses from the graduate colloquia and graduate seminars.

3. A two-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a five-unit course on teaching composition.

4. Students are encouraged to take an advanced course in literary theory or criticism.

5. A minimum of 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. The 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 periods (i.e., after the Renaissance) must offer either Latin or French or German as one language and may choose the second language from
following: Greek, Latin, French, German, Italian, Spanish. In all cases, the choice of languages offered must have the approval of the candidate's advisor. Any substitution of another language must be approved by the Graduate Studies Committee.

The Graduate Studies Committee will not accept courses taken as an undergraduate in satisfaction of the language requirement for doctoral candidates. For students coming to doctoral work at Stanford from graduate work done elsewhere, satisfaction of a foreign language requirement accepted at the other institution will normally be accepted here.

The candidate must satisfy one language requirement by the end of the first year (that is, before registration in the following year), and the other by the end of the third year.

Foreign language requirements for the Ph.D. may be fulfilled in any of the following ways:

1. Achievement of a sufficiently high score (70th percentile) on the foreign language examination prepared by the Educational Testing Service. Latin and Greek are not tested by ETS.
2. A reading examination given each quarter by the various language departments, except for Latin and Greek.
3. For Latin and Greek, an examination by the English Department. The Latin examination will be given before registration in the Autumn Quarter in order to permit those who need the course to register for Latin 3. It will also be given in the eighth week of the Winter and Spring Quarters, along with other departmental examinations for languages not tested by the Educational Testing Service.
4. Passage with a 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 section "Humanities Special Programs" 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 section "Modern Thought and Literature" 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
Seminars for English Majors: 180-189
Graduate Colloquia: 300-307
Overseas Campus Courses: 46-49, 146-149
Writing Courses, Workshops, Individual Study, etc.: 90-99, 190-199, 290-299, 300-399

INTRODUCTORY

Classes designed for students whose major is undeclared or is not in English.

Drop-In Tutorials—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, 2. 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. (DR:W)

1A, 2A. Writing Workshops: Thematic—These focus on a subject matter that reflects the instructor’s interest or expertise. The writing is largely based on discussions arising from a body of reading on the subject matter. (DR:W)
3 units, Aut-Win, Win-Spr (Staff)

1B, 2B. Writing Workshops: Prose Writing—These focus directly on student writing with special texts used as examples of different kinds of writing. (DR:W)
3 units, Aut-Win, Win-Spr (Staff)

1C, 2C. Writing Workshops: Tutorial—Focus is on individual conferences. One class meeting a week to discuss general writing techniques, plus all students meet once a week with the instructor to discuss their own writing. (DR:W)
3 units, Aut-Win, Win-Spr (Staff)

1D. Critical Reading and Writing—(Same as Center for Teaching and Learning 8.) This focuses on reading and writing. Students meet four times weekly in class and once in tutorial. (DR:W)
5 units, Sum (Staff)

3. Intensified Freshman English—A special, 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 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, 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, the 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 to fulfill the usual five units per quarter. But priority goes to those who take advantage of the opportunity this track offers to fulfill both the Western Culture requirement and the Writing Requirement simultaneously. These students meet their seminar instructors in additional class sessions and conferences other than those described above; they take the sequence for eight units during Autumn and Winter Quarters, and five units during Spring (the total is the same as if the requirements were fulfilled separately). Priority in this track also goes to those students with a 4 or 5 score on the English Advanced Placement who elect to satisfy the Writing Requirement through English 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, Sum (Wack, Staff) lectures plus sections

8. Renaissance and Enlightenment—Readings stretch from the Renaissance to the Enlightenment and include texts by Machiavelli, More, Shakespeare, Milton, Swift, Voltaire, and Mary Wollstonecraft. (DR:1)
8 units, Win (Riggs, Staff) lectures plus sections

9. The Modern World—Modern thought and literature from the English Romantics
through Austen and Dickens, to Marx, Darwin, Freud, Woolf, and Ellison. (DR:1)

5 units, Spr (Friedlander, Staff) lectures plus section

10. 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, Aut (Ryan)

11. Masterpieces of English Literature II: From the Enlightenment to the Modern Period—(English majors and other students taking the course for 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, Win (B. Gelpi)

12. Masterpieces of American Literature—(English majors and other students taking the course for 5 units, register for 112.) A reading of works by the following major American writers against their intellectual and cultural backgrounds: Thoreau, Hawthorne, Melville, Whitman, Dickinson, Mark Twain, James, Frost, Eliot, Hemingway, Fitzgerald, Faulkner. (DR:2)

3 units, Spr (A. Gelpi)

30. The Novel—(English majors and other students taking the course for 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 (Watt)

40. Drama—(English majors and other students taking the course for 5 units, register for 140.) Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries. (DR:2)

3 units, Aut (L'Heureux)

50. Poetry and Poetics—(English majors and other students taking the course for 5 units, register for 150.) An introduction to the reading of poetry through a variety of poems, with attention to the ways the meanings of the poems are shaped through diction, imagery, figurative language, and technical elements of verse. (DR:2)

3 units, Aut (Rich)

Win (Di Piero)

Spr (Perloff)

64B. Arthurian Literature—(English majors and other students taking the course for 5 units, register for 164B.) A survey of medieval classics (in translation) that recount the legends of Arthur and his companions. Focuses on the relation between history and fiction, and on the social and political uses of literature. (DR:2)

3 units, Win (Wacker)

73. Shakespeare—(Same as Drama 59.) A reading of representative comedies, histories, and tragedies. For the general student as well as the prospective English major. (DR:2)

3 units, Win (Lyons)

79. Fitzgerald and Hemingway—(English majors and other students taking the course for 5 units, register for 179A.) (DR:2)

3 units, Win (Islas)

90. Fiction Writing—Basic problems of narrative and imaginative writing. Prerequisite: Completion of the writing requirement.

5 units, Aut, Win, Spr (Becker, Carter, Havazelet, McNeal)

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 (Daniel, Di Piero, Wasserburg)


BASIC UNDERGRADUATE SURVEYS, SEMINARS, AND WORKSHOPS

Note—Graduate students may receive graduate credit for 3 courses numbered 101-199.

103. The English Language through American Literature—(Same as Linguistics 77.) The “American language” through the cultural history of those who have written and read American literature since 1825. Emphasis on discourse analysis and the phonological, syntactic, semantic, and pragmatic features of language (including regional and social dialects) of texts by Emerson, Twain, Whitman, Howell, James, Stein, Eliot, Hughes, Williams. (Area: A)

5 units, Spr (Heath)

104. Language and Literary Theory—(Same as Linguistics 78.) An introductory intellectual history of the role of language study in literary theories focusing on text analysis, author's intentions, reader response, and institutional interpretive communities. Focus is on their appli-
cation of concepts from the science of language, and linkages between their originators and the study of linguistics. (Area: A) (DR:4)

5 units, Win (Heath)

110. Masterpieces of English Literature I: Chaucer, Shakespeare, Milton, and Their Contemporaries—(See 10.)

5 units, Aut (Ryan)

111. Masterpieces of English Literature II: From the Enlightenment to the Modern Period—(See 11.)

5 units, Win (B. Gelpi)

112. Masterpieces of American Literature—(See 12.)

5 units, Spr (A. Gelpi)

113. English Literature—A basic survey.

113. The Renaissance—(Area C)

5 units, Win (Orgel)

Spr (Biggs)

115. Survey of 18th-Century Literature—

(Area: C)

5 units, Spr (Castle)


5 units, Aut (Gagnier)

121. American Literature and Culture to 1855—(Same as American Studies 150.) (Area: G)

5 units, Aut (Fliegelman) MTWTh 10

123. American Literature, 1917 to the Present—(Area: H)

5 units, Spr (Fields)

125. American Fiction, 1917-1945—(Area: H)

5 units, Win (Moser)

128. Reflections on the American Condition

—(Same as American Studies 100, History 174.) Inter-disciplinary perspective of the analytical techniques of history and literary criticism as reflected in the American character in imaginative literature. Readings: classic American works that try to come to grips with "the complex fate of being an American." Authors: Henry James, Ralph Waldo Emerson, Henry David Thoreau, Mark Twain, Harriet Beecher Stowe, Edith Wharton, Ralph Ellison, and Norman Mailer. (Area: G or H) (DR:2 or DR:3)

5 units, Aut (Chace, Kennedy)

130. The Novel—(See 30.)

5 units, Win (Watt)

131A. The 18th-Century English Novel—(Area: E)

5 units, Aut (Bender)

132. The 19th-Century English Novel—(Area: F) (DR:2)

5 units, Spr (Polhemus)

133. The 20th-Century English Novel. (Area: H) (DR:2)

5 units, Win (Ruotolo)

140. Drama—(See 40.)

5 units, Aut (L'Heureux)

150. Poetry and Poetics—(See 50.) (Area: F)

5 units, Aut (Rich)

Win (Di Piero)

Spr (Perloff)

152. Classic to Romantic: 18th-Century Poetry—Explores mid- and later 18th-century poetry (from Pope to Wordsworth), considering transformation of genres such as epic, verse epistle, and ballad. Questions the traditional assessment of this period as "pre-Romantic." (Area: E)

5 units, Spr (Donoghue)

154A. Major Romantic Poets—Explores the assumptions of English Romanticism through selected readings from the works of Blake, Wordsworth, Coleridge, Byron, Shelley and Keats. (Area: F)

5 units, Aut (Dekker)

154B. Romantic, Victorian, and Modern Poems—Readings from Blake, Coleridge, Keats, Tennyson, Browning, Arnold, Emily Bronte, Whitman, Dickinson, Hopkins, Yeats and Eliot, to trace the persistence of Romantic concerns. (Area: F)

5 units, Win (Felstiner)

161 A. The Afro-American Novel—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. (Area: H)

5 units, Aut (Drake)

162B. Chicano Literature: Creative Writing for Bilingual Students—(Same as Spanish 462B.)

5 units, Aut (Islas)

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 poetry (DR:2).

5 units, Aut (Felstiner)

164B. Arthurian Literature—(See 64B)

(Area: B)

5 units, Win (Wack)

165A. Literature of the Holocaust—How has the literary imagination envisioned the destruction of European Jewry? The Holocaust
American responses, seen through documents, diaries, fiction, poetry by Applefeld, Borowski, Delbo, Wiesel, Kosinski, Celan, Roth, Malamud, and through visual art. Survivors will address the class.

5 units, Spr (Felstiner)

166A. Literature and Politics in South Africa—(Same as German Studies 168A.) A study of the impact of political and social conflict in South Africa on writing and literary life. With reference to the historical context, addresses the changing literary articulations of politics, the status of the political novel and essay, the transformation of the stage and the role of the author in political controversies. Texts by Biko, Breytenbach, Brink, Brecht, Gordimer, Head, La Guma, Mtwa, Ndebele. All readings in English.

4 units, Win (Berman) MWF 11

169A. 19th-Century Narrative—A study of 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, Spr (Parker)

171A. Chaucer’s Canterbury Tales—(Area: B) 5 units, Aut (Brown)

171B. Chaucer’s Troilus and the Dream Poems—(Area: B) 5 units, Spr (Osberg)


(Area: D) (DR:2) 5 units, Aut (Friedlander)

173B. Shakespeare—(Same as Drama 159B.) Richard III, Romeo and Juliet, The Merchant of Venice, Henry IV: Part One, As You Like It, Othello, Macbeth, The Winter’s Tale.

(Area: D) (DR:2) 5 units, Win (Ryan)

173C. Shakespeare—(Same as Drama 159C.) Romeo and Juliet, Othello, Troilus and Cressida, Twelfth Night, Hamlet, The Tempest.

(Area: D) (DR:2) 5 units, Spr (Orgel)

178. Dickens, Trollope, and Eliot—(Area: F) 5 units, Win (Polhemus)

179. Melville—Emphasis on Melville’s writings of the 1850s in relation to the social and cultural history of the period and to Melville’s own life. Works include Typee, Moby Dick, Pierre, and stories such as “Bartleby, the Scrivener” and the “Encantadas.”

(Area: G) 5 units, Spr (Miller)

179A. Fitzgerald and Hemingway—(See 79.)

(Area: H) 5 units, Win (Islas)

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.

181A. The Development of the Heroic Ethos in Medieval Narrative: 750-1400—(Area: B) 5 units, Win (Steidle)

182A. Elizabethan and Jacobean Drama—(Area: C) 5 units, Win (Friedlander)

182B. Humanism and Militarism: The Problem of War in Renaissance Literature—(Area: C) 5 units, Spr (Marx)

183A. Shakespeare Through Performance—(Area: D) 5 units, Spr (Friedlander)

184A. Creating Lives: Walton to Wordsworth—(Area: E) 5 units, Win (Fifer)

185A. Decadents and Aesthetes—(Area: F) 5 units, Aut (Gagnier)

185B. Dickens and Balzac—(Area: F) 5 units, Spr (Paulson)

186A. American Autobiography—(Same as American Studies 203.) (Area: G or H) 5 units, Aut (Fiegelman)

187A. Psychological Themes in American Fiction, Poe to Hawkes—(Area: G or H) 5 units, Win (Moser)

187B. American Lives—(Same as American Studies 223, Chicano Studies 183.) (Area: H) 5 units, Win (Islas)

187C. Modern Comic Fiction—(Area: H) 5 units, Spr (Polhemus)

187D. Studies in Afro-American Poetry—(Area: H) 5 units, Spr (Thompson)

189A. Medicine and Culture in America—(Same as American Studies 215.) (Area: J) 5 units, Aut (Burbick)

189B. The Practice of Criticism—(Area: J) 5 units, Win (Perloff)

190. Intermediate Fiction Writing—May be taken twice. Prerequisite: 90. 5 units, Aut, Win, Spr (Becker, Carter, Havazelet, McNeal)
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, Win (Joly)

191B. Writing About Social Sciences. 3 units, Win (Heath)

191C. Writing About Business. 3 units, Spr (Harvey)

191D. Writing About Law. 3 units, Spr (Johnstone)

191E. Advanced General Composition. 3 units, Spr (Luftig)

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 five units of credit is given for 195 and/or 198 in any one quarter. 195 may not be used to fulfill departmental area or elective requirements without permission.

   any quarter, by arrangement

196B. **Senior Honors Seminar**—Required of all seniors in the English Honors Program. 5 units, Aut (Halliburton)

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 five 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 he or she prepares an appropriate reading list before the end of the Spring Quarter.

   10-15 units (for the entire year)

   Aut, Win, Spr (Staff)

**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.

200A. Introduction to Old Norse-Icelandic—(Same as German 205A/305A.) (Area: A) 5 units, Aut (Gade)

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 (Brown)

212A. Medieval to Renaissance: The Development of Literary Forms—The adaptation of established or emerging literary genres and conventions to the changing moral and intellectual attitudes toward the arts during late antiquity, the Middle Ages, and the Renaissance by means of a central distinction and its corollaries. Elucidates certain literary works by accounting, in the light of these distinctions, for their choice of genre, their procedures of organization, and their style. (Area: B) 5 units, Aut (Trimpi)

212B. Medieval to Renaissance: The Development of Literary Forms—(See 212A.) (Area: C) 5 units, Win (Trimpi)

224. Literature of the Southern Renaissance—Examination of southern writers of the 1920s-30s, a period of fundamental social and cultural transformation. Themes include the burden of the past, the Southern family, gender and race relations, narrative innovation, and the quality of Southern rhetoric. Works by Faulkner, Katherine Anne Porter, Jean Toomer, Eudora Welty, and the Southern Agrarians (Area: H) 5 units, Aut (Miller)

239. **American Short Fiction**—(Area: C or E) 5 units, Win (Fields)
257. Yeats, Lawrence, Auden—(Area: H)
5 units, Spr (Perloff)

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 (Wynter)

263A. Seminar in Feminist Studies—(Same as Feminist Studies 103/203.) For upper-level undergraduates and graduate students. The reading from documentary sources from the women's liberation movement of the 1970s and 1980s, emphasizes race, class, and ethnicity as feminist issues. Enrollment limited to 20. Prerequisite: Feminist Studies 101 undergraduates; any feminist studies course for graduates.
5 units, Aut (Rich) MW 1:15-3:05

266. The American Enlightenment—Examines the writings of such major figures of the American enlightenment as Franklin, Adams, Jefferson, Madison, and Paine with attention to European contemporaries, American antecedents, and a variety of cultural contexts. (Area: G)
5 units, Win (Fliegelman)

285B. Twain and James—Writings by Mark Twain and Henry James, comparing their themes, motifs, ideas, and techniques. Includes Tom Sawyer, Huckleberry Finn, and A Connecticut Yankee, and James' The Turn of the Screw, Portrait of a Lady, and various short novels and stories. (Area: G)
5 units, Aut (Halliburton)

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. Verse Translation Workshop—Members pursue and present work in progress, discussing practical and theoretical questions. Consult instructor during previous quarter.
5 units, Spr (Felstiner)

293A. Technique for Fiction Writers—Engages the student in critical reading, from the perspective of the writer as apprentice. Focus is on the craft of the masters, using close textual analysis to unravel, where possible, the fabric of their mastery. Student work is also examined. Prerequisites: 90, 190, and submission of manuscript.
5 units, Spr (Carter)

301. Colloquium: Medieval Romance—Backgrounds and Influence—A comparative study of medieval romance in relation to Greek and Latin antecedents, and its later legacy. Selections from Chrétien de Troyes and the Roman de la rose, and major English romances up to Malory.
5 units, Spr (Parker)

5 units, Aut (Trimpi)

303A. Colloquium: 18th-Century Satire—Theory and practice of satire from Dryden to Johnson; readings also include Swift, Pope, Defoe, and Gay.
5 units, Aut (Carnochan)

303B. Colloquium: High Life and Low Life—The Relation between Polite and Popular Forms in 18th-Century Literature—The relations between mainstream or "high" Augustan culture and subculture forms, using representative works like The Beggar's Opera, Jonathan Wild, Moll Flanders, and the Hogarth progresses.
5 units, Win (Castle)

5 units, Aut (Polhemus)

304B. Colloquium: Theories of Romanticism—Major statements on Romanticism from Arnold to the present and readings of major Romantic texts. Changing attitudes to the period are treated as representative of the development of modern criticism as a whole.
5 units, Spr (Lindenberger)

306. Colloquium: Afro-American Women Novelists—The emergence and development of Afro-American women's fiction emphasizing the modern period in historical context. Issues: How the position in U.S. society of the Afro-American community as a whole, and of Afro-American women in particular, affected thematic and stylistic characteristics of Afro-American women's fiction; how the Afro-American tradition of literary criticism, and that of the dominant society, functioned to validate and invalidate literature by Afro-American women; and how the Civil Rights and Feminist movements of the last 25 years affected Afro-American women's fiction. Novel-
ists include Zora Neale Hurston, Toni Morrison, Alice Walker and Gloria Brewster.
5 units, Win (Drake)

307A. Colloquium: Subjectivity and Value—A graduate seminar on cross-class and gendered subjectivity and literary value. Texts are 19th- and early 20th-century British, primarily autobiography; also, contemporary critical theory.
5 units, Win (Gagnier)

307B. Colloquium: Feminist Literary Criticism in the 1980s—The major themes (and conflicts) now engaging feminist literary critics through the shifting interactions of liberal, Marxist, and psychoanalytic thought. Focus is on two areas: French theory on the construction of the subject, cultural theory on the construction of the canon.
5 units, Win (B. Gelpi)

307C. Colloquium: Psychoanalysis and Theory—(Same as Comparative Literature 385.) The writing of Freud and Lacan in relation to recent developments in literary criticism and theory.
5 units, Win (Parker, Patricia) W 3:15-6:05

313. Research Seminar: Methods and Materials for the Study of Modern Literature—Some prevalent methods of inquiry into post-Enlightenment British and American literature (1750 to the present), accompanied by 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 discussion of 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)

320. Seminar: The '90s: American Literature and Culture—Study of writings published in the last decade of the 19th century including Stephen Crane, Henry James, Mark Twain, Sarah Orne Jewett, and Frank Norris, but also Harold Freidric and Hamling Gardland and overlooked authors who need to be incorporated into the canon. Attention to the general culture milieu of the period.
5 units, Spr (Halliburton)

330. Seminar: Theory of Narrative—(Same as Salvic Languages 300.)
5 units, Spr (Todd) MW 1:15-3:05

5 units, Aut (A. Gelpi)

360C. Neoclassicism, Aestheticism, and Modern Criticism—Emphasizes the degree to which the Neoplatonic reconstruction of classical literary and aesthetic theory has provided the intellectual foundations for the development of criticism since the Renaissance.
5 units, Spr (Trimpit)

5 units, Aut (Berman)

362. Seminar: Avant-Garde Poetics: The Intersection of Poetry and Theory—For those who have a basic background in later 20th century poetry who want to explore "poetheory": the interface of poetry and theory in Derrida's La Carte Postale, Barthes' Empire of Signs and Lover's Discourse, Michel Serres' The Parasite, John Cage's Silence, M, For the Birds, and Roaratorio, Laurie Anderson's United States; "language poets," Clark Coolidge, Lyn Hejinian, Ron Silliman, and Charles Bernstein; "performance" and "visual" poets, Steve McCaffery, Johanna Drucker, and David Antin. The relationship of these writers to "official verse culture." Is an avant-garde in the late 20th century possible, or is the avant-garde always already co-opted by the establishment?
5 units, Win (Perloff)

363. Seminar: Ethnic/Feminist Autobiography—Baldwin, Rivera, Rich, Hellman, Hong Kingston, Capote, Moraga, Momaday, and others. In what ways does autobiography serve the causes of the disadvantaged and disenfranchised? Does autobiography change when it is written from a non-mainstream perspective? Have women writing about themselves and members of ethnic minorities writing about their experiences from within contributed to understanding North American life and myths?
5 units, Spr (Islas)

366A.B. Seminar: The Idea of a Theater in the Renaissance—Two quarter seminar on theater 1550-1670. Explores what ends it was designed to serve, what the function of its mimesis was, what sort of social and political reality it had i.e., what it was both as an institution and a concept. Material relates as much to playhouses, theories of drama, attacks on and defenses of the stage, as to the texts of plays.
First quarter: readings, methodology and questions of evidence. Second quarter: projects out of the first term’s work, initiated by the participants and eventuating in the preparation of a serious scholarly paper of publishable quality. With the consent of the instructor, students with relevant projects may be admitted to the second term without having taken the first.

366A. 5 units, Win (Orgel)
366B. 5 units, Spr (Orgel)

368. Seminar: Theory, Feminism, and the Third World—(Same as Comparative Literature 380.) Considers the relationship between feminism and post-structuralism focusing on theoretical texts, the question of Marxism in this field, and the transformations demanded by the insertion of this theoretical material into the situation of Third-World feminism, i.e., India. Enrollment limited to 25. No auditors.

369. 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 rejections in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault). 5 units, Aut (Bender, Wellbery)

370. Seminar in Old English Prose—For graduate students with some training in Old English. Linguistic, literary, critical, and cultural analyses of selected Old English prose narratives. 5 units, Win (Brown)

385F. Seminar: Faulkner. 5 units, Aut (Moser)

388A. Seminar: Virginia Woolf. 5 units, Win (Ruotolo)

388B. Seminar: Joseph Conrad. 5 units, Aut (Watt)

389. 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 rejections in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault). 5 units, Aut (Bender, Wellbery)

390. Graduate Fiction Writing — A workshop primarily for graduate students enrolled in the Writing Program. May be repeated for credit. Prerequisite: Consent of instructor.

3-5 units, Aut (Packer)
Win (L’Heureux)
Spr (Michaels)

391A. Rhetoric and Teaching Composition—A required course 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. The apprentice sits in on classes, conferences, tutorials; later, the apprentice 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. Offered on a Pass/No Credit basis only.

5 units, Aut (Fifer)

391B. Teachers Workshop I—A seminar for second-year students who will be teaching composition. (Second-year students are advised to enroll in this course and 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

391C. 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.

REGULARLY OFFERED BUT NOT DURING 1987-88

5. Introduction to Literature.
63. 20th-Century American Women Poets.
64. The English Bible as Literature.
64A. The Biblical Presence in Modern Poetry.
68. American Indian Mythology, Legend, and Lore.
101. Linguistics and Literature.
102. The History of the English Language.
105. Linguistic Approaches to Point of View in Fiction—(Same as Linguistics 72.)
117. Romantic and Victorian Literature.
119. Modern British Literature.
120. American Historical Novel.
122. American Literature, 1855-1917.
126. American Fiction, 1940 to the Present.
134C. American Fiction: Romance to Realism.
137. Development of the Short Story.
142. Medieval and Renaissance Drama.
153. Visions and Transformations.
161. Afro-American Literature.
   161B. Afro-American Poetry.
   161F. The Harlem Renaissance.
162A. Chicano Literature.
162E. Introduction to Caribbean Poetry: English, French, Spanish.
162F. Modern Literature of the Caribbean.
163C. English Women Writers.
163D. The Female Experience: Victorian Heritage.
163E. Women's Situation.
163F. Women Writers: The Literary Tradition.
163H. Contemporary Issues in Feminist Theory—(Same as Feminist Studies 102.)
164. The English Bible as Literature.
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.
172. Milton.
174. Swift.
175. Johnson and His Contemporaries.
177. Virginia Woolf.
177A. The Brontes and Elizabeth Gaskell.
179B. Faulkner.
180. Undergraduate Seminar: English Language.
188. Undergraduate Seminar: Poetry.
200B. Advanced Old Norse.
201. Old Saxon.
202. Topics in the History of the English Language.
209. Introduction to Paleography and Codicology.
211. Readings in Middle English.
214. Representations of Women in 18th-Century Literature—(Same as Feminist Studies 161.)
216. The Romantic Age: Revolution and Revival.
   216A. The Generation of Wordsworth and Austen.
   216B. Byron, Shelley, Keats, and Their Contemporaries.
217A. The Bloomsbury Group.
227. Modern Southern Writers.
234. American Fiction and Prose.
234A. Colonial American Prose.
234C. American Fiction: Romance to Realism.
234D. Critics of America.
234E. Modern American Literary Critics.
235. Impressionist and Experimental Novel.
242. Elizabethan and Jacobean Drama.
250. Poetry and Poetics.
253C. From Classic to Romantic: English Poetry of the Later 18th Century.
255A. Modern British Poetry.
256. Emerson, Whitman, Dickinson.
259A. Symbolist Poetry, French and American.
260. 19th-Century Discourse.
262. Aestheticism: Its Roots and Branches.
263B. Gender and Interpretation.
263C. Feminist Literary Criticism: Theory and Practice—(Same as Feminist Studies 170/270.)
267. Freud and Literary Criticism.
269C. The Poet and the Artist in American Modernism.
269E. American Modernist Poets.
270A. Beowulf.
273. Advanced Study of Shakespeare.
280. Tennyson and Browning.
281. Keats and His Circle.
281A. Dickens and Trollope.
284. Hawthorne and James.
285A. Poe and Hawthorne.
285C. Gertrude Stein and Ezra Pound.
288A. Joyce.
288C. Yeats and T.S. Eliot.
290. Advanced Fiction Writing.
290A. Reading for Fiction Writers.
290B. The Writing and Criticism of Fiction.
291. Generative Devices in Fiction Writing.
311. Seminar: Methods and Materials for the Study of Medieval Literature.
312. Seminar: Methods and Materials for the Study of Renaissance Literature.
315. Literary Problems of the Restoration and the 18th Century.
315A. Seminar: The British Enlightenment.
316A. Seminar: Studies in Romanticism.
355. Seminar: Shelley and His Circle.
360A. History of Literary Theory (Ancient).
360B. History of Literary Theory (Medieval/Renaissance).
364B. Seminar: The Bloomsbury Group.
365. Topics in American Literature.
365A. Seminar: The American Historical Romance.
365B. American Literature and Culture in the 1840s.
371. Seminar: Chaucer’s Early Works in Relation to His Times.
373. Seminar: Shakespeare.
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.
388. British Authors of the 19th and 20th Centuries.
388F. Seminar: Joyce’s *Finnegan’s Wake*.
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 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”). Further information on Individually Designed majors is available at the Undergraduate Advising Center, Sweet Hall, First Floor (415) 723-2374.

The Individually Designed Major in Feminist Studies may be taken as a single major in conjunction with any other program. Further information may be obtained from the Feminist Studies office.
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 indicating 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 the 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 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:

   101. Introduction to Feminist Studies: Issues and Methods
102. Contemporary Issues in Feminist Theory
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 in the core 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 150-189. Courses that offer a cross-cultural perspective include 138, 140, 142, 149, 167, 368.

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 for 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 two to six 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 Anthropology 12.) How gender inequality is created and perpetuated. Topics include feminist theory, the family, gender and work, sexuality, the politics of health and reproduction, domestic violence, and women’s culture. (DR:5)
5 units, Win (Collier) TTh 1:15-3:05

102. Contemporary Issues in Feminist Theory—Undergraduate seminar on the most recent developments of feminist theory, including both political and methodological concerns. 5 units, Spr (Freeman)

103/203. Seminar in Feminist Studies—(Same as English 263A.) Advanced feminist theory and research exemplifying feminist methodologies in both traditional and emerging disciplines. Topics include 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. Graduate students register for 203 with written application and permission of instructor. 5 units, Aut (Rich) MW 1:15-3:05

104. Practicum.

105, 106. Honors Work.

107. Feminist Research Methods in the Social Sciences—The theoretical, practical, ethical, and methodological issues involved in conducting feminist research in the social sciences. The development of a testable research project is required.
3 units, alternate years, given 1988-89

135/235. Women and Organizations—(Same as Business 378, Sociology 167.) A sociological examination of dilemmas faced by women in contemporary American organizations: both 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, Aut (Krieger) MF 1:20-3:05

146. Women, Sexuality, and Health—Health concerns of women. Topics: menstrual cycle disorders, contraception, infertility, pregnancy, menopause, nutrition, exercise, aging, stress, addictive disorders, rheumatoid arthritis, and women and the health care system. Psychological and physiological aspects of women’s sexuality are addressed.
4 units, Spr (Matteo)

175. German Women Writers of the 20th Century—The lives and works of German women writers through selected short stories, in English translation, as was lived and experienced by German-speaking people for the last 50 years. Topics: the trauma of WW II, the suffering and resistance under Nazi tyranny, the fate of the political exile, the division of Germany and Berlin into East and West, and the role of Germans in Europe today.
3 units, Win (Spitz)

263. Feminist Theory and Poststructuralism—Introduction to contemporary French feminist theory and the intellectual and historical contexts in which it emerged. Topics, psychoanalysis, philosophy, and semiotics, are examined in terms of the interactions between major feminine and masculine theorists. Authors include Clement, Irigaray, Montrelay, Torok, Lacan, and Freud (psychoanalysis); Cixous, Kofman, Bataille, and Derrida (philosophy); and Kristeva, Barthes, and Lyotard (semiotics).
5 units, Aut (Freeman) TTh 11-1

**GROUP 2: APPROVED COURSES IN DEPARTMENTS**

**HUMANITIES**

**DRAMA**

Feminist Studies 141. Drama and Gender—(Same as Drama 141.) Examines “male” and “female” in selected plays by women and men, and explores the possibility that both dramatic structure and content may be shaped differently by the author’s gender. Students organize and participate in readings of plays.
4 units, Win (Mathieson)
ENGLISH

115. Survey of 18th Century Literature—(Enroll in English 115.)
5 units, Spr (Castle) MTTh 9

118. Growing up in Victorian and Early Modern Britain—(Enroll in English 118.)
5 units, Aut (Gagnier) MW 1:15-3:05

185A. Decadents and Aesthetes—(Enroll in English 185A; for English majors.)
5 units, Aut (Gagnier) TTh 1:15-3:05

301. Colloquium: Medieval Romance—Backgrounds and Influence—(Enroll in English 301.)
5 units, Spr (Parker)

5 units, Win (Drake)

307A. Subjectivity and Value—(Enroll in English 307A.)
5 units, Win (Gagnier) TTh 1:15-3:05

307B. Feminist Literary Criticism in the 1980’s—(Enroll in English 307B.) The major themes (and conflicts) now engaging feminist literary critics through the shifting interactions of liberal, Marxist, and psychoanalytic thought. Emphasis on French theory or the construction of the subject, and cultural theory or the construction of the canon.
5 units, Win (B. Gelpi) TTh 1:15-3:05

363. Ethnic Feminist Autobiography—(Enroll in English 363.) Baldwin, Rivera, Rich, Hellman, Hong Kingston, Capote, Moraga, Monday, etc. In what ways does autobiography serve the causes of the disadvantaged and disenfranchised? Does autobiography change when it is written from a non-mainstream perspective? Have women writing about themselves and members of ethnic minorities writing about these experiences from within contributed to understanding North American life and myths?
5 units, Spr (Islas) T 7-10 p.m.

*368. Theory, Feminism, and the Third World—(Enroll in Comparative Literature 368, English 368.) The relationship between feminism and post-structuralism focusing on theoretical texts. The question of Marxism in this field. The transformations demanded by the insertion of this theoretical material into the situation of

Third-World feminism, i.e., India. Enrollment limited to 25. No auditors.
5 units, Spr (Spivak) W 3:15-6:05

FRENCH

185/268. Simone de Beauvoir—(Enroll in French 185/268.) A study of her fictional, philosophical, political and autobiographical writings, stressing the radicalization of a feminine consciousness in contemporary French bourgeois society.
4 units, Win (Giraud)

294A. Feminism in France: Contemporary French Women Poets—(Enroll in French 294A.)
4 units, Spr (Newman-Gordon)

ITALIAN

228. Italian Literature II: From Mannerism to the Modern—(Enroll in Italian 228.)
4 units, Win (Allen)

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, affirmitive action, pornography, abortion.
4 units, Spr (Roberts, Dupre) TTh 2:15-3:30

RELIGIOUS STUDIES

*158A. Buddhism and the Feminine—(Enroll in Religious Studies 158A.) An introduction to ideas and images associated with women and the feminine in Buddhist literature, rituals and society. The background of feminine imagery associated with the central Buddhist goals of compassion and wisdom, and with female Buddhas such as the Great Bliss Queen. The differences in East-West religious paradigms that bear on cultural characterizations of the feminine.
5 units, Aut (Klein) MW 4:15-6:05

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 an understanding how women and men are shaped by particular forms of social life.
(DR:5*)
3-5 units, Spr (Collier) MW 1:15-3:05

*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, Spr (Yanagisako) TTh 9-10:15

EDUCATION

Feminist Studies 127. Feminist Perspectives on Ethics and Education—(Same as Education 278.) Ethics in education from the transformative perspective of feminism. The problems of ethics and evil with emphasis on their significance for education. 4 units, Win (Noddings) MW 1:15-3:05

Feminist Studies 130. Gender and Education—(Same as Education 170, Sociology 112.) Gender as a critical variable in educational institutions and labor markets. Interdisciplinary approach to the distribution of power in schools, determinants of occupational choice, relative payoff of schooling for women and men, and the legal redress of inequalities. 4 units, Win (Cohen, Strober) MW 3:15-5:05

*Feminist Studies 138. Women and Development in Africa—(Same as Education 175X, Anthropology 109, African and Afro-American Studies 175X.) The diverse roles of women across the African continent, relating them to problems of development. Interdisciplinary approach links women to historical and contemporary conditions of African societies. 4 units, Spr (Samoff) TTh 4:15-6:05

HISTORY

*Feminist Studies 120. Middle Eastern Women Through Film—(Same as History 286.) 1 unit, Spr (Beinin)

Feminist Studies 121. U.S. Women's History 1620 to 1870—(Same as History 173A.) First quarter of a two-quarter survey of U.S. women's history. Women's relation to the economy, the family and state, changing ideals of womanhood; class, race and ethnic variations in female experience. Women's work and status in preindustrial America and during the Revolutionary era, industrialization and the middle-class 'female sphere,' wage labor and slavery; female reform and early women's rights movement. (DR:5)

5 units, Win (Freedman) MW 1:15-3:05

Feminist Studies 122. U.S. Women's History 1870-1985—(Same as History 173B.) Second quarter of a two-quarter survey. The transformation of Victorian womanhood in the late 19th century, including the workforce participation of immigrant and black women and the educational and professional opportunities for middle-class white women, the impact of wars and depression on 20th-century women's lives, and the rebirth of feminism.

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

171. History of Women and Health in America—(Enroll in History 171.) Topics relating to women's health and healing through American history, including sexuality, childbirth issues, aging, and women healers. 5 units, Aut (Horn) MW 2:15-4:05

262A. Undergraduate Colloquium: Race and Ethnicity in American Cities—History and Public Policy—(Enroll in History 262A.) Background for understanding public policy issues related to various racial and ethnic groups in American cities from historical and contemporary perspectives. 5 units, Win (Camarillo) M 2:15-4:05

263. Undergraduate Colloquium: Women in America—(Enroll in History 263.) Selected aspects of women's history in the U.S. from the 19th Century to the present. Readings include material from psychology, sociology, economics, history, and literature. 5 units, Spr (Degler) T 2-4

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 include 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, Aut (Freedman) M 3:15-5:05

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 part 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. 5 units, Aut (Ring) T 1:15-4:05

192V. Seminar: The Women's Movement—(Enroll in Political Science 192V.) Examines contemporary feminist arguments about the status of women in society; also, women in politics. 5 units, Spr (Bridges)
Feminist Studies 126. The Psychology of Women—(Same as Psychology 116.) Research and theory on the social and psychological development of women. The biological, cultural, and social factors that influence gender specific behavior.

3 units, Aut (Carstensen) TTh 10-11:15

Feminist Studies 133. The Psychology of Women and Violence—(Same as Psychology 180C.) The issues of violence against women—rape, battered women, child sexual abuse, sexual harassment, and the links between pornography and violence, studied from the psychological viewpoints of the experimental researcher and the clinician, and within historical, cultural, and sociological frameworks.

3 units, Aut (Staff) Th 2:15-5:05

Feminist Studies 186. Undergraduate Seminar: The Social Psychology of Women Without Men—(Same as Psychology 186.) Emphasis on the psychological and physical health of women who live without men; groups of focus include widows, lesbians, and religious orders of women and the distinct aspects of social interaction, attitudes, and behavioral organization. Prerequisite: Feminist Studies 126 or Psychology 116.

3 units, Win (Carstensen) TTh 10-11:15

230. Sex Roles and Socialization—(Enroll in Psychology 230.) The effects of traditional sex roles on the behaviors, attitudes, opportunities, and health of males and females; several theories of the origins and acquisition of social norms for behavior, especially sex roles; and the apparent changes currently taking place in sex roles and in socialization.

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

244. The Psychology of Aging—(Enroll in Psychology 244.) A critical examination of theory and research in gerontology and the 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, Spr (Carstensen) W 10-12:30

351. Issues in Child Custody—(Enroll in Psychology 351.)

3 units, Aut (Maccoby, Wald) T 4:15-6

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, Spr (Berger) MW 10 plus sections M or T 2:15-4

104. The Sociology of Gender—(Enroll in Sociology 104.) 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, Win (Walker) MWF 9

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, Aut (Dornbusch) given 1988-89

142. The Family—(Enroll in Sociology 142.) 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, Education 222.) Seminar on abnormal family and group processes resulting in emotional disturbances and behavioral disorders. Topics include 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, Berger) T 7-10 pm

APPROVED COURSES IN OTHER PROGRAMS

COMPARATIVE LITERATURE


5 units, Win (Parker, Patricia) W 3:15-6:05

FAMILY, COMMUNITY, AND PREVENTIVE MEDICINE

210. Women and Health Core—(Enroll in Family, Community, and Preventive Medicine 210.) 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.

1-3 units, Spr (Martin, Defoseph, Grudzen, Berlin)

HUMAN BIOLOGY

128. Biosocial Aspects of Sexually Transmitted Diseases—(Enroll in Human Biology 128.) Topics include the legal, psychological, historical, and policy implications of sexually transmitted diseases; their impact on maternal and child health, and controversy in strategies for control.

3 or 5 units, Spr (Schoolnick, Cerel-Bower) TTh 1-3

FOOD RESEARCH INSTITUTE

Emeriti: (Professors) Roger W. Gray, William O. Jones, Dudley Kirk, S. Daniel Neumark
Director: Walter P. Falcon
Associate Director: Anne E. Peck
Associate Professor: Jeffrey Williams
Assistant Professors: Sandra O. Archibald, A. Meredith John
Affiliated Assistant Professor: Julie Anderson (Economics)
Visiting Associate Professor: Christopher Wilson
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 leading to either the Master of Arts or Doctor of Philosophy degree is an integral part of the Institute's program. 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 a limited number of coterminal degrees for undergraduate students in Economics (and occasionally other departments). For admission, a student must have a minimum letter-grade indicator of 3.2. Prerequisites for admission include Economics 51 and 52 and, typically, one course in quantitative methods. Students must seek admission to the program prior to the end of the third quarter of their junior year. Application should be made to the Chairman of the Institute's Graduate Instruction Committee. In addition to meeting the requirements for the Bachelor of Arts, students are required to complete the requirements for the Master of Arts as stated below.

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 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 in the first four quarters at Stanford, with an LGI of "B" or better. The master's program is designed to equip students with specific skills, and admission is not encouraged for those desiring a Ph.D. from the Food Research Institute.

Qualified graduate students from other schools and departments may apply for an A.M. degree within the Food Research Institute. For such candidates, the same regulations prevail as for the regular A.M., except that the four-quarter rule may be waived. Applications should be made to the Chairman, Graduate Instruction Committee.
DOCTOR OF PHILOSOPHY

The first two years of the program for doctoral students consist of a series of required and elective courses totaling about 90 units. Economics 202, 203 (Price and Allocation Theory), Economics 210 (Macroeconomic Theory), 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 Graduate Instruction Committee.

Each student is required to prepare a detailed prospectus of his or her doctoral dissertation, which is subject to committee approval, and to defend 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 Chairman of the Graduate Instruction Committee of the overall program of work.

FELLOWSHIPS

The Food Research Institute has available a limited number of University fellowships for qualified students, ranging in amount of support to $7000 a year plus tuition. Instructions for applying for financial aid are included in the admissions 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, Spr (Johnston) MWF 10

105. Commodity Futures Markets and Prices—(Same as Economics 107.) (Graduate students register for 205.) The uses and functioning of commodity futures markets. Topics: business uses of the markets, the meaning and evolution of hedging practices, speculation, market performance issues and measures, and discussion of the economic role of futures markets.

5 units, Win (Peck) MW 10-11:50

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, market structure considerations, and complete commodity models. Links to micro-economic theory are drawn but emphasis is on empirical analysis and policy contexts.

5 units, Aut (Williams) TTh 10-11:50

121. Development and Population Interactions in the Third World — (Same as Economics 119.) 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, Win (Yotopoulos) TTh 1:15-3:05
139. 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 10-11:50

140. 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 agricultural 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 1:15-3:05


5 units, Win (Wilson) MW 10-11:50

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, Aut (John) TTh 1:15-3:05

138. Introduction to Epidemiology—(Same as Human Biology 106.) (Graduate students register for 238.) Topics include: 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, Aut (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 include the role of agriculture in American economic development, policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States 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, Spr (Archibald) MWF 9

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, Win (Josling) TTh 3:15-5:05

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 include: 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, Aut (Staff) TTh 3:15-5:05

166. International Trade Policy—(Same as Economics 166.) (Graduate students register for
266. Formulation and 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, multination commodity agreements and cartels, 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 (Arthur, Feldman, John) W 4:10-5:30

PRIMARILY FOR GRADUATE STUDENTS

205. Commodity Futures Markets and Prices—(See 105.)

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 with different economic and social structures, 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 include 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, such as 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 with emphasis on agriculture, and migration disequilibria.

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

225. Agricultural Development and Economic Growth—Selected aspects of rural/agricultural development, including dualistic models of development, economics of farm households, risk and uncertainty in agriculture, technical change, interlinked markets, and impact of land tenure and institutional structure. Emphasis on application of microeconomic theory to rural development; also, historical and current experiences of particular countries. Prerequisite: Advanced microeconomic theory, preferably Economics 202-203.

5 units, Aut (Staff) given 1988-89


5 units, Aut (Arthur) given 1988-89

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.)

248. Economic Development in China—(See 149.)
250. Nutritional Problems of Developing Nations—(Same as Anthropology 250, Human Biology 110.) The various malnutrition syndromes common in developing countries with emphasis upon 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 10-11:30

251. Food and Nutrition Strategies in Development—Major policy issues related to raising food consumption levels and improving nutritional status of populations in developing countries. Focus is on low-income developing countries and economic, technical, institutional, and political factors that influence problems of restructuring growth to achieve broad participation in gains in productivity and income.
5 units, Spr (Johnston) TTh 1:15-3:05

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.
5 units, Win (Josling) given 1988-89

5 units, Aut (John) given 1988-89

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 include: 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, Spr (Arthur) TTh 9-10:50

305. Seminar: Commodity Price Analysis—Students prepare a discussion and paper analyzing some aspect of commodity market and/or price behavior. Prerequisites: 205 and 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, Aut (Reynolds, Yotopoulos) by arrangement

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 (Arthur, 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

401,402,403,404. Dissertation Reading and Research.
401. Aut (Staff) by arrangement
402. Win (Staff) by arrangement
403. Spr (Staff) by arrangement
404. Sum (Staff) by arrangement
Emeriti: (Professors) Raymond D. Giraud, Roberto B. Sangiorgi, Leo Weinstein
Chairman: Jean-Marie Apostolidès
Vice Chairman: John Freccero (Italian Division)

French Division
Professors: Jean-Marie Apostolidès, Marc Bertrand, Robert G. Cohn, Jean-Pierre Dupuy, René Girard, Ralph M. Hester, Alphonse Juillard (on leave Autumn, Winter, Spring), Pauline Newman-Gordon, Michel Serres
Associate Professor: Brigitte Cazelles (on leave Autumn, Winter, Spring)
Professor (Teaching): John G. Barson
Senior Lecturers: Marguerite Bauer, Clio P. Dorr, Hélène Fredrickson, Nelee Langmuir, Michelle Morran, Jacqueline Ollivier
Lecturers: Mary Jane Parrine (Curator, Romance Languages and Humanities)
Acting Assistant Professor: Danielle Trudeau-Apostolidès
Visiting Professor: Patricia Parker (Winter, Spring)

Italian Division
Professor: John Freccero
Associate Professor: Jeffrey Schnapp (Director, Undergraduate Program, on leave Autumn, Winter, Spring)
Assistant Professors: Beverly Allen, Robert Harrison, Carolyn Springer
Senior Lecturers: Maria Devine, Leda S. Mussio, Annamaria Napolitano (Language Program Coordinator), Leopoldina Viggiano
Lecturers: Carla Riga, Giovanni Tempesta
Visiting Professors: Guelio Frulla (Autumn), Patricia Parker (Autumn)

FRENCH DIVISION

OFFERINGS

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.

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 château 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'Études Politiques, the École Polytechnique and other prestigious institutions. There is an annual exchange permitting two doctoral candidates in French to study at the Écoles 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 four 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 Honor 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 semiotics (202); 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 cultural history courses (290 and 291).
3. Four literature or culture courses: one among the courses numbered 150 to 189; and three among the courses numbered 280-289.
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 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.

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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<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 Ed. 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 both 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 M.A. or 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 M.A. 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 a B.A., 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 to have acquired competency 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 M.A. 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 370 to 379 series.
2. Three courses among the 380 to 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 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.

**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 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 deve-
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, "Introduzione alla storia italiana."
   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 six to nine 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. 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...
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 their financial support with training as scholars and prospective university teachers. Tenure as a Fellow, assuming satisfactory academic progress, will be for a maximum of four years (graduate-level work completed elsewhere being counted as part of this four-year period). Although financial support is limited to four years, the timetable for the completion of requirements allows students to spread their work out over a five-year period. Students in their fifth year normally apply for outside fellowships or for part-time teaching positions in the department.

Aside from the benefits of the program's structure and fellowship plan, a number of unique resources are available to Ph.D. students in Italian at Stanford. During their years of study, students may be permitted to take 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 questions 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. 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 require
ments 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 & 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.

60. French Musical Culture.

3 units, Aut (Marshall)

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, Aut (Cohn)


4 units, Spr (Cohn)

281. Mimesis in Literature—The history of mimesis and its literary uses. Mimesis and imitation in aesthetics and human relationships. Readings from Plato, Aristotle, Shakespeare (A Midsummer Night’s Dream, Troilus and Cressida), Thomas Mann (Mario and the Magician); Freud (Beyond the Pleasure Principle and other texts); Mikkel Borch-Jacobsen (The Freudian Subject.)

4 units, Win (Girard)

284A. Literature and Philosophy: From Heidegger to Deconstruction—Heidegger’s influence on French literary theory. Deconstruction and the logic of exclusion. Readings from Plato’s *Phaedrus*, Heidegger’s *On Humanism* and Derrida’s *Of Grammatology, Writing and Difference*, and *Dissemination*.

4 units, Aut (Girard)

284B. Literature and Philosophy: The Logic of Specularity in the Humanities—(Same as Philosophy 284.) Undecidability, infinite deferment, structural incompleteness, bifurcation and structural stability, the text as a machine, etc. Interdisciplinary approach is of interest to students in the humanities, and the sciences who wish to explore the conceptual foundations of modern critical theory. Topics include: deconstruction of structuralism, the logic of mimetic desire. Readings from Lacan, Derrida, Lévi-Strauss, Girard.

2 units, Win (Dupuy)

294A. Feminism in France: Contemporary French Women Poets—Readings of Andree Chedid, Annie Salager, Yvonne Caroutetch, etc. in the light of contemporary feminist theory.

4 units, Spr (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 Saturday, September 26.

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 both 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.

3 units, Aut, Win (Staff)


5 units, Aut, Win, Spr (Staff) MTWThF

2C. First-Year Conversation—Cours de conversation au niveau linguistique du Français 2.
Prerequisite: 1 or equivalent. Course offered on a Pass/No Credit basis only.

2 units, Aut, Win, Spr (Staff)


5 units, Aut, Win, Spr (Staff) MTWThF

3C. First-Year Conversation—Cours de conversation. Les étudiants utilisent leurs connaissances en les appliquant à l'étude de la culture et de la vie française: actualités, théâtre, cinéma, voyages, agences, etc. Renseignements utiles pour les étudiants qui partent pour le Campus de Tours ou qui projetent un voyage en France. Prerequisite: 2 or equivalent. Course 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, conversation drills, and daily work in the language laboratory are an integral part of the course. See Summer Session Bulletin for details. (No auditors permitted.)

8-12 units, Sum (Staff) MTWTh

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—Le français dans les situations de la vie de tous les jours. 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 with emphasis on 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


4 units, Aut, Win, Spr (Staff) MTWTh
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, Spr (Trudeau)

123. Advanced Grammar and Syntax—Language orale et ecrite, grammaire descriptive, analyse grammaticale, composition, explication de textes. Prerequisite: 24 or equivalent.
4 units, Aut, Win, Spr (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 Usage of Spoken and Written French—Prerequisites: 123 and 124 or equivalent.
4 units, Spr (Bertrand)

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 epic (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 (Staff)

131. French Literature II: 17th and 18th Centuries—Etude générale de la littérature françaises du 17e et 18e siècles. Corneille, Molière, Racine, Mme de La Fayette, Voltaire, Marivaux, Prévost, Rousseau. Prerequisite: 24 or equivalent. (DR:2)
4 units, Win (Weinstein)

132. French Literature III: 19th and 20th Centuries—Etudes d'oeuvres majeures de Flaubert et Baudelaire à Camus, Ionesco et Beckett. Prerequisite: 24 or equivalent. (DR:2)
4 units, Spr (Bertrand)

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.”

153. Le Théâtre au 17e siècle.
4 units, Aut (Massumi)

160. Le Roman au 18e siècle—La fiction au service du combat d'idées et innovations dans les modes de présentation romanesque: Voltaire, Diderot, Prévost, Choderlos de Laclos, Marivaux.
4 units, Win (Apostolides)

170. La Poésie Romantique—Lamartine, Vigny, Hugo, Musset: vers une définition de l'âme romantique à travers ses thèmes et ses métaphores obsédantes.
4 units, Spr (Newman-Gordon)

171. French Symbolist Poetry—Baudelaire, Mallarmé, Verlaine, Rimbaud. Extensive readings, in French, of the works of these four masters.
4 units, Spr (Cohn)

185. Simone de Beauvoir—(Graduate students register for 268.) Her fictional, philosophical, political, and autobiographical writings with stress on the radicalization of a feminine consciousness in contemporary French bourgeois society. Lectures and discussions in English; reading in French or English.
4 units, Win (Giraud)

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 four-unit credit toward the major. See instructor for section number.
1-4 units (Staff) by arrangement
ADVANCED UNDERGRADUATE AND GRADUATE
LANGUAGE

200. Textual Analysis—Etude de différentes stratégies d’explication de texte. 
4 units, Aut (Newman-Gordon)

201. Pronunciation and Phonetics — Etude théorique et travaux correctifs, articulation, rythme, intonation, timbre, quantité, graphie traditionnelle et voyelle instable, liaison et enchâinement, graphie phonétique. 
4 units, Spr (Trudeau)

4 units, Win (Staff)

LITERATURE

249. Le Liberalisme fran§ais avant et aprèe la Révolution—Etude de textes de Montesquieu, Jean-Jacques Rousseau, Benjamin Constant et Alexis de Tocqueville. 
2 units, Spr (Dupuy)

259. Simone de Beauvoir—(See 185.)

281. See under “General Courses.”

283A. Literature and Science—Qu’est-ce qu’un algorithme? La fable et la pensée algorithmique. La tradition grecque et l’origine des mathématiques. La tradition classique: Pascal, Leibniz, La Fontaine. 
2 units, Spr (Serres)

284A. See under “General Courses.”

284B. See under “General Courses.”

2 units, Aut (Serres)

290. Histoire Culturelle, I: De Louis XIV à la Révolution de 1789—Approches: civilisation matérielle et modes de vie; Etat et classes sociales; traditions populaires et culture savante; idéologies et mentalités. (DR.3) 
4 units, Win (Bertrand)

293. Methods of Teaching French — (Same as Education 293.) Second language acquisition with specific reference to French theory and practice, including frequent observations of a demonstration class. 
4 units, Spr (Hester)

294A. See under “General Courses.”

GRADUATE LITERATURE

318. 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, Spr (Cazelles)

319A. Colloquium: Medieval Romance—Backgrounds and Influence—(Same as Comparative Literature 301.) A comparative study of medieval romance in relation to Greek and Latin antecedents and its later legacy. Texts selections from Chrétien de Troyes and the Roman de la rose, and major English romances up to Malory. 
5 units, Spr (Parker)

322. Rabelais—The first three books plus selections from the Quart Lieure. Critical approaches from early historical (Lefrane) and popular culture (Bakhtin) to contemporary linguistic (Rigalot) and post-structuralist (Cave). Text in original and modern French. 
4 units, Win (Hester)

338. Corneille. 
4 units, Win (Massumi)

346. Diderot—A general approach. The author as a novelist, playwright, and philosopher; the diversity of his work. Focus on the unity of Diderot’s thought and his importance for the definition of modernity. 
4 units, Aut (Apostolidès)

353. Stendhal—The principal novels, autobiographical works, and essays of Stendhal in a social historical context and as examples of permanently valuable insights into the nature of human relations. 
4 units, Aut (Girard)

354. Flaubert—Madame Bovary, Salammbo, L’Education sentimentale, and Bouvard et Pécuchet read in conjunction with the Correspondances. Flaubert, the man and the artist, in the context of his time, and a representative of the modern European novel at its greatest. 
4 units, Win (Girard)

356. Baudelaire—The major writings: poetry, prose, prose poems, criticism. The important critics: Benjamin, Poulet, Richard are consulted. 
4 units, Win (Cohn)

359A. European Novel in the 19th Century: French and Others—(Same as Comparative Literature 375.) Main types of European fiction beginning with the Gothic and historical novel--Focuses on the rise of Realism and Naturalism in the works of Stendhal, Balzac, Flaubert, Dickens, Dostoevsky, Zola. 
5 units, Win (Frank)

359B. Le 19e siècle à travers les âges. 
4 units, Spr (Muray)
361. Proust et la critique—Lecture de *La recherche comme un itinéraire spirituel.*
4 units, Win (Newman-Gordon)

369A. Le Roman en France actuellement.
4 units, Spr (Muray)

5 units, Win (Parker)

387. 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.
2 units, Aut (Parrine)

388. 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

389. 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 should 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)

240. Boccaccio's *Decameron*—(Graduate students should register for 340.) Boccaccio's masterpiece studied with attention to its representation of 14th century Italy and against the background of such precedents as the *Gesta Romanorum* and the *Novellino*. Topics: story and frame in the *Decameron*, literature and its public in the Middle Ages, Boccaccio's relation to Dante and Petrarch, Medieval literature and play. Open to all students, including freshmen.
4 units, Aut (Harrison)

248. Machiavelli—(Graduate students should register for 348.) In-depth introduction to Machiavelli's works, *The Prince*, *The Discourses*, the *Dialogo della lingua*, and the theatrical works, emphasizing Machiavelli's relation to classical and post-classical political theory, and to the political institutions of his period. Open to all students, including freshmen.
4 units, Aut (Frulla)

250. The Italian Renaissance—(Graduate students should register for 350.) An interdisciplinary course on Renaissance Humanism in Italy from the 14th through the 17th centuries emphasizing the interaction of literature, theater, music, architecture, and the visual arts. Major 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, Sanazzaro, Michelangelo. Open to all students, including freshmen.
4 units, Win (Freccero)

267. Italy as a Literary Symbol—(Graduate students should register for 367.) The symbolic impact of Italy in the travel journals, fiction, poetry, and the drama of non-Italian writers such as 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, Win (Freccero)
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.
   - 5 units, Aut, Win, Spr (Staff) MTWThF plus additional 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 additional work in the language laboratory

2A. **L'Italia d'oggi (Italy Today)**—A conversation 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.
   - 3 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 additional 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 5½ weeks. 5B represents 4 additional units and covers Italian 3 in 2½ weeks.
   - 8-12 units, Sum (Staff) MTWThF 9-11:50 plus additional 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 five 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) MWF

30A, B. **Italian Conversation**—Intermediate and advanced level conversation courses for students 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 of each course 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 (Staff) 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 (Staff) MWF

53. **Second-Year Italian (Third Quarter)**—Continuation of 52. Prerequisite: 52 or equivalent.
   - 3-4 units, Spr (Staff) MWF

70, 80, 90. **Intensive and Accelerated Italian**—Offered only at the Stanford Florence Center (consult the Overseas Studies catalogue).
   - 3 units or more, 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 (Staff)

115. **Economic and Business Italian**—For graduate and undergraduate students interested in acquiring the necessary language skills and vocabulary to function and communicate effectively in the Italian-speaking business world.
   - 4 units (Staff)
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 (Staff)

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 emphasized. Prerequisite: 52 or consent of the instructor.

4 units, Spr (Staff)

122. Il cinema italiano—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. Introduzione alla storia italiana—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 (Mussio)

157. Italian Opera—Historical and aesthetic introduction to Italian opera from its origins to the early 20th century. Emphasis on Verdi, Puccini, and Rossini. Readings from librettos, and study of videotaped and recorded opera performances. Prerequisite: 3 or equivalent.

3 units, Spr (Napolitano)

157. Italian Opera—Historical and aesthetic introduction to Italian opera from its origins to the early 20th century. Emphasis on Verdi, Puccini, and Rossini. Readings from librettos, and study of videotaped and recorded opera performances. Prerequisite: 3 or equivalent.

3 units, Spr (Napolitano)

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 (Springer)

228. Italian Literature II: From Mannerism through the Modern—Reading of selected works from such authors as Marino, Campanela, Tasso, Galileo, Vico, Goldoni, Alfieri, Leopardi, Foscolo, Manzoni, Verga, and Pirandello. Required of all Italian majors. In Italian.

4 units, Win (Allen)

233. Dante's Divine Comedy—(See "General Courses.")

4 units, Aut (Freccero)

240. Boccaccio's Decameron—(See "General Courses.")

4 units, Aut (Harrison)

248. Machiavelli—(See "General Courses.")

4 units, Aut (Frulla)

250. The Italian Renaissance—(See "General Courses.")

4 units, Win (Freccero)

267. Italy as a Literary Symbol—(See "General Courses.")

4 units, Aut (Allen) given 1988-89

281. Novels into Film—(See "General Courses.")

4 units, Win (Springer)

ADVANCED UNDERGRADUATE AND GRADUATE LITERATURE

THE MIDDLE AGES

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 (tenzioni), and the young Dante. Offered in alternative years from the 335-337 sequence.

4 units, Aut (Schnapp) given 1989-90

333. Dante's Divine Comedy—(See "General Courses.")

4 units, Aut (Freccero)

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 textual and intertextuality in Medieval literature. Prerequisite for undergraduates: 233 or special permission from the instructor. The 335, 336 and 337 sequence is offered in alternating years from 330 and 338.


4 units, Aut (Schnapp) given 1988-89


4 units, Win (Freccero) given 1988-89


4 units, Spr (Schnapp) given 1988-89
338. Dante’s Minor Works—The Rime, Vita Nuova, Convivio, De Vulgari Eloquentia, and Monarchia. Offered in alternating years from the 335-337 sequence.
4 units, Win (Harrison)

340. Boccaccio’s Decameron—(See “General Courses.”)
4 units, Aut (Harrison)

THE RENAISSANCE

345. Petrarch and Petrarchism—Readings from the Canzoniere, Epistoleae, De Vita Solitaria, and Secretum studied in relation to later developments in Petrarchan poetry 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, Spr (Freccero)

348. Machiavelli—(See “General Courses.”)
4 units, Aut (Frulla)

350. The Italian Renaissance—(See “General Courses.”)
4 units, Win (Freccero)

352. Seminar: Epic and Romance Transformations—Ariosto’s Orlando Furioso and Tasso’s Gerusalemme liberata as transformations of ancient epic and romance models and as influences on Renaissance epic-romance. Topics: epic and romance structures, poetic influence, poetry and politics. Also, selections from Homer’s Odyssey, Virgil’s Aeneid, Ovid’s Metamorphoses and Spenser’s Faerie Queene.
4 units, Spr (Parker)

353. Italian Renaissance Epic—The transformation of Renaissance epic from Boiardo’s Orlando innamorato, through Ariosto’s Orlando furioso, to Tasso’s Gerusalemme liberata viewed against the background of Ancient Roman and Medieval Italian epic models. Major topics: epics and epic genealogy, lyric and romance in Renaissance epic, Renaissance epic and political legitimation. Offered in alternating years from 365.
4 units, Aut (Springer) not given 1987-88

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 poetry and his art work. Readings: Plato’s Symposium, Michelangelo’s Poems, and writings by Panofsky. Open to all students.
4 units, Spr (Harrison) given 1989-90

356. Giordano Bruno and Renaissance Hermeticism—Bruno’s work studied in relation to the development of the occult cult and the Hermetic tradition.
4 units, Spr (Schnapp) not given 1987-88

358. (Re)Constructing the Self: Italian Autobiographies—A seminar on the Italian autobiographical tradition from Dante and Petrarch through Vico and Alfieri, studied in relation to contemporary theories of autobiography.
4 units, Spr (Schnapp) 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, Spr (Harrison)

362. Seminar on the Italian Baroque—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 include Tasso, Marino, Chiabrera, Bernini, Borromini, and Monteverdi.
4 units, Spr (Springer) given 1989-90

363. The Italian Theater from Goldoni to Pirandello—The development of Italian theater from the mid-18th century to the WW II. Topics include 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, Win (Springer) given in 1988-89

365. Ruins and Representation in Romanticism—The role of archaeology as a political metaphor in the world of the Italian Risorgimento. Texts cover a broad ideological range from the Papal neo-Classicism of Monti to the democratic rhetoric of Risorgimento patriots such as Mazzini and Garibaldi. Others include Foscolo, Leopardi, Gioberti and Bel. Emphasis given to the visual arts; museums,
cycles, and political festivals. Offered in alternating years from 353.
4 units, Spr (Springer)

367. Italy as a Literary Symbol—(See “General Courses.”)
4 units, Aut (Allen) given 1988-89

4 units, Spr (Allen) given 1988-89

369. The Literature of Unified Italy—Italian literary production from the time of national unification until WW I. Readings from Carducci, Pascoli, Verga, D’Annunzio, Aleramo, Pirandello, Svevo, and Ungaretti presented in the context of movements such as verismo, decadentism, hermeticism, the art of the Tuscan macchialivi and Futurism. Also Italy’s post-unification disillusionment (the bank scandal, De Pretis’ trasformismo, etc.) and the resulting rift between Italian political and cultural life. Offered in alternating years from 368.
4 units, Spr (Allen)

370-379. Specialized Seminars on Major 19th and 20th Century Authors and Literary Movements—Offer students the opportunity for 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.

371. Pier Paolo Pasolini: The Poetics of Heresy—Pasolini’s Opus and its place in the cultural and political world of post-war Italy.
4 units, Win (Allen)

372. Italo Calvino: Neo-Realism to Metafiction—A study of 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, Win (Allen) given in 1989-90

373. Filippo Tommaso Marinetti and Italian Futurism—Marinetti’s literary career in relation to the historical trajectory of the Futurist movement. Major 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, Win (Springer) given in 1989-90

374. Pirandello—Readings from Pirandello’s major novel (The Late Mattia Pascal), and the major plays (Henry IV; Each In His Own Way; It Is If You Think It Is So and Six

Characters in Search of an Author.) How the problem of identity in Pirandello’s work changes the traditional notions of theater, stage, character, and performance. Open to all students.
4 units, Spr (Harrison) given in 1988-89

381. Novels into Film—(See “General Courses.”)
4 units, Win (Springer)

382. 20th Century Italian Poetry—The development of modern Italian poetry in relation to developments in literary theory and the field of poetics. Major Authors: Pascoli, D’Annunzio, Montale, Ungaretti, Quasimodo, Luzi, Zanzotto.
4 units, Aut (Allen) not given 1987-88

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, Spr (Schnapp) not given 1987-88

397. The History of the Italian Language—The Italian language in its lexical, morphological, and syntactical evolution from the 11th century to the present, with an emphasis on the philological analysis of literary texts. Recommended: Some background in Latin.
4 units, Win (Devine) given 1988-89

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

GRADUATE

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) given 1988-89

490. Proseminar on Italian Literary Studies—Italian studies in its historical development,
in relation to other disciplines and fields, and in terms of problems of literary theory and methodology.

4 units, Aut (Schnapp) given 1988-89

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 the particular fields of interest to each student.

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)

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)

500. Dissertation Research—Exclusively for graduate students in Italian working on dissertations.

1-12 units, Aut, Win, Spr, Sum (Staff)

GERMAN STUDIES

Emeriti: (Professors) Helmut R. Boeninger, Gertrude L. Schuelke; (Adjunct Professor) Gertrude Mahrholz
Chairman: Orrin W. Robinson III
Associate Professors: Russell A. Berman, David Wellbery
Assistant Professor: Sabine Wilke
Senior Lecturer: Kathryn Strachota
Lecturers: Peter Frank, William E. Petig, Brigitte Turnerauer
Consulting Professor: J. Alan Pfeffer
Visiting Professors: Wolf-Dieter Narr (Freie Universität Berlin) Winter; Spring; Hanspeter Neuholb (Universität Wien) Winter; Spring; Günther Teubner (European University Institute, Florence) Spring
Mellon Fellow: Kari Ellen Gade, Autumn

OFFERINGS AND FACILITIES

The department offers a variety of programs in German language and linguistics, literature, culture, and thought. Courses are open not only to majors but to all interested students.

The department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy.

By carefully planning their programs, students may fulfill the A.B. requirements for a double major in German Studies and another subject. An extended undergraduate major program in English and German literatures is available, as are coterminal programs for the A.B. and A.M. degrees in German Studies, and joint programs for the Ph.D. degree with 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, 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 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 (241-43) 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 six to nine units of academic work. This essay will be on a topic chosen in consultation with a faculty member of the department.

EXTENDED MAJOR IN ENGLISH AND GERMAN LITERATURES

Students may enter this program with the consent of the chairmen of both departments. See the "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 section “School of Education” in this bulletin.

DOCTOR OF PHILOSOPHY

The requirements for the Ph.D. are: (1) a minimum of 36 graduate units during the first year of graduate study and a minimum of nine units per quarter during the six quarters following the first year; (2) a reading knowledge of one language other than English and German; and (3) the writing of a dissertation. Students in medieval studies must also have a reading knowledge of Latin.

The first year of graduate work, which leads to the A.M. degree, is designed to introduce each student to the three major areas of study. During the Spring Quarter of their first year's study, all students must take an oral A.M. examination. They will then devote the Summer Quarter to writing a qualifying paper which will be evaluated by the department in the following Autumn Quarter. When the qualifying paper has been submitted and approved by the department, the student will be admitted to candidacy for the Ph.D. Students who do not qualify for the Ph.D. continue through the second year.

The qualifying paper, although ordinarily 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. The necessary research and the writing of the paper must be completed by the
beginning of the Autumn Quarter. Procedural details are available from the department. All students, regardless of their future field of concentration, are expected to acquire near-native proficiency in German and a thorough knowledge of the grammatical structure of German. 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 three units of graduate credit for practice teaching in literature.

During the first year, all graduate students planning to continue through the Ph.D. take essentially the same core program, as shown in the following specific suggestions of appropriate work in language and linguistics, literature, or German thought. This flexibility permits students to change direction at some later stage, as they develop their intellectual identity on the basis of actual experience.

Under any concentration, electives chosen from graduate level courses in German or approved courses in related fields must be added to accumulate the 36 units of study required for the A.M. For basic University requirements see the "Degrees" section of this bulletin.

INTERDISCIPLINARY PROGRAMS

The department participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in German Studies and Humanities. For a description of that program, see the section "Humanities Special Programs" in this bulletin. 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.

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
203. History of the German Language or 312. Linguistics and the Analysis of German
208A. Introductory Middle High German
303. Old Norse or 306. Old High German or 307. Old Saxon
311. Syntax of Modern German
312. 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).

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
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. Presentation of external history and internal relationships. (DR:4)
3 units, Spr (Robinson)

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:5)
3 units, Aut (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, Win (Staff) not given 1987-88

33A. Democracy, Protest, and Political Culture in German-Speaking Europe—An introduction to central issues in German thought since 1945 with reference to the political context. "Overcoming the past" at 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, 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, roman, saga, and lyric. Designed to follow the medieval segment of Western Culture. Lectures and discussions. (DR:2)
3 units (Andersson) given 1988-89
165A. Writings of Thomas Mann—(Same as 265A.) Readings in translation from selected stories, essays, and novels (Buddenbrooks, Dr. Faustus, Felix Krull); Mann’s major themes and artistic legacy; his participation in the political and intellectual life of the first half of the 20th century. Open to non-majors.
3-5 units, Win (Gillespie)

168A. Literature and Politics in South Africa—(Same as English 166A.) The impact of political and social conflict in South Africa on writing and literary life. With reference to the historical context, addresses the changing literary articulations of politics, the status of the political novel and essay, the transformation of the stage and the role of the author in political controversies. Texts: Biko, Breytenbach, Brink, Gordimer, Head, La Guma, Mtwa, Ndebele. All readings in English.
4 units, Win (Berman) MWF 11

273A. European Novel I: Renaissance Heritage—(Same as 373A.) Theory and practice of prose fiction in Europe from Rabelais and Cervantes to the Enlightenment period; the evolution of form, subject matter, and terminology in the romance and novel; the humoristic, encyclopedic, picaresque, quester, and adventure modes in British, French, German, Spanish, and Italian literature. The relevance of post-Romantic theory (Todorov, Barthes, Warning, Genette, Bakhtin, Meyer) to pre-Romantic fictions.
3-5 units, Win (Gillespie)

284A. 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), forms of consciousness (Bergson, Nietzsche, Freud, Jung) and artistic expressions (opera, painting) of their age.
3-5 units (Gillespie) given 1988-89

290A. Colloquium on Post-Modernism, Context, Art, and Architecture—(Same as Art 299.)
2 units, Aut (Turner)

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—These comprehensive courses provide a 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.
2-3 units, Aut, Win, Spr (Staff) MWF 10

1P, 2P, 3P. Individually Programmed Beginning German—For those who wish to complete more or less than five 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 designed for students who need to acquire reading ability in German for the Ph.D. and/or for advanced research in their own field. No auditors.
4 units, Win (Petig) MTWTh 9
Sum (Petig) MTWTh 9

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.
21. Intermediate German I—Continues the balanced approach of 1, 2, and 3. It includes 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)

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, Aut (Staff) MWF 10
  52B. Readings in History.
  3-4 units, Win (Staff) MWF 12
  52C. Readings in Art History.
  3-4 units, Spr (Staff) MWF 12
  52D. Readings in Political Science and International Relations.
  3-4 units (Staff) given 1988-89
  52E. Readings in Music and Music History.
  3-4 units (Staff) given 1988-89
  52F. Readings in Philosophy and Religious Studies—(Same as Religious Studies 52F.)
  3-4 units (Staff) given 1988-89

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, Spr (Petig)

70, 80, 90. Intensive German—Given only in Berlin. See 'Overseas Studies' section in this bulletin.
  Aut, Win, Spr, Sum

77. Refiguring Culture: Films from Berlin—Recent cultural developments in Berlin, with reference to contemporary aesthetic projects, the new social movements, and national identity. Given in the first half of November in conjunction with a film series and a related symposium.
  1-2 units, Aut (Berman)

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.
131. Central Europe: Geography, Institutions, and Society—Prerequisite: 22 or consent of instructor. (DR:5)
4 units, Aut (Lohnes)

132. The Culture of Modernism in Austria and Germany—Prerequisites: 22 or consent of the instructor. (DR:2)
4 units, Win (Staff) not given 1987-88

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, Spr (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 1940. Readings of Brecht, Dürrenmatt, Frisch, Weiss, Handke, Sperr, and Plenzdorf. Performances, films, tapes, and videotapes and other plays.
4 units, Aut (Strachota)

154. Modern Short Prose—Readings by Kafka, Brecht, Böll, Frisch, Bobrowski, Kunert, Wolf, Bachmann, and others. (DR:2)
4 units, Win (Turneaure)

156. The Classical Period—Introduction to major authors, works, and literary movements of the 18th century in historical context. Emphasis on the rise of Weimar classicism against the background of Winckelmann's aesthetics of Greek art ("noble simplicity and quiet grandeur"), Lessing and the Enlightenment, and Storm and Stress. Examples of drama, narrative, lyric poetry, essays from Goethe, Schiller, Hölderlin, and others from the richest period of German literature.
4 units, Aut (Mommsen) MWF 11

157. Introduces the specific developments and topics of German literature and culture with some emphasis on methods of literary interpretation. Prerequisites: 22 plus 2 additional courses or consent of instructor.
158. German Women Writers of the 20th Century—(Same as Feminist Studies 175.) Explores the lives of German women writers through selected short stories, available in English translation, which provide a picture of life as it was lived and experienced by German-speaking people for the last 50 years. Topics: the trauma of WW II, the suffering and resistance under Nazi tyranny, the fate of the political exile, the division of Germany and Berlin into East and West, and the role of Germans in Europe today.
3 units, Win (Spitz)

179. Special Topics—Explores the possibility of interdisciplinary studies and research in areas of special interest: women authors, social satire, political speeches, Freud and literature, literature in the German Democratic Republic.

179K. Religious Existentialists—(Same as Religious Studies 277.)
5 units, Win (Harvey) MW 4.15-6

199. Individual Reading—Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit. Enrollment only by permission of the department. Prerequisite: 22 or consent of instructor.
1-2 units, Aut, Win, Spr (Petig) by arrangement

ADVANCED 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 (Robinson) given 1988-89

204. Gothic—(Same as 304.) Introduction to grammar and texts of the Gothic language; also, grammar of Proto-Germanic.
3-5 units (Robinson) given 1988-89

205A. Introduction to Old Norse—Icelandic—(Same as 305A, English 200A.) Grammar and readings from Gordon, Introduction to Old Norse. Emphasis on the acquisition of reading skills.
5 units, Aut (Gade)

205B. Advanced Old Norse—Icelandic—(Same as 305B, English 200B.) Readings in Laxdœla saga.
3-5 units (Andersson) given 1988-89
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AND SCIENCES

206. Old High German—(Same as 306.) Introduction to the grammar and documents of the earliest attested stage of High German.
3-5 units, Win (Robinson)

208A. Introduction to Middle High German—Emphasis on basics of grammar and rapid reading.
3-5 units (Andersson) given 1988-89

208B. Advanced Middle High German—Readings in courtly epic and romance.
3-5 units (Andersson) given 1988-89

208C. Advanced Middle High German—Close reading of Wolfram von Eschenbach's Willehalm.
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)

212. Linguistics and the Analysis of German—(Same as 312, Linguistics 175.) An introduction to linguistic theory and analysis emphasizing the analysis of modern German.
3-5 units, Aut (Robinson)

218. Introduction to German Dialects—(Same as 118, Linguistics 176.)
3 units (Robinson) given 1988-89

3-5 units, Win (Frank)

241-243. Acquaints 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. Note: This series is given in German in alternate years (1988-89).
3-5 units, Spr (Bender, Wellbery)

247. Poetics II: Theory and Analysis of the Lyric—(Same as 347.) The theory and analysis of lyric poetry in terms of works from several periods in German literary history. Topics: problems in the definition of the lyric; lyrical forms; the levels of the poetic text (sound patterns, rhythm, meter, syntax, strophic forms, trope, figure, symbol; types of affectivity; reader response. Major poems from the German tradition are examined with a spectrum of theoretical positions from Jakobson to Adorno.
3-5 units, Spr (Mueller-Vollmer)

3-5 units, Win (Mommsen)

251-259. German Literature and Culture I—(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.
3-5 units, Aut (Andersson)

251H. Introduction to Medieval Hermeneutics—Reading of key texts and recent scholarly developments.
3-5 units, Aut (Andersson)

251L. Introduction to Carolingian Literature—Reading and discussion of Latin verse from 800-900 A.D.
3-5 units, Spr (Andersson)
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)

263. Rilke: Duino Elegies—(Same as 363.) An in depth study of Rilke’s poems within the context of European modernism.

3-5 units (Mueller-Vollmer) given 1988-89

265. Writings of Thomas Mann—(Same as 165A, 265A.) Readings in German from selected stories, essays, and novels (Buddenbrooks, Dr. Faustus, Felix Krull, possibility of substitutions for majors with some background). Mann’s major themes and artistic legacy; his participation in the political and intellectual life of the first half of the 20th century.

3-5 units, Win (Gillespie)


3-5 units, Spr (Mommsen)

270-279. Genres—The development, contents, and formal characteristics of such kinds of writing as lyric poetry, epic, drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focuses on such matters as medieval drama, baroque “metaphysical” poetry, the diary as a literary form, autobiography.


3-5 units (Mommsen) given 1988-89

290-299. Special Subjects and Problems—Variable topics.

293. Minority Literature—Investigates, with reference to recent critical discussions of difference, colonialism, and stereotypes, the issue of minority literature as it pertains to the German field. Attention to the literatures of Turkish, Jewish, and Slovene populations. The problem of “small nations” and the questions of assimilation and marginalization.

5 units, Spr (Berman)

297. Myth in Contemporary Literature—The role and function of myth in postmodern literature from the late 70’s and 80’s. Historical aspects and contemporary transformations of a modern discourse on mythology. Readings by Heiner Müller, Botho Strauss, Peter Weiss, Tankred Dorst, Christa Wolf, Michael Ende. (In German).

3-5 units, Win (Wilke)

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


1-2 units, Aut (Mommsen)

301. Individual Work—Exclusively for work on the A.M.-level qualifying paper.

units by arrangement (Staff)

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

2 units, Aut (Lohnes)

303. Curricular Problems—Given on request only.

3 units, Aut (Lohnes) by arrangement
304. Gothic—(Same as 204.)
5 units (Robinson) given 1988-89

305A. Introduction to Old Norse—Icelandic—
(Same as 205A, English 200A.)
5 units, Aut (Gade)

305B. Advanced Old Norse - Icelandic—
(Same as 205B, English 200B.)
3-5 units (Andersson) given 1988-89

306. Old High German—(Same as 206.)
3-5 units, Win (Robinson)

311. Syntax of Modern German—(Same as 211.)
3-5 units, Spr (Lohnes)

312. Linguistics and the Analysis of German—
(Same as 212, Linguistics 175.)
3-5 units, Aut (Robinson)

3-5 units, Win (Frank)

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).
3-5 units, Aut (Bender, Wellbery)

347. Poetics II: Theory and Analysis of the Lyric—(Same as 247.)
3-5 units, Spr (Bender, Wellbery)

349C. Seminar: Literary Hermeneutics—
(Same as 449C.) Its history and principles since the Enlightenment. Classical hermeneutics: Schleiermacher, Boeckh. The impact of historical and philosophical hermeneutics: Droysen, Dilthey, Heidegger, Gadamer. Current issues of literary hermeneutics within the spectrum of post-structuralist, phenomenological, and Marxian criticism.
3-5 units, Aut (Mueller-Vollmer)

349L. Goethe, West-östlicher Divan—(Same as 249L.)
3-5 units, Win (Mommsen)

349T. Seminar: Literary Theory in Early Romanticism—(Same as 449T.)
3-5 units (Mueller-Vollmer) given 1988-89

349R. Seminar: Romantic Archetypes— Formation of Romantic concepts of "archetype"; their importance for modern literature and thought; the rise of a "neomythological" approach in art, psychology, and the philosophy of history. Topics in literary reinterpretations of ancient myths (Prometheus, Oedipus, Dionysos, Venus), remythizing of the Biblical and Christian past and the Renaissance (Cain, Satan, Mary, Christ, Faust, Hamlet, Don Juan), dominant archetypes in contemporary Romantic fictions.
3-5 units, Aut (Berman)

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.

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, Hofmannsthall, Thomas Mann, Kafka, Brecht.

363. Rilke: Duino Elegies—(Same as 263.)
3-5 units (Mueller-Vollmer) given 1988-89

366. Nietzsche and Contemporary Theory,
3-5 units, Aut (Wellbery)

367. Seminar: Stefan George (1868-1933)—
(Same as 267.)
3-5 units, Spr (Mommsen)

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. Focuses on medieval drama, baroque "metaphysical" poetry, the diary as a literary form, autobiography.

374. Balladendichtung von Bürger bis Grass—
(Same as 274.)
3-5 units (Mommsen) given 1988-89

375. Formen der Lyrik vom 17. bis 20. Jahrhundert—(Same as 275.)
3-5 units (Mommsen) given 1988-89

390-399. Special Subjects and Problems.

390A. Seminar: The Modern Tradition—
(Same as English 361.) Conceptualizations of modernity, modernism, and modernization in terms of cultural criticism and social theory. Topics: diachronic designations with reference to tradition and postmodernism; the institutional status of culture; modern identity and confrontation with alterity. Readings: Max Weber, DuBois, Hoggart, Thompson, Adorno, Habermas, Baudrillard, Kristeva, Lyotard.
5 units, Aut (Berman)
391A. Madame de Stael and the Discovery of Germany—(Same as Comparative Literature 391A.) Madame de Stael’s career as a writer and mediator between French and German culture in the age of Romanticism. The literary, political, and social significance of her work.

3-5 units (Mueller-Vollmer) given 1988-89

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.

449C. Seminar: Literary Hermeneutics—(Same as 349C.)
3-5 units, Aut (Mueller-Vollmer)

3-5 units, Spr (Mommsen)

449T. Seminar: Literary Theory in early Romanticism—(Same as 349T.)
2-5 units (Mueller-Vollmer) given 1988-89

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 (on leave 1987-88), Stephen C. Ferruolo, Stephen H. Haber, Nancy S. Kollmann, Richard Roberts (on leave 1987-88), Lynn Zastoupil

Courteous Professors: Paul David, Michael Jameson, Susan M. Treggiari

Affiliated Professor: Albert E. Dien

Senior Lecturer: Joseph J. Corn (on leave Autumn)

Modern Europe Lecturers: Laurel Carrington, Michael Curtin, Ronald K. Delph, Marci J. Sortor, Laurence H. Winnie

Lecturer: Margo Horn (Autumn)

Visiting Professor: Norman M. Naimark (Winter and Spring)

Visiting Associate Professor: Jeffry M. Diefendorf (Winter and Spring)

Visiting Tinker Professor: Jose R. Deustua-Carvallo

Mellon Fellow: William Worger

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 for 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 three 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
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 at least a letter grade indicator of "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 Birdsell Weter prizes are awarded each year for the outstanding Honors essay.

SECONDARY (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 coterminal A.B. and A.M. degree in History. Applications for admission to this program should be submitted during the Spring Quarter of the student’s junior year and must be submitted no later than November 1 of his 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 meet all requirements for both degrees. They must complete 15 full-time quarters (or the equivalent) or 3 full-time quarters after completing 180 units for a total of 216 units. During their senior year they may, with the consent of the instructors, register for as many as two graduate courses. In the final year of study they must complete at least three courses that fall within a single Ph.D. field.

GRADUATE PROGRAMS

ADMISSION TO GRADUATE STANDING

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 (totalling not less than 36 units) of graduate work; seven courses of this work must be History Department courses. Of these seven, one must be a graduate seminar and three must be either graduate colloquia or graduate seminars. Directed reading may be counted for a maximum of 10 units. A candidate whose undergraduate training in history is deemed inadequate must complete nine courses of graduate work in the History Department. The department does not recognize for credit toward the A.M. degree any work that has not received the letter grade indicator of "A," "B," or "+.

TERMINAL A.M. PROGRAM

The department admits applicants who do not wish to continue beyond the A.M. degree at the discretion of the individual fields (U.S., modern Europe, etc.). Students admitted to this program may not apply to enter the Ph.D. program in History during the course of their work for the A.M. degree.

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 description under 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 (not candidacy in) the Ph.D. program. Those seeking admission to the program should file application during their second quarter of enrollment in graduate work at Stanford. 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
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 independent work and is a contribution to knowledge. It should evidence the command of approved techniques of research, ability to organize findings, and competence in expression. For details and procedural information, please apply to the department.

JOINT Ph.D. IN HISTORY AND HUMANITIES

The Department of History participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in History and Humanities. For description of that program see the section “Humanities Special Programs” in this bulletin.

RESOURCES

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.
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 Brash Collection on Sir Isaac Newton and scientific thought during his time, and other such materials.

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:

See the Time Schedule for changes in course offerings each quarter. For updated information, the History Department has a board listing all courses with the appropriate meeting days and times.

COURSES

INTRODUCTORY

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 both the Middle Ages and the Renaissance. The texts include selections from Aristotle, Virgil, Augustine, Marie de France, Aquinas, Dante, Chaucer, Petrarch, Machiavelli, and Erasmus, and from the Bible. (DR: 1, three-quarter sequence)

5 units, Aut (Brown) lectures plus a two-hour colloquium

2. Europe from the Wars of Religion to the Present — A survey of the evolution of the European state system from the Thirty Years War; political, social, and intellectual currents of the 17th and 18th centuries; the French Revolution and the Napoleonic empire, and their impact on European politics, society, and culture. (DR: 1; three-quarter sequence)

5 units, Win (Diefendorf) lectures plus a two-hour colloquium

3. 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 cen-
tury. 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)

lectures plus a two-hour colloquium

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, Win (Rick, 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 Peru, China, and Nigeria. Recommended: Anthropology/History 21. (DR:5; also satisfies Area 3 when taken in sequence with 21.)

5 units, Spr (Abernethy, Van Slyke, Varese)

24A. Russian Civilization I: The Shaping of Culture and Society from the 9th to 17th Century—An interdisciplinary approach to Russian history and culture; examines literature, society, institutions. (DR:5)

5 units, Aut (Kollman)

24B. Russian Civilization II: Society, Cultur, and Politics in Imperial Russia—An interdisciplinary approach to Russian history and culture; examines literature, society, institutions.

5 units, Win (Emmons)

64. Introduction to Chicano Life and Culture—(Same as Anthropology 11, 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, Aut (Camarillo, Cuellar)

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, Win (Bogenschield, Jacksic)

INTRODUCTORY 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".

7S. Introductory Seminar: Joan of Arc.

5 units, Aut (Langmuir)


5 units, Spr (Kollmann)

39S. Introductory Seminar: Ireland and India.

5 units, Win (Zastoupil)

41S. Introductory Seminar: Britain and the First World War.

5 units, Aut (Stansky)


5 units, Win (Rakove)


5 units, Aut (Lowen)

60S. Introductory Seminar: Religion and Social Change in Antebellum America.

5 units, Win (Reuben)

61S. Introductory Seminar: Social Reform and Social Control—The Case of Pullman Town.

5 units, Spr (Przybyszewski)

75S. Introductory Seminar: The Atomic Bomb in History—(Same as History of Science 75)

5 units, Win (Bernstein) M 3:15-5:30

ADVANCED

Courses numbered 100 through 199 are primarily lecture courses designed for advanced undergraduates.
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 (Jameson)

102. Greek and Roman History from Alexander to Caesar—(Enroll in Classics 102.) (DR:5)
   4-5 units, Win (Staff)

103. History of the Roman Empire—(Enroll in Classics 103.) (DR:5)
   4-5 units, Spr (Staff)

MEDIEVAL AND RENAISSANCE EUROPE

   5 units, Win (Funkenstein)

106B. Jewish Intellectual History: Modern.
   5 units, Spr (Funkenstein)

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, Win (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)
   5 units, Win (Robinson)

HISTORY OF TECHNOLOGY

115. History of Technology, 1500-1918—(Same as Values, Technology, Science, and Society 121.) The interplay of technological change, and social and cultural developments from the late Middle Ages through WW I. Focus is on Europe and the United States, 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 (Corn) TWTh plus section

EASTERN EUROPE AND RUSSIA

122B. Soviet Foreign Policy—(Same as Political Science 136.) (DR:5)
   5 units, Aut (Griffiths)

123A. The Soviet Union: Politics and Society Since 1917—(Same as Political Science 119A.) 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, Spr (Dallin)

WESTERN EUROPE

136A. European Thought in the 19th Century—Great thinkers and major movements of the 19th century. Romanticism, liberalism, Marxism, and the origins of modern irrationalism; seminal writings of Burke, Mill, Marx, Ruskin and Nietzsche. (DR:3)
   5 units, Win (Robinson)

HISTORY OF SCIENCE


138A. Ancient Period—(DR:3; also satisfies area 6 when taken in sequence with 138B.)
   4 units, Win (Knorr) MWF 2:15

138B. Middle Ages to Newton—(DR:3; also satisfies area 6 when taken in sequence with 138A.)
   4 units (Knorr) given 1988-89

138C. Newton to Einstein—(DR:3)
   4 units, Spr (Knorr)
138D. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Same as History of Science 140, 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, Spr (Knorr) TTh 10-11:15

138E. Galileo and the Church: Political Inquisition or Critical Dialogue?—(Same as History of Science 142.) The hidden dialogue between Galileo and the Jesuits; intellectual elite of the Catholic Church. Galileo’s trial and specific developments of Galileo’s scientific thought resulting from this dialogue. The Galileo affair in light of the conflict between the Jesuits’ and Dominicans’ cultural policies.

4 units, Win (Feldhay) TTh 2:15-3:30

139. Scientific Revolution—(Same as History of Sciences 145, Philosophy 145.) 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.

4 units, Aut (Galison) MWF 1:15

139A. History and Philosophy of 20th Century Physics—(Same as Philosophy 168, History of Science 168, VTSS 133.) 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.

4 units, Win (Galison) TTh 11-12:15

AFRICA

147B. The History of South Africa. 5 units, Win (Worger)

149A. History of East Africa. 4-5 units, Spr (Jackson)

THE UNITED STATES

153. America in Depression and War, 1929-1945—The Great Depression, the New Deal, and WWII 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 United States in the 1930s and early 1940s; the military and geopolitical history of WWII; and the wide-ranging transformations in American society set in motion by the war experience.

5 units, Win (Kennedy)

157. Afro-American History: The Modern Civil Rights Movement. 5 units, Spr (Carson)

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)

159B. The Gilded Age: Late 19th Century America—Major developments in American history from Reconstruction to 1900. The consequences of the Civil War, industrialism and class conflict, the growth of an American state, and the crisis of the 1890s. The extent to which the governing ideologies, cultural patterns, and institutional arrangements of 20th century America originated during the Gilded Age.

5 units, Aut (Fredrickson)

163. America and the 'Bomb': Politics, Diplomacy, and Culture in the Nuclear World, 1939-Present—(Same as History of Science 163.) 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 critical 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 (Gillam)

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 United States 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 (Rakove)  
165B. 19th Century America. (DR:5)  
5 units, Win (Degler)  
165C. 20th Century America. (DR:5)  
5 units, Spr (Camarillo)

171. History of Women and Health in America—Topics relating to women’s health and healing through American history, including sexuality, childbirth issues, aging, and women healers.  
5 units, Aut (Horn) MW 2:15

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)

172A. U.S. Women’s History, 1620-1870—(Same as Feminist Studies 121.) A two-quarter survey exploring women’s relation to the economy, the family, and the state; changing ideals of womanhood; and class, race, and ethnic variations in female experience. 172A covers women’s work and status in preindustrial America and during the Revolutionary era; industrialization and the middle-class “female sphere”; wage labor, slavery, female reform, and the early women’s rights movement. (DR:5)  
5 units, Win (Freedman)

173A. U.S. Women’s History, 1870-1985—(Same as Feminist Studies 122.) The transformation of Victorian womanhood in the late 19th century, including workforce participation of immigrant and black women, and the educational and professional opportunities for middle-class white women; the impact of wars and depression on 20th-century women’s lives; and the rebirth of feminism. (DR:5)  
5 units, Spr (Freedman)

174. Reflections on the American Condition—(Same as English 128, American Studies 100.) Interdisciplinary perspective of the analytical techniques of history and literary criticism as reflected in the American character in imaginative literature, early 19th century to the present. Readings include classic American works that address “the complex fate of being an American.” Authors include: Henry James, Henry David Thoreau, Harriet Beecher Stowe, Edith Wharton, Mark Twain, and Ralph Ellison. (DR:2 or DR:3)  
5 units, Aut (Kennedy, Chase)

LATIN AMERICA

177. Modern Latin America.  
5 units, Spr (Haber)

179. The Historical Evolution of Mexico—From the conquest of the 1520’s to the crises of economic development and political legitimacy of the 1980’s.  
5 units, Aut (Bowser)

MIDDLE EAST

189. Zionism and the State of Israel—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. Attention to the relationship of ideology and action.  
5 units, Win (Mancall)

EAST ASIA

192A. China from Earliest Times to the 9th Century — (Same as Asian Languages 156.) Geo-historical origins to the Tang period: the first 4,000 years of social formations and historical transformations of ancient and early medieval China. (DR:5*)  
5 units, Aut (Dien, Kahn) MTWThF 11

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 currents. Recommended: 192A. (DR:5*)  
5 units, Spr (Van Slyke)

193. Science, Technology, and Material Culture in Traditional China—(Same as Asian Languages 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, Spr (Dien) TTh 2:15-4:05
194. Early and Medieval Japan to 1336—Prehistoric origins of the people and culture, emergence of the first polity, Chinese influences, flowering of the native culture, the samurai, and feudal government.  
5 units, Aut (Mass)

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 reorientation 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*)  
5 units (Dien) given 1988-89

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 colloquiums principally 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 (Staff)

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.)

202. Undergraduate Colloquium: Introduction to Problems of Historical Interpretation and Explanation.  
5 units, Spr (Emmons)

213A. Undergraduate Colloquium: Luther and the Radicals—(Same as Religious Studies 241A.)  
5 units, Aut (Spitz)

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)

216A. Undergraduate Colloquium: Political Ideals and Social Realities in the Renaissance—Italy from City Republics to Territorial States.  
5 units, Win (Brown)

216S. Undergraduate Seminar: Jewish History—(Same as Religious Studies 226.)  
5 units, Spr (Funkenstein)

222. Undergraduate Colloquium: Jewish Literature and Society.  
5 units, Spr (Mancall)

223S. Undergraduate Seminar: Eastern Europe Between the Wars.  
5 units, Win (Naimark)

224S. Undergraduate Seminar: Eastern Europe Since World War II.  
5 units, Spr (Naimark)

235. Undergraduate Colloquium: War in European Society.  
5 units, Win (Sheehan)

239. Undergraduate Colloquium: Comparative Early Modern Aristocracies—East and West Europe.  
5 units, Win (Kollmann)

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, Spr (Worger, Zastoupil)

244. Undergraduate Colloquium: British Intellectuals and India.  
5 units, Aut (Zastoupil)

5 units, Aut (Jackson)

249A. Undergraduate Colloquium: Africa Since 1945.  
5 units, Win (Jackson)

251S. Undergraduate Seminar: Material Culture—(Same as American Studies 217.) An }
production to the study of culture through three-dimensional objects. The history of the built environment in the United States over the last 100 years.
5 units, Spr (Corn) TTh 1:15-3:05

255. 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, Spr (Kennedy)

5 units, Aut (Gillam)

261S. Undergraduate Seminar: The American Character—(Same as American Studies 200.)
5 units, Spr (Gillam)

262A. Undergraduate Colloquium: Race and Ethnicity in American Cities—History and Public Policy.
5 units, Win (Camarillo)

263. Undergraduate Colloquium: Women in America—(Same as American Studies 209.)
5 units, Spr (Degler)

265A. Undergraduate Colloquium: Sexuality in American History—(Same as American Studies 213.)
5 units, Aut (Freedman)

271A. Undergraduate Colloquium: Ideas in America from the Revolution to 1900—(Same as American Studies 212.)
5 units, Aut (Fredrickson)

286. Undergraduate Colloquium: Middle Eastern Women through Film—(Same as Feminist Studies 120.) P/NC
1 unit, Spr (Beinin)

290. Undergraduate Colloquium: Japan and America—Conflict and Cooperation.
5 units, Aut (Duus)

299. Undergraduate Colloquium: The Institutions of Medieval Japan.
5 units, Spr (Mass)

GRADUATE

300W. Graduate Directed Reading.
units by arrangement (Staff)

301. Graduate Colloquium: Historiography of American Education—(Same as Education 301.)
4 units, Spr (Tyack)

302A. Graduate Colloquium: Introduction to Problems of Historical Interpretation and Explanation.
5 units, Spr (Emmons)

303C. Graduate Colloquium: Process of Industrialization in the 19th and 20th Centuries—Europe, the United States, and Latin America.
5 units, Aut (Haber)

304A. Graduate Colloquium: Historiography of Colonial and 19th Century Spanish America.
5 units, Win (Bowser)

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

307. Graduate Core Colloquium in Medieval History.
5 units, Aut (Langumir)

308. Graduate Colloquium: The Religious Crisis of the 11th and 12th Centuries.
5 units, Win (Langmuir)

320A. Graduate Colloquium: Major Problems in Early Russian History.
5 units, Win (Kollmann)

323A. Graduate Colloquium: Topics in Russian History.
5 units, Aut (Emmons)

331A,B,C. Graduate Core Colloquium on Modern Europe.
15 units, Aut, Win, Spr (Spitz, Brown, Staff)

335. Graduate Colloquium: War in European Society.
5 units, Win (Sheehan)
339. Graduate Colloquium: Comparative Early Modern Aristocracies—East and West Europe.
   5 units, Win (Kollmann)

341B. Graduate Colloquium: Topics in the Culture and Society of Early Modern England.
   5 units, Aut (Seaver)

343D. Graduate Colloquium: Empire and Race—The Decline and Fall of the British Empire in India and South Africa.
   5 units, Spr (Worger)

344. Graduate Colloquium: British Intellectuals and India.
   5 units, Aut (Zastoupil)

   5 units, Aut (Jackson)

349A. Graduate Colloquium: Africa Since 1945.
   5 units, Win (Jackson)

   5 units, Win (Berkhofer)

351A,B,C,D,E,F. Graduate Core Colloquium in American History.
   30 units, Aut, Win, Spr (Rakove, Degler, Fredrickson, Freedman, Kennedy, Bernstein)

365A. Graduate Colloquium: Sexuality in American History.
   5 units, Aut (Freedman)

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)

395B. Graduate Colloquium: Medieval and Early Modern Japan—1600-1800.
   5 units, Aut (Mass)

395C. Graduate Colloquium: Modern Japan.
   5 units, Win (Duus)

399. Graduate Colloquium: The Institutions of Medieval Japan.
   5 units, Spr (Mass)

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)

408. Graduate Seminar in Medieval History.
   5 units, Spr (Langmuir)

   5 units, Spr (Brown)

412A,B. Graduate Seminar: Medieval Pre-suppositions of the Scientific Revolution.
   10 units, Win, Spr (Funkenstein)

415. Graduate Seminar in Jewish History.
   5 units, Win (Funkenstein)

416. Graduate Seminar in Jewish History.
   5 units, Spr (Funkenstein)

421A. Graduate Seminar: Topics in Russian History.
   5 units, Win (Emmons)

422A. Graduate Seminar: Introduction to Graduate Research on Soviet History and Politics (I).
   5 units, Win (Dallin)

422B. Graduate Seminar: Introduction to Graduate Research on Soviet History and Politics (II).
   5 units, Spr (Dallin)

423. Graduate Seminar: Eastern Europe Between the Wars.
   5 units, Win (Naimark)

424. Graduate Seminar: Eastern Europe Since World War II.
   5 units, Spr (Naimark)

437. Graduate Seminar: Modern European Cultural and Intellectual History.
   5 units, Aut (Robinson)

   5 units, Win (Seaver)

   5 units, Win (Stansky)

   5 units, Win (Carson)

459/459A. Graduate Seminar: Social History of the U.S. in the 19th Century.
   10 units, Aut, Win (Degler)

   5 units, Aut, (Camarillo)

464A. Graduate Seminar: Race and Ethnicity in 20th Century America.
   5 units, Win (Camarillo)

479. Graduate Seminar: Economic History of Latin America.
   5 units, Spr (Haber)
Graduate Seminar: Andean History—
(Same as Latin American Studies 480.) Topics in social and economic history of the Andes, including the "longue duree" of Andean civilization, the birth of capitalism in the 19th century. 5 units, Win (Deustua-Carvallo)

Graduate Seminar: Late Traditional China.
5 units, Win (Kahn)

Graduate Seminar: Late Traditional China.
5 units, Spr (Kahn)

Graduate Seminar: Modern Japan.
5 units, Spr (Duus)

Graduate Seminar: Japanese Historical Texts.
5 units, Win (Mass)

PROGRAM IN THE HISTORY OF SCIENCE

Associate Professors: Peter Galison, Wilbur Knorr, Timothy Lenoir (on leave 1987-88)
Committee in Charge: (Chairman) Wilbur Knorr (Classics and Philosophy), James Adams (Engineering), Barton Bernstein (History), Nancy Cartwright (Philosophy), John A. Dupré (Philosophy), Francis Everitt (Physics), Marcus W. Feldman (Biological Sciences), Alexander Fetter (Physics), Peter Galison (Philosophy and Physics), Burton Richter (SLAC), James J. Sheehan (History)
Affiliated Faculty: Robert L. Byer (Applied Physics), Joseph J. Corn (VTSS), Albert E. Dien (Asian Languages), Amos Funkenstein (History), Henry Lowood (Bibliographer Stanford Libraries)
Visiting Faculty: Mott Greene (Associate Professor), Margaret Morrison (Assistant Professor), Rivka Feldhay (Fellow, Humanities Center)

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 accomodate 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 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, room 200-33.

COURSES

20. From Klystrons to Lasers: The Stanford Connection—(Enroll in Applied Physics 20.) The development of coherent radiation from the early radio and klystron sources to masers and lasers. Operational principles of the laser explored at the elementary level with laboratory visits.
3 units, Aut (Byer)

60. The Growth of Scientific Knowledge—
(Same as Philosophy 60.) Introduction to the philosophy of science by way of the historical analysis of philosophical-scientific debates. Discussions of general ideas about theory change and experiment, e.g. Hempel, Kuhn, Lakatos, Popper, and Hacking. Specific case studies of Copernican and Einsteinian revolutions with historical scrutiny. Readings from philosophers, historians, and the original scientific texts. A writing intensive course. (DR:3).
5 units, Spr (Galison) MWF 11 plus section

62. Introduction to the History of Biology—
(Same as Philosophy 62.) The changing nature of the biological sciences, addressing what was considered good biology at different times through history (including now) and what sorts of factors brought about the changes? Focuses on cell theory, evolution, heredity, and development in the 19th and 20th centuries, with a brief introduction to earlier periods.
4 units, Aut (Greene) MWF 11

75. Introductory Seminar: The Atomic Bomb in History—
(Same as History 75S, Values, Technology, Science, and Society 152.) Introductory seminar, an analysis of the use of the A-bombs, the role of scientists, problems of
postwar international control of atomic energy, the quest for the H-bomb, the rise of nuclear strategy, and the issues of "atomic spies."

121. History of Technology in Western Society, 1500-1918—(Same as History 115, Values, Technology, Science, and Society 121.) The interplay of technological change, and social and cultural developments, from the late Middle Ages to WWI.


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.

142. Galileo and the Church: Political Inquisition or Critical Dialogue?—(Same as History 138E.) The hidden dialogue between Galileo and the Jesuits, the intellectual elite of the Catholic Church. Galileo's trial and specific developments of Galileo's scientific thought resulting from this dialogue. The Galileo affair in light of the conflict between the Jesuits and Dominicans' cultural policies.

144A, B. Medieval Presuppositions of the Scientific Revolution—(Same as History 112A, B.) Undergraduate seminar. Textual reading of theological, epistemological, and scientific discussions that, from the 14th century, prepared for the scientific revolutions of the 17th century, the debates concerning the limits of God's omnipotence, the status of infinities, the propagation of light and projectiles. Some central texts from the 17th century.

145. Scientific Revolution—(Same as History 139, Philosophy 145, VTSS 132.) 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.

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)

152. The Darwinian Revolution and Modern Geology—(Same as Philosophy 152.) The Darwinian Revolution transformed biology by establishing a new perspective for the study of organic forms, heredity, and genetics. It had consequences for earth history and planetary science from a biological and geological viewpoint, including the age of the earth, paleontology, continental drift, biological inheritance, and genetic theory.

153. Science, Technology, and Material Culture in Traditional China—(Same as Asian Languages 153, History 193.) A general survey of the technological achievements and scientific undertakings of traditional China, and the ideological and social factors which aided or hindered such enterprises. (DR:5*)
ig3. 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 include 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 133.) 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. 4 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 (Morrison, Galison) T 4:15-6:05

**PROGRAM IN HUMAN BIOLOGY**

Chairman: H. Craig Heller
Faculty: Sandra Archibald (Food Research Institute), Brian Arthur (Food Research Institute), J. Myron Atkin (Education), Clifford Barnett (Anthropology), Merton Bernfield (Pediatrics), Carol Boggs (Biological Sciences), Diane Bray, J. Martin Brown (Radiology), John Bunker (Health Services Research), Luca Cavalli-Sforza, Roland Ciarnello (Psychiatry), Carl Djerassi (Chemistry), Sanford Dornbusch (Sociology), William H. Durham (Anthropology), Anne Ehrlich, Shirley Feldman (Psychiatry), James Fox (Anthropology), Dolores Gallagher, Albert H. Hastorf (Psychology), Kevin Hayashi (Psychiatry), H. Craig Heller (Biological Sciences), Meredith John (Food Research Institute), Herant Katchadourian (Psychiatry), Donald Kennedy (President), Abby King (Stanford Center for Research in Disease Prevention), James Lawry, Seymour Levine (Psychology, Psychiatry), Michael Marmor (Ophthalmology), Reynaldo Martorell (Food Research Institute), Thomas McBride (Law), Lorraine Morgan, Thomas Raffin (Medicine), John Rick (Anthropology), Gary Schoolnick (Medicine), Robert Siegel, Harold Sox (Medicine), David Spiegel (Psychiatry), David Sutton, Tjeerd Van Andel (Geology), Bruce Wilcox (Biological Sciences), Christopher Wilson (Food Research Institute), Jeffrey Wine (Psychology), Arthur B. Wolf (Anthropology), Dona Wong (Psychiatry)

Director of Advising, Honors, and Teaching Coordinator: Lorraine Morgan

Director of Internship Program: David Sutton
Student Advisors: Beth Dugnan, Eric Elkin, Matt Gallagher, Karen Hauer, Sandra Lee, Louise Miller, Tricia Swartling

The Program in Human Biology is an inter-school, interdepartmental, undergraduate major designed to integrate natural and social science approaches to the study of humans. The program's curriculum offers a strong background in basic biological sciences and enriches that background by exposure to a variety of fields in the social sciences. This combination enables students to develop a broad perspective on crucial problems faced by humans worldwide. For example, Human Biology students address issues of interactions between biological and cultural evolution, interactions between biological and psychological development, and interactions of human populations.
with each other and with their environments. Knowledge gained from such considerations give 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 Human Biology 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.

The offices of the chairman, the administrative staff, director of advising, director of internships, student advisors, and teaching, learning and writing assistants of the Program in Human Biology are located in Building 80 of the Inner Quad. A computer facility for the use of majors is also housed in Building 80. 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 requirements are: Statistics 60, Psychology 60, or Biological Sciences 141. A list of courses which will satisfy the policy requirement can be obtained from the Human Biology Office.

   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 introduces 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. Homid 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 (Brentfield, 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 (Katchadourian, 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, the concept of culture, cultural evolutionary theory, differential social transmission, and the scientific methods. Recommended for those considering the Human Biology Core. (DR:5* or DR:7*)
3 or 5 units, Spr (Durham)

10. Human Sexuality—A broad perspective in human sexuality. Part I: the biological aspects of sex—anatomy, physiology, endocrinology, preg-
nancy, contraception, and diseases of the sexual organs. Part II: sexual behavior—its development, patterns, variations and interpersonal aspects. Part III: the relationship of sex and society in historical and cross-cultural contexts. Lecture without discussion sections. Emphasis on information, not advice. Preregistration is required.

3 units, Win (Katchadourian)

40. Public Decisionmaking Regarding Human Health—(Same as Health Services Research 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 United States; 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 or equivalent.

4 units, Spr (Bunker) MWF 11

41. Public Decisionmaking Regarding the Human Environment—Introduces and sensitizes the class to the complexity of public decision making 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, Win (Staff) MWF 11

not given 1987-88

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 (Arthur, 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.

102. Evolutionary Ecology—(Same as Biological Sciences 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, Aut (Boggs) MWF 1:15

104. Psychosocial Aspects of Aging—Survey examining 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 individual 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 is 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 disease. Case studies from developed and developing countries. Prerequisites: Human Biology core or Biology core or equivalent, and Mathematics 21 or equivalent.

5 units, Aut (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; human biology majors have preference when enrollment must be restricted.

5 units, Win (Martorell) TTh 10-11:50

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. Policies in Education—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 (Marmor)

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, Aut (Fox)

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 1987-88

115. Humans and Viruses—Human virology and selected topics illustrate important concepts in biology and the social sciences. Main focus 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, Spr (Siegel)

116. Eye and Implications of Vision—Seminar on the workings of the eye, and how vision influences a variety of human endeavors. Compares the human eye to the specialized eye of animals. Explores visual illusions, compares influences of the eye on visual physiology in art, history, and literature. Enrollment limited to 12. Prerequisite: Human Biology Core, Biology Core, or consent of the instructor. (Non-science majors welcome.)  
3 units, Win (Morgan)

117. Development of Science Education Policy—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 to the use of museums and the media in a comprehensive program to improve science education. International comparisons where appropriate.  
3 units, Aut (Atkin)

118. Seminar on Evaluation of Health Care Technology—Health care technology from numerous perspectives. Part I: the problem of the rising cost of health care and what measures are being taken by hospitals, the federal government, and third party payers to alleviate this problem. Part II: medical technologies—systematic methods of evaluating a technology’s effectiveness and cost-benefits ratios; what affects the diffusion of a technology into medical practice. Part III: a case study in which the methods discussed are applied to a state-of-the-art medical technology. Limited to 15 students. Prerequisite: Human Biology Core, or consent of the instructor.  
3 units, Win (Sox) not given 1987-88

119. Conservation Biology—(Same as Biological Sciences 180.) An introduction to the science of preserving biological diversity and its applications to conservation and policy. Covers biological theory relevant to the processes of extinction, small population dynamics, minimum viable population analysis, island biogeography and habitat fragmentation, and preserve design and management. Prerequisites: Human Biology Core, Biology 33 or 40, and consent of the instructor.  
3 units, Spr (Wilcox) not given 1987-88

120. Human Nutrition—(Same as Food Research 119.) An introduction to human nutrition including the function, digestion, absorption, and metabolism of nutrients, dietary recommendations and standards, and a general overview of national nutrition problems. Prerequisite: Human Biology core or consent of instructor.  
4 units, Aut (Martorell, Bray) MWF 10
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) not given 1987-88

125. Legal and Political Perspectives in Biology and Technology—(Same as Values, Technology, Science, and Society 150.) How legislatures, courts, and regulatory agencies deal with contemporary issues related to biology and technology. Issues: computers and privacy; carcinogens 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. An introduction to the workings of law, politics and regulation; emphasis is on research. Students 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 30 students.

4 units, Spr (Bernfield) 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; now "sexually transmitted diseases" number in the twenties, 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 in the STD field. 5 units require 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 in consultation with the teaching assistant. Evening sessions may be required. Prerequisite: Human Biology Core or consent of instructor.

3 or 5 units, Spr (Cerel-Bower, Schoolnick)

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 (Durham) not given 1987-88


5 units, Win (Wilson) MW 10-11:50

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, anthropometry, and epidemiology; birth interval dynamics; infant and child mortality; infectious diseases; the impact of nutrition on fertility, mortality, and morbidity.

5 units, Aut (John) TTh 1:15-3:05

142. The Impact of AIDS—AIDS as a viral infection, particularly 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 also 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, Spr (Siegel)

143. Early Experience—(Same as Psychology 190A.) Experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function.
covers animal and human research, and deals with behavioral and physiological function. Prerequisite: Human Biology Core or consent of instructor.

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

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 is on the U.S.; international perspective are 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, human environmental issues. Two discussion hours per week. Enrollment limited to 15 Human Biology seniors. Prerequisite: Human Biology Core 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, Win (Djerassi) not given 1987-88

150C. Seminar: Feminist Perspectives of Birth Control—
(Same as Feminist Studies 145.) 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 prior to Winter Quarter is essential using special preregistration forms available from the Human Biology office. Limited to 15 seniors. Under exceptional circumstances junior standing considered.

6 units, Win (Djerassi) not given 1987-88

153. U.S. Agriculture: Interaction of Biology and Economics—(Same as Food Research 145.) Agriculture in the United States is shaped by biological and economic influences. Issues include 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, Spr (Archibald) MWF 9

154. The Biosocial Aspects of Cancer—
(Same as Therapeutic Radiology 154.) Aspects of cancer as a biological phenomenon and as a clinical, emotional, and societal problem. The diagnosis and treatment of human neoplasms, their psychosocial and economic impact, and the organization of cancer care and research. 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 equivalent.

4 units, Spr (Brown, Staff) not given 1987-88

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, Win (Spiegel) not given 1987-88

166. Biosocial Aspects of Cardiovascular Disease—
Epidemiological, biological and behav-
ioral perspectives of cardiovascular disease and the assessment and modification of risk factors relating to it. The potential for disease prevention and an examination of the major preventive trials. Public policy ramifications. Topics: weight control, smoking, Type-A behavior, and exercise. Enrollment limited to 35. Prerequisites: Human Biology Core or consent of instructor.

4 units, Aut (King)

167. Molecular Biology of Central Nervous System Development—Traces 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. Attention to the 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 Bio 31, 32.

5 units, Spr (Ciaranello, Wong)

171. Adolescence—Adolescence viewed from anthropological, sociological, psychological, and psychiatric perspectives. Topics: physical and physiological development, cognitive growth, identity, peer group, generation gap, impact of the school, vocational development. Prerequisites: Human Biology Core or Psychology 111, a basic 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 relationships, patterns of vocational choice; physiological and psychological changes at midlife. Lectures to be 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

173. Medical Ethics—(Same as Philosophy 78.) How ethical theory and the rules of moral reasoning can be applied to issues in clinical medicine and biomedical research. Topics: guidelines for genetic engineering and experimentation on humans, surrogate motherhood, the just management of the AIDS epidemic, euthanasia, the just allocation of scarce medical resources, organ transplants, etc.

4 units, Aut (Zalta)

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 (Mnookin) not given 1987-88

177. Social Psychology of Physical Deviance and Disability—(Same as Psychology 177.) The issues and problems faced by the handicapped with a three-pronged approach. The biological basis of various handicaps with the psychosocial problems and stigmas associated with them. Also, the legal and political issues concerning the handicapped.

4 units, Win (Hastorf) TTh 11-12:15

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 in all populations across 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 larger elderly populations in developed countries? What implications do they have for social policy? These questions are addressed through readings, lectures, films, field visits, and guest panelists. Students are assisted in carrying out research projects.

3-5 units, Win (Barnett)

183. Hunter-Gatherers in Archeological Perspective—(Same as Anthropology 187.) The organization and subsistence of band-level hunter-gatherers as approached through archeological investigations. Survey of modern hunter-gatherers, providing background for prehistoric groups. The archeological record of Africa, Europe, and the New World provides examples of how data reconstructs the cultural systems of extinct hunter-gatherers. Artifact typology, settlement pattern analysis, modeling approaches, ethnoarcheological methods, and other techniques determine the similarity of early groups to their modern counterparts.

(DR.5*)

5 units, Win (Rick)
184. **Intensive Life Support Systems: Present Practice and Moral Issues**—An investigation of intensive life support systems used in intensive care units. Topics: the current state of the art of critical care medicine focusing on the function, need, productivity and national costs of intensive care units; examples of how our basic understanding of physiology can be translated through bioengineering into life support systems; and the moral issues surrounding which patients should be admitted to intensive care units and how to “help the dying and their families have a good death.” Students spend time in intensive care units. Limited to 30 students. Prerequisite: Human Biology Core. 3 units, Win (Raffin) not given 1987-88

185. **The Evolution of Prehistoric Civilizations**—(Same as Anthropology 188.) The radical transitions involved in the evolution from original non-complex societies to complex state organizations. Basic problems include the change from food collecting to food-producing societies, the evolution of rank and stratification in society, and the role of trade, interaction, mobility, population growth, and ideology in the development of civilizations. Theories of state evolution are examined in the light of prehistoric Mesoamerican and South American complex societies. (DR:5) 5 units (Rick) not given 1987-88

186. **Behavioral Endocrinology**—(Same as Psychology 189.) The behavioral and environmental influences on endocrine regulation, in particular those hormones which are related to responses to stress. The basic endocrinology and neuroendocrine regulation of stress-related hormones. Emphasis on the interaction of psychological variables and the activity of the pituitary-adrenal system. Also, a detailed examination of the concepts of stress and coping from a theoretical perspective. Prerequisite: Human Biology Core, or consent of the instructor. 3 units, Win (Levine) not given 1987-88

187. **Advanced Neurochemistry Seminar**—Seminar topics decided by the students and the instructor, and taken from areas of current importance and activity in neurochemistry. Through 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 plus either 167 or Biochemistry 300, and Neurobiology 200. 3 units, Spr (Ciaranello) not given 1987-88

188. **Internship in Human Biology**—Required of all program majors. Offers the opportunity to augment the formal course work with a supervised field, community, or laboratory project of his or her own choosing. To be arranged in advance and 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**—An opportunity for 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 should consult with Program’s Academic Assistant for explicit requirements. (Staff) by arrangement

HUMANITIES SPECIAL PROGRAMS

Emeriti: (Professors) John W. Dodds, Paul H. Kocher
Chairman: Paul Robinson
Professors: Kurt Mueller-Vollmer (German Studies and Humanities), Lawrence V. Ryan (English and Humanities)
Program Coordinator: Helen Brooks
honors Program Committee in Charge: Paul Robinson (Chairman), Beverly Allen, Helen Brooks, Edwin M. Good, Marsh McCall, Kurt Mueller-Vollmer
Committee in Charge Graduate Program: Kurt Mueller-Vollmer (Chairman), Karol Berger (Music), Russell A. Berman, Eckart Förster, Eden Quainton, Lawrence V. Ryan, Paul Robinson, Michael Saler

Humanities Special Programs include:

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 “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. A course in a non-Western culture approved by the Committee in Charge of the Program. (This course will fulfill one of the general distribution requirements for graduation.)
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 PROGRAM

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
merits, to ensure that the proposed three seminars and proseminals 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 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.

61. The World of Classical Antiquity— Homer, Bible, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Epictetus, Sappho, Vergil. (DR:1; three-quarter sequence)
5 units, Aut (McCall, Staff) MTW11 plus two hours by arrangement

62. Christian and Secular Europe: Medieval and Renaissance—St. Augustine, Marie deFrance, Dante, More, Machiavelli, Luther, Montaigne, Cervantes, Galileo, Shakespeare, Milton. (DR:1; three-quarter sequence)
5 units, Win (Ryan, Staff) MTW 11 plus two hours by arrangement

63. From the Enlightenment to the Present— Voltaire, Rousseau, Marx, Darwin, Freud, Emerson, Goethe, de Beauvoir, Dostoevsky. (DR:1; three-quarter sequence)
5 units, Spr (Harvey, Staff) MTW 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)

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

176. SLE Tutoring.
   2-5 units, any quarter (Ryan) 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, Spr (Wilke) MW 1:15-3:05

192. The Arts and the Humanities.
   5 units, Spr (Lewis) W 2:15-5:05

193. Philosophy and the Humanities.
   5 units, Aut (Pruitt) TTh 3:15-5:05
   Win (Moravesik) TTh 1:15-3:05

194. Literature and the Humanities—The critical study of major texts; theory and practice of criticism.
   5 units, Aut (Robinson) TTh 1:15-3:05
   Spr (Brooks) TTh 2:15-4:05

197. Modernism and the Humanities.
   5 units, Win (Harrison) M 2:15-5:05

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
specifically prescribed courses preparatory to and essential for that year of graduate work. Students seeking admission to the program from university backgrounds other than Stanford must, therefore, supply a description of coursework that they would like to have considered in connection with their application for admission to this program.

The total program emphasizes understanding of the historical processes that gave rise to the contemporary world scene; sufficient training in economics and political science to provide a basis for understanding and analyzing the international activities and policies of governments and important private interests; 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, international trade, or international finance; training in accounting and computer science; proficiency in one modern foreign language; and the completion of 45 units of approved courses, at least 25 units of which must be at the graduate level, i.e., usually courses numbered 200 or above. An effort will also be made to incorporate in the program an internship with an international firm, research project, or governmental agency whenever possible.

ADMISSION

Students may enter the program in three different ways:

Early Admission for Stanford Undergraduates—Because the program requires such extensive and specific undergraduate preparation, it is possible for students already enrolled as undergraduates at Stanford to apply for admission as early as their eighth quarter (or upon completion of 105 units) and no later than their eleventh quarter. They are strongly advised to make such application prior to the end of their ninth quarter. 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 a letter grade indicator of 3.5 or better, an up-to-date transcript, two letters of recommendation from university-level instructors familiar with the student and his or her academic work, and a statement setting forth any personal background information the student would like to have considered, describing the reasons for which the student wishes to enroll in the program, and the way in which the student's contemplated schedule of studies will make a coherent and practical contribution to his or her career goals. Application is made through the International Relations office, Bldg. 200, room 19. Prior to making formal application, students should obtain from this office and familiarize themselves with a detailed description of the program entitled "Information for Students in the Master of Arts Program in International Policy Studies." Thereafter, they should obtain a "Petition for Admission to the Coterminal Degree Program," and the "Coterminal 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 January 1. For the present, total enrollment in the program is limited to approximately 30 in all categories of entrants.

Early Admission for Transfer Students—Transfers from other colleges or universities with a view toward early admission to the program in undergraduate status are subject to Stanford's normal policies for transfer students. Transfer admissions are limited to a relatively small number of students who are admitted only to the sophomore and junior classes. Application for admission to Stanford as a transfer student is a separate process and should be made directly to the Office of Admissions, Stanford University, Stanford, CA 94305. Admission to the program is possible only after acceptance as a transfer student by the Office of Admissions. The procedures involved are identical with those described above.

Admission at the Graduate Level—Applicants for admission to the program at the graduate level from universities other than Stanford or applicants from Stanford who did not apply by their eleventh quarter 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 plus a statement setting forth any personal background information the student would like to have considered, describing the reasons for which the student wishes to enroll in the program, and the way in which the student's contemplated schedule of studies will make a coherent and practical contribution to his or her career goals. Applicants will be expected to have an A.B. or B.S. degree from an accredited college or university and a letter grade indicator of 3.5. Applications for admission at the graduate level are accepted only for the Autumn Quarter, and must be filed, together with supporting credentials, 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. Where departmental requirements at the A.B. level are concerned, 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 above noted "Information for Students," and set forth in tabular form in Appendix I of that document. They involve a total of 103-115 units of specified courses and seminars normally to be completed in the space of five years (four undergraduate and one graduate). 45 of these units must be completed while enrolled for three terms with graduate standing at Stanford. 25 of the total 103-115 units must be in graduate level courses or seminars (usually those bearing course numbers of 200 or higher). These are normally taken during a student’s fourth or fifth years. 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 a student should list no more than 45 of the most appropriate course units. Adding units for other courses completed is not to the student’s advantage.

Students should be aware that no financial aid from the University will be available to students in this program during their period of graduate level registration. Such support is limited to the first four years of undergraduate work at Stanford or to work for the doctoral degree.
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 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). 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.

The Honors program is designed as a two-year undertaking. 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 humanities and social science courses; 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.

AWARDS

The International Relations Program invites undergraduate Stanford 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 truly distinguished honors theses.

Funds may be used to finance travel to places where field work or library research is to be conducted, or may be used to support intensive work during the summer at Stanford. The 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 section on “International Policy Studies” 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, Spr (Abernethy, Van Slyke, Varese)


5 units (Abernethy) given 1988-89

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 (Holloway)

75S. Introductory Seminar: The Atomic Bomb in History—(Enroll in History 75S, History of Science 75.)

5 units, Win (Bernstein)

112C. Transition to Democracy in Latin America—(Enroll in Political Science 112C.)

5 units, Win (Cheresky)

117R. The Role of the Military in Politics—(Enroll in Political Science 117R.)

5 units, Aut (Rice)

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)

114A. People and Cultures of Mainland Southeast Asia—(Enroll in Anthropology 114.) Examines processes of sociocultural persistence and
European balance of power and reorganization by absolute empires (Austria, Prussia, and Russia) by the 18th century.

5 units (Kollman) given 1988-89

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 adaptation. 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, Spr (Triska)

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, Winter (Packenham)

5 units, Win (Newhold)

133. Peace Studies—(Enroll in Political Science 133.) 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, Moses, Ross)
134. U.S. and Soviet National Security Policies: The Responsibilities of Empire in the Nuclear Age—(Enroll in Political Science 133R.) The formulation and execution of national security policy in the United States and the U.S.S.R. Emphasis is creation and rapid growth of the national security apparatus after 1945 and the attempt to balance domestic concerns with expanding international responsibilities. Several cases of security policy formation and conduct provide an analytical basis for comparison, including weapons procurement, nuclear arms control, and crisis management. Prerequisite: Political Science 138A.

5 units, Aut (Blacker)

134N. The Use of Force and the Peaceful Settlement of International Disputes—(Enroll in Political Science 134N.) Interdisciplinary discussion of two complementary key principles of international law against the background of current political and military realities (e.g., Soviet invasion of Afghanistan, conflict between U.S. and Nicaragua).

5 units, Spr (Neuhold)

136. Soviet Foreign Policy—(Same as History 122B, Political Science 136.) Foreign and domestic determinants of policy; intentions and capabilities; continuity and change since 1917; institutions and personnel; war and peace; perceptions, priorities, and attitudes; alternative futures.

5 units, Aut (Griffiths)

138A. Arms Control—(Enroll in Political Science 138A.) International security relations since 1945, the revolutionary development of nuclear weapons, the arms competition, and efforts at arms control and disarmament in the post-World War II period. Topics: political, technological, and conceptual problems of national policies and arms control, analyses of strategic military doctrines and negotiations on strategic and regional military forces, including SALT, START, INF, and space-based weapons. Taught by an interdisciplinary faculty.

5 units, Win (Blacker)

138B. Seminar: Arms Control—(Enroll in Political Science 138B.) The substantive and procedural aspects of arms control negotiations. Core faculty is assisted by guest speakers with negotiating experience. Limited enrollment. Prerequisite: 138A.

5 units, Spr (Blacker)

138D. Topics in Arms Control—(Enroll in Political Science 138D.) Research and tutorial course, supervised by members of the arms control faculty. Prerequisites: 138A and B.

5 units, Spr (Lewis, Blacker) given 1988-89

139. Seminar: Chinese Foreign Policy—(Enroll in Political Science 139.) 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: Political Science 115 or equivalent, or permission of the instructor.

5 units, Spr (Halpern)

139D. Japanese Foreign Policy—(Enroll in Political Science 139D.) The postwar evolution of Japan's foreign policy: historical background, external environment, and domestic institutions.

5 units, Win (Okimoto)

142L. Seminar: Theories of International Conflict—A survey of some of the major approaches to the study of international conflict.

5 units, Spr (Lalman)

143H. Makers of Modern Strategy—(Enroll in Political Science 143H.)

5 units, Aut (Sagan)

144W. Seminar: Conflict and Cooperation in International Relations—(Enroll in Political Science 144W.) Recent developments in international relations theory relevant to issues of conflict and cooperation between states. The emphasis is on cooperative behavior in security issues; also theories from international political economy. Theories derived from structural realism, liberalism, game-theory, regime theory, and others. Applications to historical case studies: international trade, arms control, US-Soviet detente. Prerequisite: Political Science 35 or equivalent.

5 units, Aut (George, Weber)

145J. American Foreign Policy—(Enroll in Political Science 145J.) Introduction to American foreign policy, its formulation and implementation, and specific problems which were influential in its development in the post-WW II era. Begins with the modes of foreign policy analysis and the internal and external constraints facing American central decision-makers. Topics: the development and evolution of American containment policy, American foreign economic policy, U.S. national security policy, and important contemporary issues of American foreign policy. (Fulfills the American foreign policy requirement.) Prerequisite: Political Science 35 or equivalent.

5 units, Spr (Sagan)

146. Seminar: Foreign Policy in the Third World—(Enroll in Political Science 146.) The economic, cultural, political, and military behavior of the Soviet Union and its allies in the Third World, Latin America, Africa, the Middle East, and Asia; the ways competition between East and West affects states and regions in the
Third World; the constraints upon the Soviet behavior posed by, and Soviet opportunities in, states and regions in the Third World. Emphasis on contemporary Soviet foreign policy.
5 units, Win (Triska)

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. World-wide 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)

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 characteristic 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 United States 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, Win (Kennedy)

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.) Survey of different 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.)
5 units, Spr (Haber)

179. The Historical Evolution of Mexico—(Enroll in History 179.) From the conquest of the 1520's to the crises of economic development and political legitimacy of the 1980's.
5 units, Aut (Bower)

195. Nomad Empires of Inner Asia—(Enroll in History 195, Asian Languages 152.) (DR:5*) 5 units (Dien) given 1988-89

5 units, Spr (Abernethy)

228A. Seminar: The U.S. and the U.S.S.R. as Regional Powers—(Enroll in Political Science 228A.) Research on the progressive alienation between restive, frustrated social forces and obsolete political structures in Eastern Europe, Central America, and the Caribbean. The dilemma of the two regional powers and how to deal with social change without harming their regional interests.
5 units, Win (Triska)

236A,B. Graduate Research Seminar: Soviet Defense Policy and Military Affairs—(Enroll in Political Science 236A,B.) The development and current status of the Soviet armed forces. The external and internal factors that have shaped Soviet military power and conditioned its use in support of policy. Theoretical approaches to understanding Soviet policy. The second quarter offers the opportunity to write a research paper. Prerequisite: Consent of instructor.
5 units, Win, Spr (Holloway)

243. Seminar: International Relations Theory—(Enroll in Political Science 243.) 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, Win (Sagan)

244A. British Intellectuals in India—(Enroll in History 224.)
5 units, Aut (Zaspoupil)

244R. The Politics of Alliances—(Enroll in Political Science 244R.) Role of political-military 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 both the 19th and 20th centuries, including NATO and the Warsaw Pact. Prerequisite: Political Science 35 or consent of instructor.
5 units, Win (Rice)

249A. Africa Since 1945—(Enroll in History 249A.)
5 units, Win (Jackson)

290. Japan and America: Conflict and Cooperation—(Enroll in History 290.)
5 units, Aut (Duus)

CLUSTER B: HUMANITIES EMPHASIS

27. Islam—(Enroll in Religious Studies 27.)
Forms of Islam from the beginning to the present day; interpretations of Muhammad and the Koran; the legal, mystical, and rationalistic foci of Islamic thought, feeling, and behavior; modern movements of reform and their contact with the West. Comparison and contrast with forms of Christianity and Judaism. Limited enrollment. (D:R5*)
3 units, Aut (Berman)

64. Introduction to Chicano Life and Culture—(Enroll in History 64.) 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. An opportunity to interact with three different Chicano faculty from three disciplines. Historical texts, novels, poems, and enthographies are required readings. (DR:5)
3 units, Aut (Camarillo, Cuellar)

77. Ethics in International Relations—(Enroll in Philosophy 77.) 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, Spr (Jenni)

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:5)
5 units, Win (Jacksic, Bogenchild)

5 units, Win (Funkenstein)

106B. Jewish Intellectual History: Modern—(Enroll in History 106B.)
5 units, Spr (Funkenstein)

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 religiosity.
5 units, Win (Langmuir)

114. Core Seminar: Western Culture and the Black Diaspora—The Semiotics of Self and Other—(Enroll in African and Afro-American Studies 113.) Selected texts to examine the significations accorded Africa, the "Negro" and the Black Diaspora in the signification system of Western Culture. Analyzes the deconstruction of these significations by some schools of modern Western scholarship and by counter-discourse of emancipatory movements in the Diaspora itself.
3 units (Ueda) given 1988-89

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)


4 units, Win (W. Corn)

136A. European Thought in the 19th Century—(Enroll in History 136A.) Great thinkers and major movements of the 19th century, romanticism, liberalism, Marxism, and the origins of modern irrationalism; seminal writings of Burke, Mill, Marx, Ruskin, and Nietzsche. (DR:3)

5 units, Win (Robinson)


5 units, Win (Robertson)

165. Afro-Hispanic Culture and Literature—(Enroll in African and Afro-American Studies 165.) An outgrowth of Africa and the Black Diaspora, concentrating on Spanish-speaking countries with a sizeable Black population, particularly Colombia and Cuba. Introduction to less-known Afro-Hispanic cultures. Emphasis placed on (1) the relationship of these cultures to the countries in which they are found; (2) their relationship to other African cultures and peoples; and (3) the uniqueness of the individual cultures.

5 units (Wynter)

166. The Reciprocal Vision—(Enroll in English 166C.) A study of 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 1988-89

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, Spr (Allen)

215S. Undergraduate Seminar: Jewish History—(Enroll in History 215S.) 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.)

5 units, Spr (Funkenstein)

241. Afro-Hispanic Cultural Worlds: An Introduction—(Enroll in Spanish 241.) The literature and thought of Black Latin American writers in the Spanish-speaking Americas and in Brazil. An introduction to the popular syntactic cultures of interesting but little known worlds. Reading Spanish/Portuguese, and in English translations.

3-5 units, Spr (Wynter)

244A. British Intellectuals in India—(Enroll in History 224.)

5 units, Aut (Zaspouil)


5 units, Aut (Wynter)

254. Spanish American Writings of the 20's and 30's: Vanguardismo, Regionalismo, Feminismo—(Enroll in Spanish 254.) A study of these three developments in culture, in connection with processes of urbanization, modernization, and North American expansionism.

5 units (Pratt) given 1988-89

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 1988-89

CLUSTER C: POLITICAL-ECONOMIC ISSUES AND POLICY ANALYSIS

106. The World Food Economy—(Enroll in Food Research 103, Economics 106.) The inter-
The 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, Spr (Johnston)

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, Spr (Karl)

116. The Economics of Development—(Enroll in Economics 118.) 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, Win (Anderson)

117. Africa: Development and Dependence
—(Enroll in Political Science 118J.) A survey of African politics examining alternative explanations for the contemporary African situation and alternative strategies for development. Topics: colonial rule, decolonization, persistence of white rule in southern Africa, colonial and post-colonial social structure, patterns of political and economic organization, internal and external constraints on development. (DR:5*)

5 units, Aut (Samoff)

118. Development and Population Interactions in the Third World—(Enroll in Economics 119, Food Research 121.) The 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, Win (Yotopoulos)

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, Win (Fagan)

122. The Theory of Capitalist Development
—(Enroll in Economics 122.) The theoretical and historical analysis of the process of capitalist development: economics; 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, with focus on Marxian theory and recent elaborations and extensions of that theory. Relevant historical case studies. Prerequisites: Economics 51 and 52.

5 units, given 1988-89

123. Economic Development in Latin America—(Enroll in Economics 123, Food Research 218.) (Open to advanced undergraduates only 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 5 and 52.

5 units, Spr (Reynolds)

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, Spr (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 emerging specific policy dilemmas in the issue area.
democratization, national security, and human rights.

5 units, Spr (Karl)


5 units (Karl) given 1988-89

128. Sociocultural Implications of High Technology—(Enroll in Anthropology 138/238.) Seminar on the development, diffusion, and utilization of technology as a cultural process. Emphasizes the high technology developed in and around Stanford: biogenetics, microelectronics, and information technology. Local technologists and venture capitalists give weekly in-class presentations. Also, unintended human damage such technological innovations produced; ways innovations drive or enable profound changes in other parts of a sociocultural system (its symbolic, value, belief patterns, and its social and economic organization), and implications for appropriate technological design and public and educational policy. Case studies from non-Western cultures of varying levels of sociotechnical complexity, and a unit on modern Japan.

5 units, Aut (Textor)

140A, B, C. Ethics of Development in a Global Environment (EDGE)—(Enroll in Political Science 140A, B, C.) A series of speakers on current development issues with emphasis on the problems of the poorer nations. Autumn Quarter: world resources—energy, food, housing, population, and environment, Winter Quarter: the rule 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 five units may be credited toward Cluster C for course sequence.)

1 unit (4 units with workshop) each quarter, Aut, Win, Spr (Fagen, Lasignan, McWhorter, Siegel, Textor)

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. Prerequisite: Economics 51, 52, and Food Research 144, or consent of instructor.

5 units, Win (Josling)

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. Topics: 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.) (DR:5)

5 units, Win (Inkeles)

164. 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, Spr (Staiger)

167. International Trade Policy—(Enroll in Economics 166, Food Research 166.) Formulation and 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)

168. European Economic Integration—(Enroll in Economics 167.) 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: Economics 165 or consent of instructor.

5 units, Win (Schröder)

191. Undergraduate Seminar in United States-Mexico Relations—(Enroll in Latin American Studies 191.) The principal problem areas in the complex relationship between the United States and Mexico. A survey of U.S.-Mexico economic and social relations is followed by 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)

207. Seminar on International Cooperation in Educational Development—(Enroll in Education 207X, Political Science 248.) The role of international and bilateral organizations involved in development assistance, especially education. See as part of an interlocking system of political/economic power and cultural/intellectual objectives. Case studies: the World Bank, UNESCO, OECD, regional development organizations such as the African Development Bank or the European Development Fund, and bilateral programs.

5 units (Weller) given 1988-89


5 units, Win (Okimoto)

240 International Political Economy — (Enroll in Political Science 241.) Major theoretical approaches emphasizing structural/mercantilism, liberalism, and Marxism. Applied to a variety of historical and contemporary issues. Lectures and class presentations on readings.

5 units, Aut (Lake)

251. Communication and Development—(Enroll in Communication 151/251.) The causes of underdevelopment, the dynamic role of communication in national, social, and cultural development, and the potential and practice of mass media in Third World countries as a tool of transformation.

3-5 units, Aut (Storey)

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 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, and international market regulation and to the role of international institutions. Prerequisites: Economics 51, 52, or equivalent.

5 units (Josling) given 1988-89

INDEPENDENT STUDY

197. Directed Study in International Relations.*

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, 1987-88.

BERLIN

Political Economy—(Enroll in Overseas Studies/Germany 1.) Cluster C.

5 units, Aut (Okimoto)

The German Question—(Enroll in Overseas Studies/German 7.) Cluster A.

5 units, Win (Klinger)

The Federal Republic of Germany in the International System—(Enroll in Political Science 140X.) Cluster A.

4-5 units, Spr (Gortemaker)

FLORENCE

Terrorism in Italy and Europe—(Enroll in Overseas Studies/Florence 7.) Cluster A.

4 units, Win (Della-Porta)

U.S. and Western Europe After World War II—(Enroll in Political Science 121X.) Cluster A.

4-5 units, Win (Mammarella)

International Economics—(Enroll in Economics 165X.) Tutorial only—no seminar. Cluster C.

5 units, Spr (Grant)

KRAKOW

East-West Relations: Central Europe between the Superpowers—(Enroll in Overseas Studies/Krakow 1.) Cluster A.

4 units, Spr

Polish History—(Enroll in Overseas Studies/Krakow 4.) Cluster A.

2 units, Spr

The Socialist Economies of Poland and the COMECON States: Evolving Structures—(Enroll in Overseas Studies/Krakow 5.) Cluster C.

4 units, Spr

* Obtain section number from International Relations office.
OXFORD

The Political Economy of the European Economic Community—(Enroll in Overseas Studies/Oxford 2.)
5 units, Aut (Allen)

British Empire and Commonwealth—(Enroll in Political Science 132X.) Cluster A.
5 units, Spr (Rizvi)

British Foreign Policy and International Relations, 1935-1985—(Enroll in Political Science 138X.) Cluster A.
4-5 units, Win (Holmes)

TOURS

Contemporary Problems of Economic Growth—(Enroll in Economics 128X.) Cluster C.
5 units, Aut, Win, Spr (Staff)

French Foreign Policy—(Enroll in Political Science 120X.) Cluster A.
5 units, Aut, Spr (Billard)

France and Europe and the Economic Crisis—(Enroll in Economics 127X.) Cluster C.
5 units, Win (Leboucher)

France and the Third World—(Enroll in Political Science 140X.) Cluster A.
5 units, Win (Billard)

PROGRAM IN JEWISH STUDIES

Co-Directors: Arnold Eisen, Amos Funkenstein
Faculty Advisory Committee: Lawrence Berman, John Felstiner, Estelle Friedman, Van Harvey, Seymour Martin Lipset, Mark Man- call

The Program in Jewish Studies brings to focus the various courses given on campus relating to Jewish history, thought, literature, and culture from biblical times to the present.

Faculty affiliated with the program are available to advise undergraduates interested in devising a Jewish Studies program within the Individually Designed Major. Such students are required to participate in at least two Jewish Studies seminars.

Graduate students will enroll in either the Department of Religious Studies or the Department of History, and will be required to meet the requirements of that department as well as those of the Jewish Studies program. They will participate in a central seminar in Jewish Studies to be offered yearly.

A standing series of guest lectures and conferences are an integral part of the program and its courses of study.

JEWSH STUDIES 473

COURSES

1,2,3. Hebrew: Beginning, Intermediate, and Advanced—(Enroll in Linguistics 628, 629, 630.)
   Aut, Win, Spr (Staff)

4. Seminar in Jewish History—(Enroll in History 215S/415.)
   Win (Funkenstein)

5. Seminar in Jewish History—(Enroll in History 216SD/416.)
   Spr (Funkenstein)

6. Jewish Intellectual History: Medieval Period—(Enroll in History 106A.)
   Win (Funkenstein)

7. Jewish Intellectual History: Modern Period—(Enroll in History 106B.)
   Spr (Funkenstein)

8. Encounters Between Modern Philosophy and Judaism—(Enroll in Religious Studies 281.)
   Spr (Eisen)

   Aut (Eisen)

10. Hebrew Bible—(Enroll in Religious Studies 121A.)
    Win (Good)

11. Hebrew Bible—(Enroll in Religious Studies 121B.)
    Spr (Good)

12. The Biblical Presence in Modern Poetry—(Enroll in English 164A.)
    Aut (Felstiner)

13. Literature of the Holocaust—(Enroll in English 165A.)
    Spr (Felstiner)

14. Zionism and the State of Israel—(Enroll in History 189.)
    Win (Mancall)

15. Jewish Literature and Society—(Enroll in History 222.)
    Spr (Mancall)

20. Founders in Myth and History—(Enroll in Religious Studies 131.)
    Win (Berman)

21. Mystics and Intellectuals—(Enroll in Religious Studies 122.)
    Spr (Berman)

NOT OFFERED 1987-88

   Eisen

17. Contemporary Jewish Thinkers.
   (Eisen)
18. Genesis of Anti-Semitism.
   (Langmuir)
19. Religions of Abraham.
   (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 audiotapeces 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.

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*COUNCIL FOR LATIN AMERICAN STUDIES

Chairman of the Committee and Director of the Center: George A. Collier

Affiliated Faculty:

- Anthropology: Clifford Barnett, George Collier, Jane Collier, José Cuellar, William Durham, James Fox, John W. Rick, Renato Rosaldo, Bernard Siegel
- Classics: Gregson Davis
- Communication: Elie Abel, Steven Chaffee
- Economics: Julie Anderson, Donald Harriss, Ronald McKinnon
- Education: Martin Carnoy, Isidoro Cherehek (Tinker Visiting Professor)
- English: Sandra Drake, John Felstiner, Shide B. Heath
- Food Research Institute: Bruce Johnston, Renaldo Martorell, Clark Reynolds
- History: Frederick Bowser, Albert Camarillo, Jose Deustua (Tinker Visiting Professor), Stephen Haber, Sabine MacCormack, John D. Wirth
- School of Law: John Barton, William Gould, Thomas Heller, John Merryman
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 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 outside the student's major discipline 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 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 (LAS) 152, is required the Spring Quarter before departure and an extensive written report is submitted the following Autumn Quarter for the independent research seminar, LAS 153. Students from all departments are eligible to apply.

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 or a B.S. degree, training in at least one of the social sciences, and a working knowledge of Spanish or Portuguese. Applicants must 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 (LAS 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 (LAS 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 three years of university training. Students with advanced competency in Spanish, but with no knowledge of Portuguese, must take Portuguese 109, Portuguese for Students of Spanish, during the Autumn Quarter; otherwise, first- and second-year language courses may not be counted toward the degree. If Spanish or Portuguese is the student's base discipline, he or she must show ability in both languages. Courses in linguistics may be counted toward this concentration.

There is no thesis requirement for the A.M. degree in Latin American Studies. Instead, a paper that gives satisfactory evidence of methodological, analytical, research, and writing skills is required from each member of the Core Seminar. All requirements for the A.M. degree are normally completed in three academic quarters by a full-time student.

JOINT DEGREE PROGRAMS

LAS/Law—The Center for Latin American Studies (LAS) and the Stanford Law School offer a joint program leading to the J.D. degree in law and the A.M. degree in Latin American Studies. Students must apply to and be independently accepted by both Law and Latin American Studies.

LAS/Education—The degree of Master of Arts in Teaching with an interdisciplinary concentration in Latin American Studies is offered jointly by the center and the School of Education. For the general requirements, see the section “School of Education” in this bulletin. Candidates must have a teaching credential.

LAS/Medicine—An A.M. degree in Latin American Studies is also offered in conjunction with the M.D. degree program at Stanford. Students accepted by the School of Medicine can then apply to the Center for Latin American Studies for admission into the special joint-degree program.

For additional information regarding Latin American Studies joint degree requirements, inquiry should be made to the center.

Since the University does not offer a Ph.D. in Latin American Studies, students who wish to remain in an academic program at Stanford after completing their A.M. must be accepted by one of the 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, Win (Bogenchild, Jaksic)

137. State and Society in Latin America—The historical evolution of the Latin American social structure and the nature of the state (role incumbents, political regime, institutional characteristics, and policy outputs) in relation to society in Latin America.

5 units, Spr (Phillipps)
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

159. Directed Individual Study—For students engaged in special interdisciplinary work that cannot be arranged by department. (Graduate students enroll in 269.) 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 United States and Mexico. A brief historical survey of U.S.-Mexico economic and social relations is followed by trade problems, the foreign debt crisis, foreign investment, agriculture, energy policy (and the migration issue), immigration policies and labor markets. Prerequisite: 91, or consent of the instructor. Enrollment limited to 12. 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 (Bower) M 2:15-4:05

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

281. Colloquium in Contemporary Andean History—(Same as History 281.) Focuses on the peculiar aspects of economic development in the Andean countries, Peru, Bolivia, Ecuador, and Columbia. Emphasis on the relationship between the export sector and the traditional agrarian system. 5 units, Spr (Deustua-Carvallo)

450. Graduate Seminar: Andean History—(Same as History 450.) Topics in social and economic history of the Andes, including the "longue duree" of Andean civilization, the birth of capitalism in the 19th century and changes in social and ethnic structures. 5 units. Win (Deustua-Carvallo) T 2:15

LINGUISTICS

Emeriti: (Professors) Charles A. Ferguson, Joseph H. Greenberg
Chairman: Dorothy A. Huntington
Professors: Joan Bresnan, Clara N. Bush, Eve V. Clark, Shirley Brice Heath, Dorothy A. Huntington, Paul Kiparsky, Will Leben, P. Stanley Peters, Elizabeth C. Traugott, Tom Wasow
Associate Professors: John Rickford, Ivan A. Sag (on leave 1987-88)
Assistant Professors: Gregory Guy, William J. Poser
Affiliated Faculty: Jon Barwise, Herbert L. Clark, James A. Fox, Kung-Yi Kao, Mary L. Pratt, Orrin W. Robinson, III, Richard D. Schupbach
Senior Lecturers: Beverley McChesney, Fried N. Politzer
Consulting Professors: Philip Cole, Ronald M. Kaplan
Consulting Assistant Professors: Philip Cohen, Ronald M. Kaplan
Consulting Associate Professors: Philip Cohen, Ronald M. Kaplan
Consulting Assistant Professor: Annie Zaenen
English for Foreign Students
Director: Beverley McChesney
Senior Lecturers: Beverley McChesney, Fried N. Politzer
Lecturers: Philip Hubbard, Michelle Marchovitch
Lecturer in Arabic: Khalil Barhoum
Lecturer in African Languages: Lioba Modica
Lecturer in Hebrew: Aliza Kreisel
Special Language Program Coordinator: Mary Deutsch-Dwyer

OFFERINGS

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...
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 theoretical issues in natural language lunches. 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, Communications, Computer Science, Education (Language Arts and Language Teaching), Hearing and Speech Sciences, Languages, 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.

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) Speech Production and Perception—This specialization focuses on behavioral and physiological aspects of normal and defective processes of human communication. It is an appropriate preparation for graduate work in speech, language, and hearing sciences, speech and hearing disorders, or neurolinguistics. Specific requirements include 110, 115, and 116. Designated courses in psychology may be selected.

g) 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. An application to pursue honors work should be presented well before the end of the junior year; approval will be given only to students who have maintained 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 and allied fields 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), 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 their 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., 16 units exclusive of dissertation units. This includes:
   a) In the first year, the following core 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 242, 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, 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, or to be turned in by the end of Winter Quarter, the other by the end of May. The subject matter must be clearly distinct though they may be related. Fulfilled by Linguistics 395A, B, Research Workshop 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 a 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 requirements 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 in this section of the bulletin.

**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,Aut (Rickford)

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, Aut (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 (Kay) MWF 10

45. Introduction to Language and Speech Disorders—Survey of disorders of human communication. Major congenital and acquired pathologies (deafness, aphasia, articulatory deficits, vocal malfunctions), their physiological bases and remediation.

3 units, Aut (Huntington)


4 units, Spr (Ferguson)

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.

4 units, Aut (Staff)

70. The Structure of English Words— The analyzing of English vocabulary words in order 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, Spr (Leben)

71B. Linguistics and Literature—(Same as English 101.) An introduction to literary analysis through applications of concepts from the science of language. Emphasis on discourse analysis and the phonological, syntactic, semantic, and pragmatic structure of English, with attention to the use of regional and social dialects in literature. (DR:4)

alternate years, given 1988-89

73. 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)

alternate years, given 1988-89

75. 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. Presentation both of external history and internal relationships. (DR:4)

3 units, Spr (Robinson)

77. The English Language through American Literature—(Same as English 103.) The “American language” through the cultural history of those who have written and read American literature since 1825. Emphasis on discourse analysis and the phonological, syntactic, semantic, and pragmatic features of language (including regional and social dialects) of texts by Emerson, Twain, Whitman, Howell, James, Stein, Eliot, Hughes, Williams. (Area: A)

5 units, Spr (Heath)

78. Language and Literary Theory—(Same as English 104.) An introductory intellectual history of the role of language study in literary theories focusing on text analysis, author’s intentions, reader response, and institutional interpretive communities. Their applications of concepts from the science of language, and linkages between their originators and the study of linguistics. (Area: A) (DR:4)

5 units, Win (Heath)

85. Introduction to Methods of Teaching English as a Foreign Language—A practical approach to problems of teaching English to speakers of other languages including a survey of those features of English phonology, morphology, and syntax which present particular difficulties – presentation of problems, construction of exercises and lesson planning. For the quarter, each student serves as a tutor to an individual who is learning to speak English.

3 units, Win (McChesney)

86. 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 class observed. Prerequisite: 85 or equivalent.

2-3 units, Spr (McChesney)

98A,B. Honors Research.

2 units, Aut (Staff)

4 units, Win (Staff)
110. Introduction to Phonetics and Phonology—Basic anatomy of the articulatory apparatus and survey of the speech sounds of the world's languages with practice in transcription and production exercises. Introduction to phonological analysis including notions of alternation, distinctiveness, and distinctions between different kinds of rules. For students desiring a broad background in the field.
4 units, Aut (Mohanan)

115. Speech Perception—Perceptual and physiological correlates of the acoustic constituents of speech. Prerequisite: Course in phonetics, 110, or consent of instructor.
3 units, Win (Huntington)

116. Physiology of Speech Production—The structure of the speech mechanism and its function. Includes laryngeal control in the production of segmented, prosodic features of speech, and articulatory coordinations and control. Prerequisite: Course in phonetics or consent of instructor.
4 units, Spr (Huntington)

120. Introduction to Syntax—Introduction to syntactic theory. Analyses of various grammatical constructions, primarily English, and their consequences for a general theory of language. Practical experience in forming and testing linguistic hypotheses, reading, and constructing rules. (DR:4)
4 units, Win (Zwicky)

130. Introduction to Semantics and Pragmatics—Meaning in language from the perspectives of speaker, sentence, and word, with analysis of the implications of each perspective for theories about linguistic meaning. Prerequisite: Consent of instructor.
4 units, Spr (Staff)

135. Basic Concepts of Mathematical Logic—Introduction to the basic concepts and techniques used in mathematical logic: sets, functions, structures, formalization, proof, mathematical induction, enumerability and effectiveness.
3 units, Aut (Staff)

136. 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) and application. Prerequisites: Philosophy 57 and basic knowledge of set theory for students with no mathematics or computer science background.
4 units, Aut, Win (Etchemendy, Devlin)

138. Meaning and Experience—(Enroll in Philosophy 183/283.) The interrelationships between meaning and experience, emphasizing how our judgments concerning meaning may be based on empirical evidence. Philosophers discussed include W.V. Quine and Donald Davidson. Lectures presuppose acquaintance with the philosophy of language.
4 units, Spr (Follesdal)

139. Computational Linguistics—(Enroll in Symbolic Systems 150.) An introduction to the basic tools and techniques of computational linguistics. Students write programs in LISP to solve linguistic problems, mainly in lexicography, phonology, morphology, and syntax. Recommended: Some previous experience of either linguistics or computer programming.
4 units, Spr (Staff) 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: 1L or its equivalent.
4 units, Win (Ferguson)

152. Topics in the Ethnography of Speaking—Introduction to how affective states (excitement, surprise, anger) are communicated in different languages and societies. Topics: word order, particles, and prosody. Also, the lexicon for features of language use—the organization of conversation, laughter, irony, and the "communicative competence" of affect expression in different societies with attention to specific speech events.
4 units, Spr (Brown)

153. Inter- and Intra-Ethnic Variation in Urban Vernacular English—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 re-
search 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, Win (Rickford)

154. Language and Gender—The expanding literature on the relation between gender and speech style, distinguishing linguistic, sociolinguistic, and feminist issues. Research in linguistics, anthropology, social psychology, and sociology. Empirical questions are isolated and quantitative, qualitative, and experimental methods for investigating these are explored.

4 units, Win (Brown)

167/267. Writing Systems—A survey of writing systems, emphasizing linguistic properties, history, and mental processing. Topics: the history of different writing systems, the history of the discovery of ancient documents and their decipherment, the psychology of reading, neurological deficits affecting reading and writing, and the relative merits of different writing systems.

4 units, Win (Poser)

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.

3-5 units, Aut (Poser)

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) alternate years, given 1988-89

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. For the duration of the course, each student is required to serve as a tutor to an individual who is learning to speak English. Prerequisite: Introductory course in linguistics or consent of instructor.

4-5 units, Aut (Staff)

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 (Traugott)

Win, Spr (Mohanan, Ferguson)


4 units, Aut (Poser)

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 (Staff)


4 units, Spr (Kiparsky)


4 units, Win (Poser)

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 (Kiparsky)


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.

218. Graduate Seminar: Prosody, Language, and Affect—(Same as Psychology 245.) Linguistic and psycholinguistic approaches to the study of intonation. Topics: acoustic analysis of prosodic features; cross-language comparison of intonation systems; syntactic, semantic, and discourse functions of intonation; prosody and speech processing; intonation and the expression of affect.

3 units, Spr (Fernauld, Leben)

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), categorical 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, Spr (Sag)

223A. Lexical Functional Grammar I—First of a two-quarter advanced introduction to current syntactic theory from the view of the lexical-functional theory of grammar (LFG). Topics: the multi-tier model of grammatical structure, the mapping between trees and functions, nonconfigurality and head-marking, interactions between word structure and phrase structure, the lexical mapping from functions to predicate argument structures, control and anaphoric binding, complementation and case, coordination, the topic and focus functions, long-distance dependencies, cross-over phenomena. Emphasis on grammatical analysis and architecture, with analytic problems drawn from Warlpiri, Spanish, Moroccan Arabic, Greenlandic Eskimo, Irish, French, Serbo-Croatian, Russian, Italian, Japanese, Dutch, Icelandic, Chichewa, and English. Prerequisites: 220A,B, or permission of instructor.

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)


4 units, Win (Kiparsky)

227. Computational Models of Syntax of Natural Language—(Same as Computer Science 275.) Formal systems and computer implementations for syntax with relevant material from linguistics and formal language theory. Past and current parsing systems. Relevant aspects of the syntax of English.

4 units, Win (Kiparsky)

229. Mathematical Linguistics—(Same as Philosophy 282.) Mathematical results about syntactic and semantic systems having empirical application to linguistic theory and its applications. Prerequisite: 135, or Philosophy 159, or consent of instructor.

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 283.) 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, Win (Peters)

236. Computational Models of Discourse—(Same as Computer Science 277.) Text and

3-4 units, Spr (Cohen, Perrault)

238A. Topics in Semantics and Pragmatics: Gricean Principles—Gricean and non-Gricean principles of pragmatic interference. Topics: nature and origin of such principles, scope for formalization, the nature of the interaction between linguistic structure, the relation between other semantic/pragmatic phenomena.

4 units, Aut (Levinson)

238B. Topics in Semantics and Pragmatics: Discourse and Interpretation—Seminar focusing on two ways in which the interpretation of a sentence is constrained by the discourse context in which it occurs: implicature and discourse functions associated with topic, focus and intonation. The relationship between these aspects of discourse using current literature and relevant work in artificial intelligence, psychology, and philosophy of language.

4 units, Win (Roberts)

240. Language Acquisition I—(Same as Psychology 240.) Review 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: Theories of Meaning Acquisition—(Same as Psychology 241.) Examines proposals about and constraints on meaning acquisition.

4 units, Spr (Clark) by arrangement

246. Psycholinguistics—(Same as Psychology 214.) Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) TTh 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)


4 units, Win (Levinson)

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.

alternate years, given 1988-89

264. Historical Phonology—The nature of linguistic change in phonology and morphology. Internal and comparative reconstruction. The role of language acquisition and use in the explanation of diachronic processes.

4 units, Spr (Kiparsky)

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.

alternate years, given 1988-89

278. The Structure of Modern Chinese—(Same as Asian Languages 291.) Prerequisite: Asian Languages 23 or equivalent. Recommended: A general introductory course in linguistics.

Spr, by arrangement

285. Research Methods in Developmental Psycholinguistics—Observational and experimental techniques used in the study of language acquisition, ethical and ethical issues in research, logical connections of hypothesis to prediction to test of the hypothesis, collection and organization of data, and data analysis.

4 units, Win (Clark)

286. Topics in Language Change: Oral and Written Language—Spoken and written language: an introduction to writing systems, structural, and stylistic properties of oral and written language, and influences of written language on oral language change. Other topics: oral literature, approaches to the study of literacy, and the cognitive and social consequences of literacy.

4 units, Spr (Heath)

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 ob-
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)

99A,B. Research Workshop—Student presentations of research toward qualifying papers. Designed for second year students in the doctoral program.  
2 units, Aut (Bresnan)  
Spr (Staff)

996. Directed Teaching.  
1-5 units, any quarter (Staff)  
by arrangement

997. Directed Reading.  
1-5 units, any quarter (Staff)  
by arrangement

998. Directed Research—Research at predissertation level.  
1-6 units, any quarter (Staff)  
by arrangement

999. Dissertation Research.  
1-15 units, any quarter (Staff)  
by arrangement

REGULARLY OFFERED BUT NOT DURING 1987-88

4. Language and Culture.

51. Language Minorities in Modern Nations.

52. Linguistic Approaches to Point of View in Fiction.

100. Typology and Universals of Language.

151. Pidgins and Creoles.

155. Multilingualism.

160. Languages in Contact.


212. Metrics.

219. Topics in Phonology, Morphology.

222. Topics in Information-Based Linguistics.

224. Advanced Syntactic Theory.

225. 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.

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.

276. History of the German Language.

277. The Structure of Japanese.


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 (Moshi)

607A,B,C Intermediate Swahili.  
4 units, Aut, Win, Spr (Moshi)

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 Yoruba.

614A,B,C. Beginning Wolof.

615A,B,C. Advanced Wolof.

616A,B,C. Setswana.

618A,B,C. Beginning Bambara.
The Special Language Program offers a number of foreign languages not otherwise taught at Stanford. Courses planned for 1987-88, 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)

628A, B, C. Beginning Hebrew — Successful completion of 628C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Staff)

4 units, Aut, Win, Spr (Staff)

630A, B, C. Advanced Hebrew.
4 units, Aut, Win, Spr (Staff)

640A, B, C. Beginning Danish.
3 units, Aut, Win, Spr (Staff)

642A, B, C. Beginning Norwegian.
3 units, Aut, Win, Spr (Staff)

645A, B, C. Beginning Swedish.
3 units, Aut, Win, Spr (Staff)

648A, B, C. Beginning Polish.
3 units, Aut, Win, Spr (Staff)

650A, B, C. Beginning Romanian.
3 units, Aut, Win, Spr (Staff)

652A, B, C. Beginning Russian.
3 units, Aut, Win, Spr (Staff)

654A, B, C. Beginning Tagalog.
3 units, Aut, Win, Spr (Staff)

661A, B, C. Beginning Turkish.
3 units, Aut, Win, Spr (Staff)

670A, B, C. Modern Greek — Successful completion of 670C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Prionas)

671A, B, C. Intermediate Greek.
4 units, Aut, Win, Spr (Prionas)

673A, B, C. Intermediate Hungarian.
3 units, Aut, Win, Spr (Staff)

674A, B, C. Beginning Irish.
3 units, Aut, Win, Spr (Staff)

675A, B. Intermediate Irish.
3 units, Win, Spr (White)

675A, 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 office 380-381A. 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, Building 380-381E.

Languages offered on the basis of student requests during the last few years have included:

646A, B, C. Beginning Belorussian (Computer-Assisted).

648A, B, C. Beginning Quechua.

650A, B, C. Beginning Navaho.

654A, B, C. Beginning Tagalog.

658A, B, C. Beginning Korean.

660A, B, C. Beginning Taiwanese.

ENGLISH AS A FOREIGN LANGUAGE

The courses below represent the basic offerings in English as a Foreign Language. Each quarter, additional sections of these courses are scheduled as needed. Those students who are required to take 697 should normally expect to take the subsequent course in the sequence during a succeeding quarter.

During the regular 8-week summer session, courses in spoken and written English up to a maximum of 8 units will be offered.

An 8-week program in Intensive English and Academic Orientation for Foreign Graduate Students is also offered in the Summer.
Quarter. This program is open to qualified graduate students who have been admitted to degree programs at other United States institutions, as well as those who have been admitted to Stanford for the following Autumn Quarter. Students at the most advanced levels of English proficiency may enroll for the latter six weeks only.

690. Spoken Usage—Structured practice in spoken English with emphasis on current usage in a variety of natural situations. Review and practice of grammatical patterns as needed.

3 units, Aut, Win (Staff) by arrangement

691A. Discussion and Speech—Opportunity to participate in and lead seminar discussions on academic and general topics. 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—Opportunity to make biweekly oral presentations to a small group, followed by short discussions. Emphasis on appropriate language and style in academic or non-academic settings. Feedback from instructor and other students.

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 in oral presentations. With collaboration of Center for Teaching and Learning, various methods of feedback are utilized (audio, video, peer, and staff evaluations). Techniques of self-criticism encouraged.

1 unit, Aut, Win (McChesney, Marincovich) by arrangement

693. Aural Comprehension—Graded exercises in listening to lectures, dialogs, and discussions with evaluation of comprehension. Prerequisite: Consent of instructor.

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

695. Special Topics in English—Topics such as vocabulary, reading comprehension, or pronunciation, are determined each quarter according to enrollment.

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

697. Written English I—Intermediate work in expository writing with attention to correct grammatical usage. Prerequisite: Consent of instructor.

3 units, Aut (Staff) by arrangement

698A. Written English II—For students with some facility in written English. Emphasis on fluency, idiomatic usage, and style. Attention to mechanics and form appropriate to academic papers. May be repeated for credit. Prerequisite: Consent of instructor.

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

698B. Written English II—Weekly class meetings grouped by academic interests, plus one individual conference per week. 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

114. Haiku.


132. Chinese Fiction and Drama in Translation.

133. Modern Chinese Literature in Translation.


137. Classics of Japanese Literature in Translation II.

given 1988-89
given 1988-89
given 1988-89
197. Images of Women in Modern Japanese Literature.

CLASSICS
11. Age of Heroes—given 1988-89

FRENCH AND ITALIAN
FRENCH
105. The Writings of Albert Camus.
114B. Modern French Novel.
281. Mimesis in Literature.
284A. Literature and Philosophy: From Heidegger to Deconstruction.
284B. Literature and Philosophy: The Logic of Specularity in the Humanities.
294A. Feminism in France: Contemporary French Women Poets.

ITALIAN
233/333. Dante's Divine Comedy.
248/348. Machiavelli.
250/350. The Italian Renaissance.
281/381. Novels into Film.
360. Giambattista Vico and René Descartes.

GERMAN STUDIES
19A. Introduction to the Germanic Languages.
31A,32A,33A. German Culture and Civilization I-III.
165A/265A. Writings of Thomas Mann.
168A. Literature and Politics in South Africa.
390A. The Modern Tradition.

HUMANITIES SPECIAL PROGRAMS
301. The Greek Period.
302. The Roman Period.
303. The European Middle Ages.
304. From Renaissance and Reformation to the Enlightenment.
305. From Enlightenment to Modernism: The 18th and 19th Century.
306. The 20th Century.

SLAVIC LANGUAGES
AND LITERATURES
145. Survey of Russian Literature in English Translation I.
146. Survey of Russian Literature in English Translation II: The Novel and Beyond.
147. Survey of Russian Literature in English Translation after 1917: Invention of Tradition.
151. Fyodor Dostoevsky.

SPANISH AND PORTUGUESE
SPANISH
145. The Spanish Republic, the Civil War, and the Aftermath.
230. The Literature of Deviance: From the Picaresque to the Criminal Autobiography.
248. The Caribbean-Americas: An Introduction to Their Literature, Thought, and Cultural Worlds.

PORTUGUESE
267. Brazilian Literature I: Modern Brazilian Fiction.

MATHEMATICAL
AND COMPUTATIONAL
SCIENCE

Committee in Charge: Bradley Efron, Chairman (Statistics); Ernst W. Mayr, Associate Chairman (Computer Science); Paul W. Berg (Mathematics), William J. Clancey (Computer Science), Richard W. Cottle (Operations Research), Robert W. Floyd (Computer Science), John G. Herriot (Computer Science), Joseph B. Keller (Mathematics), Robert Osserman (Mathematics), Stuart T. Reges (Computer Science), 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 E. 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.

**UNDERGRADUATE PROGRAMS**

**BACHELOR OF SCIENCE**

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>
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<tbody>
<tr>
<td><strong>Mathematics (33-34 units)</strong></td>
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<tr>
<td>1. Math 41, 42, 43. Calculus and Analytic Geometry or Math 19, 20, 21, 43</td>
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<tr>
<td>Math 44. Calculus</td>
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<td>Math 103. Matrix Theory and Its Applications or Math 113. Linear Algebra and Matrix Theory</td>
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<tr>
<td>Math 104. Continuation of Math 103 or Math 114. Continuation of Math 113</td>
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<tr>
<td>Math 109. Modern Algebra and its Applications or Math 120. Modern Algebra</td>
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<tr>
<td>Math 130. Ordinary Differential Equations</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>
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<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 (14-15 units)</strong></td>
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<tr>
<td>1. CS 106X. Introduction to Software Engineering (CS 106A and B may be substituted)</td>
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<tr>
<td>2. CS 108A. Fundamentals of Computer Science</td>
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<td>3. One of the following:</td>
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<td>CS 108B. Fundamentals of Computer Science</td>
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<td>CS 110. Introduction to Computer Systems and Assembly Language</td>
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<tr>
<td>CA 137. Fundamentals of Numerical Computation</td>
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<tr>
<td>CS 154. Introduction to Automata and Complexity Theory</td>
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<tr>
<td>CS 157. Logical Basis for Computer Programming</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Operations Research (7-9 units)**

| OR 151. Introduction to Operations Research I | 3 |
| OR 153. Introduction to Operations Research II | 4 |
| or | |
| OR 240. Linear Programming | 3 |
| OR 250. Deterministic Models in Operations Research | 3 |
| OR 251. Stochastic Models in Operations Research | 3 |

**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
- Stat 217. Introduction to Stochastic Processes

For Computer Science, suggested electives include those courses not taken under Part 3 of the above listing for Computer Science and the following courses:

- CS 112. Computer Organization
- CS 140. Concurrent Programming
- CS 143A. Compilers
- CS 161. Discrete Structures and Algorithms
- CS 211. Logic Design
- CS 212. Computer Architecture and Organization
- CS 223. Fundamentals of Artificial Intelligence
- CS 224. Introduction to Artificial Intelligence
- CS 225A. Declarative Programming
- CS 237A or B or C. Numerical Analysis
- CS 240A. Operating Systems
- CS 243. Advanced Compiling Techniques
- CS 254. Automata, Languages, and Computability
- CS 260. Concrete Mathematics

With the advisor’s approval, courses other than those offered by the sponsoring department 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 science 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 meet the following:

1. A letter grade indicator equivalent in mathematical sciences courses of at least 3.4.
2. Completion of at least 15 units in mathematical sciences in addition to the requirements for the 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. Included in the above 15 units must be at least one of the following: (a) an approved higher level graduate course, (b) participation in a small group seminar, or (c) at least three units of directed reading.

MATHEMATICS

Emeriti: (Professors) Harold M. Bacon, Georg Kreisel, James L. McGregor, Ralph Phillips, Hans Samelson, Menahem Schiffer, Mary Sunseri

Chairman: Solomon Feferman


Associate Professors: Steven Kerckhoff, Peter Sarnak, Brian White

Assistant Professors: Alejandro Adem, Daniel Bump, Walter Craig, Russell Lyons, Rafe Mazzeo, Brad Osgood, Jacob Rubinstein, Philip Scowcroft, Peter Sternberg

Visiting Professors: Paul Halmos, Atle Selberg

Acting Assistant Professor: Scott Adams

The Department of Mathematics offers programs leading to the degrees Bachelor of Science, Master of Science, and Doctor of Philosophy in Mathematics, and participates in the program leading to the degree B.S. in Mathematical and Computational Science.

ADVANCED PLACEMENT FOR FRESHMEN

Secondary school students of unusual ability in mathematics often pursue one or more semesters of college-equivalent courses in mathematics while they are still in high school. Under certain circumstances it is possible for such students to secure both advanced placement and credit toward the bachelor's degree on the basis of these courses. A decision as to placement and credit will be made by the department after consideration of the student's performance on the Advanced Placement Examination in Mathematics (either forms AB or BC) of the College Entrance Examination Board. This examination is the only one used for 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 three 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, and any of the courses numbered in the 150's; analysis—44H, 45H, 106, 115, 130, 131, 132, 134A,B, 171, 173 and 175; geometry—any of the courses numbered in the 140's; foundations—150A,B, 161, 162. Notice that the algebra courses 103 (formerly 113S), 104 (formerly 114S) and 109 (formerly 120S) will not satisfy these requirements. Graduate courses in the same subject may be substituted for the preceding courses—for example, 206A for 106.

3. Five additional courses, each carrying at least three credits, chosen from courses numbered 100 or above.

Mathematics majors must have 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 Undergraduate Affairs Committee of the Department of Mathematics.

   Variations in the basic program described above are possible. In particular, students interested in applied mathematics may obtain the B.S. in Mathematics by taking a suitable program of courses in a field of application of mathematics in place of some of the courses prescribed above. Individual programs in such cases must be approved by the departmental Committee on Undergraduate Affairs.

   To receive the departmental recommendation for graduation a student must have been enrolled as a major in the department for at least two full quarters, including the last full quarter before graduation, and must complete at least 15 units of 100 (or higher) level courses in the department.

   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 of the program 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 40H, or equivalently, Math 44, 101, 113, and 130. Beyond this level, 14 three-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 among these, 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 six 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>171</td>
<td>173</td>
<td>114</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>
<tr>
<td>Senior Thesis</td>
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</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 section "Degrees" 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 "Computer Science Department" 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 further to strengthen their academic preparation. Detailed requirements are outlined under the section "School of Education, Master of Arts in Teaching." in this bulletin.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the "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 sufficient breadth in mathematics outside the student's field of application of mathematics. In addition, the student must pass the University oral examination and pass a reading examination in two foreign languages, chosen from French, German, and Russian. A student must receive a 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 Department" 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, 10, 11 and 1:15

TTh 11-12:15 and 1:15-2:30

Win (Staff) MWF 8, 9, 10, and 11
40. Calculus and Analytic Geometry—Continuation of 19. Prerequisite: 19. (DR:6)
3 units, Win (Staff) MWF 8, 9, 10, 11, and 1:15, TTh 11-12:15 and 1:15-2:30
Spr (Staff) MWF 8, 9, and 10

41. Calculus and Analytic Geometry—Continuation of 20. Prerequisite: 20. (DR:6)
4 units, Aut (Staff) MWF 8 and 2:15
Spr (Staff) MWF 8, 9, 10, 11, and 1:15

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 (Kerckhoff) 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 (Staff) MTWThF 10 and 1:15
Win (Staff) MTWThF 10 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 11 and 1:15
Win (Staff) MTWThF 10 and 1:15

43H. Honors Calculus and Analytic Geometry—The sequence 43H, 44H, 45H covers essentially all the topics of 43, 44, 101, 113, and 130, and additional topics from advanced calculus and ordinary or partial differential equations. 43H, 44H, and 45H are for students contemplating majors in Physics, Chemistry, Engineering, Mathematical and Computational Sciences, or Mathematics who have a firm grasp of the methods and ideas of differentiation and integration. The pace of 43H is faster than 43 and greater attention is paid to justification and more thorough understanding of techniques. Topics in 43H include those listed under 43 and selected topics from power series and Taylor's theorem, infinite series, complex numbers and functions, and ordinary differential equations. Prerequisite: A score of 5 on the BC form of the CEEB Advanced Placement calculus test or consent of instructor. (DR:6)
5 units, Aut (Osgood) MTWTh 2:15-3:15

44. Calculus—Continuation of 43. Topics: Taylor's theorem; line and surface integrals, Green's theorem, Stokes' theorem; complex numbers and functions. Prerequisite: 43 or equivalent.
3 units, Aut (Staff) MWF 10 and 1:15
TTh 11-12:15
Win (Staff) MWF 10 and 1:15

44H. Honors Calculus—Continuation of 43H. Elements of linear algebra and ordinary differential equations. Topics are the same as 113 and 130. Prerequisite: 43H or consent of instructor. (DR:6)
5 units, Win (Osgood) MTWTh 2:15-3:15

5 units, Spr (Staff) MTWTh 2:15-3:15

51, 52, 53. The Nature of Technology, Mathematics, and Sciences—(Enroll in Values, Technology, Science, and Society 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 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. No partial credit allowed, whole sequence must be taken. (DR:6, 7, and 8 when entire sequence taken.)
alternate years, given 1988-89

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: 113 or 113S, or equivalent.

3 units, Win (Gilbarg) MWF 10
Spr (Staff) MWF 11

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. Introduction to eigenvalues and eigenvectors. (DR:6)

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)

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 (Berg) MWF 2:15
Spr (Staff) TTh 1:15-2:30

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 (Lecine) MWF 10
Spr (Finn) MWF 9

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
Win (Staff) 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 11

114. Linear Algebra and Matrix Theory—
(Continuation of 113.) A deeper study of 113 topics plus additional topics chosen among 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 (Bump) MWF 10
Spr (Staff) MWF 11


3 units, Aut (Staff) MWF 11 and 1:15
Win (Chung) 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 (Bump) MWF 1:15

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 1987-88

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 1987-88

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.

alternate years, given 1988-89

130. Ordinary Differential Equations—Special equations, exact equations, linear equations; series solutions, numerical solution; Laplace transform; systems of equations. Prerequisite: 44, concurrent registration in 44, or consent of instructor.

3 units, Aut (Staff) MWF 9 and 10
Win (Staff) MWF 10 and 1:15
Spr (Staff) MWF 1:15, TTh 11-12:15
Sum (Staff)
**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, Sternberg) MWF 10 and 2:15 Spr (Staff) MWF 1:15


3 units, Spr (Sternberg) MWF 10

**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 use 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 (Gilbarg)

**Perturbation Methods in Mathematics and Physics**—Introduction of the analysis inherent in securing quantitative results for problems which lack exact solutions, but are correlated with others that admit complete solution. 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.

3 units, Win, Spr (Gilbarg)

**Higher Geometries**—A study of various geometries, including projective, affine, and non-Euclidean geometry. Prerequisite: 113.

3 units, Win (Royden)

**Differential Geometry**—Geometry of curves and surfaces in 3-space and higher dimensional manifolds. Parallel transport, curvature geodesics. Surfaces with constant curvature. Minimal surfaces.

3 units, Aut (Ye) MWF 11

**Topics in Geometry**.

not given 1987-88

**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.

not given given 1987-88

**Differential Topology**—(Replaces 159.) Smooth manifolds, transversality, Sard's theorem, embeddings, degree of a map, Borsuk-Ulam theorem, Hopf degree theorem, Jordan Curve Theorem. Prerequisites: 115 or 171, 173.

3 units, Spr (Milgram)

**Algebraic Topology**—Fundamental group, covering spaces, Euler characteristic, classification of surfaces, knots. Prerequisite: 171.

not given given 1987-88

149. **Topics in Topology**.

not given 1987-88

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, homomorphisms, 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 (Adams)

155. **Geometrical Groups**—The rotation and unitary groups emphasizing two, three, and four dimensions. Quaternions. The Lorentz group and SL(2,C).

alternate years, given 1988-89


3 units, Spr (Adem)

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, Aut, Win (Devlin, Etchemendy)

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 undecid-
able problems. Prerequisite: 160A.

4 units, Spr (Devlin)

161. Axiomatic Set Theory—(Enroll in Philosophy 158.) Zermelo-Fraenkel axioms. Opera-
tions on sets, relations, and functions. Equiva-
ience 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, 2:15 on the first class day of
the quarter.

4 units, Aut, Win, Spr (Suppes)

162. Set Theory—Non-axiomatic (informal)
approach. Operations on sets and Boolean alge-
bra. Relations, orderings, equivalence rela-
tions, and functions. Set-theoretical character-
ization of the basic number systems. Equi-
numerosity of sets, the axiom of choice and
cardinal numbers. Well-ordering relations and
ordinal numbers. Transfinite arithmetic. Pre-
requisite: 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 conver-
gence in metric spaces; compact metric spaces,
basic point set topology. Recommended for
math majors and required of Honors math
majors. Prerequisite: 44.

3 units, Aut (Simon) TTh 9:35-10:50

173. Analysis on Manifolds—Differentiable
manifolds, tangent space, submanifolds, implicit
function theorem, differential forms, vector and
tensor fields, Frobenius' theorem, De-
Rham theory. Prerequisite: 113.

3 units, Win (Simon) MWF 11

175. Elementary Functional Analysis—(For-
merly 117.) Linear operators on Hilbert space.
Spectral theory of compact operators; applica-
tions to integral equations. Elements of Banach
space theory. Prerequisite: 115 or 171.

3 units, Spr (P. Cohen) MWF 11

181. Topics in the History of Mathematics
from Antiquity to the 17th Century—(Enroll in
History 138D, History of Science 140, Philos-
ophy 140.)

3 units, Spr (Knorr)

182A, B. Topics in the History of Mathemat-
ics.

182A. Topics from the 17th to the 19th cen-
tury. Principally, the rapid development of

the powerful new concepts and methods in
analysis and their direct connection with the
physical sciences, i.e., mechanics. Illustra-
tions from the work of famous mathemati-
cians from Descartes to Abel.

alternate years, given 1988-89

192B. Topics from the 19th to the early 20th
century. The extension and expansion of anal-
ysis and its applications. Rigorization and
generality; the rise of algebra and abstract
mathematics. Illustrations from the work of
famous mathematicians from Fourier to
Lebesgue.

alternate years, given 1988-89

195. Teaching Practicum—An opportunity for
students to assist in an undergraduate course,
lead problems sessions, and tutor. Some read-
ing in topics in mathematics education is re-
quired.

3 units, Aut, Win, Spr

196. Undergraduate Colloquium—Readings
and discussions of topics in mathematics, its
history and philosophy. Emphasis on the in-
fluence of models on science and western civil-
zation. Topics determined on the basis of inter-
ests and backgrounds of class members. Term
paper required.

not given 1987-88

199. Independent Work—An opportunity for
any undergraduate to pursue a reading program
on a topic of the student's choice under the
direction of a faculty member of the depart-
ment. Topics are limited to those which are not
the content of regular course offerings of the
department. Credit may be used toward the ful-
fillment of the elective requirement for the
degree in mathematics. Students wishing to use
credit toward the fulfillment of the department's area requirements must receive the ap-
proval of the Undergraduate Affairs Commit-
tee. Students having a topic they wish to investi-
gate but who need help in finding a faculty
member to direct their reading should consult
the Academic Secretary of the department.

(Staff) by arrangement

PRIMARILY FOR
GRADUATE STUDENTS

205A, B. Theory of Functions of a Real Var-
able—Functions of bounded variations, abso-
lute continuity. Lebesgue measure, and the
Lebesgue-Stieltjes integral. Point set topology
in metric spaces and general spaces. More ad-
vanced theories of measure and integration.
Prerequisite: 171 or equivalent.

205A. 3 units, Aut, Spr (Craig, Staff)

MWF 10

205B. 3 units, Win (Craig) MWF 10

205C. 3 units, Spr (Lyons) MWF 10
206A,B,C. Theory of Functions of Complex Variable—Complex integration. Cauchy's theorem, calculus of residues; power series, infinite products, entire functions, Picard's theorem; Riemann mapping theorem. Prerequisite: 116 or 171 or equivalent.

206A. 3 units, Aut (Simon) MWF 11
206B. 3 units, Win (Osserman) MWF 11
206C. 3 units, Spr (Osserman) 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 (P. Cohen) TTh 11-12:15
210B. 3 units, Win (Milgram) TTh 11-12:15
210C. 3 units, Spr (Milgram) TTh 11-12:15


217A. 3 units, Win (Mazzeo) MWF 1:15
217B. 3 units, Spr (Ye) 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 (Rubinstein) TTh 9:35-10:50
220B. 3 units, Win (Keller) TTh 9:35-10:50
220C. 3 units, Spr (Keller) TTh 9:35-10:50

221A,B. Calculus of Variations—Euler-Lagrange equations, sufficient conditions; applications to eigenvalue and scattering problems; direct methods. Dirichlet's principle.

221A. 3 units, Win (Levine)
221B. 3 units, Spr (Staff)

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 1987-88

226. Mathematical Models in Population Biology—(Same as 126.)

alternate years, given 1988-89


230A. 3 units, Win (Chung) MWF 9
230B. 3 units, Spr (Chung) MWF 9
230C. 3 units, Sum (Chung) MWF 9

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.

alternate years, given 1988-89


alternate years, given 1988-89

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.

3 units, Aut (Chung, Karlin) MWF 9

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.

235A. 3 units, Aut (Ornstein) MWF 2:15
235B. 3 units, Win (Ornstein) MWF 2:15
235C. 3 units, Spr (Ornstein) MWF 2:15

236A,B. Mathematical Population Genetics—Classical evolutionary models of one and multigene traits subject to natural selection, migration, and mutation forces. The effects of nonrandom mating (e.g., preferential mating systems). 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 non-linear transformation, algebraic concepts of Kronecker and Schur products, group symmetries and invariants, aspects of real and probabilistic analysis.

given when teaching staff available


not given 1987-88

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 1987-88

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.

244A. 3 units, Aut (Royden) MWF 11
244B. 3 units, Win (Royden) MWF 11


not given 1987-88


not given 1987-88


3 units, Aut, Win, Spr (Karlin)

254A,B. Ordinary Differential Equations—Fundamental existence theorems, stability and asymptotic behavior of nonlinear systems, Poincaré-Bendixson theorem, linear systems and Sturm-Liouville eigenvalue problems; selected topics from equations in the complex domain; Fuchsian theory, Hamiltonian systems, existence of periodic solutions and orbital stability.

254A. 3 units, Win
254B. 3 units, Spr


alternate years, given 1988-89


261A. 3 units, Aut (Halmos) MW 3:15-4:30
261B. 3 units, Win (Halmos) MW 3:15-4:30


263A. 3 units, Win (Bump) TTh 11-12:15
263B. 3 units, Spr (Bump) TTh 11-12:15

given when teaching staff available

292A,B. Set Theory—(Same as Philosophy 392A,B.) The 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, models constructed by forcing, and models which admit atoms and non-well-founded sets. Prerequisite: Philosophy 160A or equivalent.

292A. 3 units, Aut (Barwise) MW 1:15-2:30
292B. 3 units, Win (Barwise) MW 1:15-2:30

293A,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 or equivalent.

Aut, Win (Staff)

294. 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)

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


by arrangement

381. Seminar in Analysis.

by arrangement

383. Seminar in Function Theory.

by arrangement

385. Seminar in Abstract Analysis.

by arrangement

386. Seminar in Geometry and Topology.

by arrangement

387. Seminar in Algebra and Number Theory.

by arrangement


by arrangement

389. Seminar in Mathematical Biology.

by arrangement

391. Seminar in Foundations of Mathematics.

by arrangement

MEDIEVAL STUDIES

Committee in Charge: George Brown (Chairman), Theodore M. Andersson, Lawrence Berman, Hester Gelber, William Mahrt, Mary Wack

Affiliated Faculty: Theodore M. Andersson (German Studies), Lawrence V. Berman (Religious Studies), George H. Brown (English), Brigitte Cazelles (French and Italian), Stephen Ferruolo (History), John Freccero (French and Italian), Hester Gelber (Religious Studies), Gavin J. Langmuir (History), Suzanne Lewis (Art), Sabine G. MacCormack (Classics and History), William Mahrt (Music), Eleanor Prosser (Drama), Jeffrey Schnapp (French and Italian), William M. Todd III (Slavic Languages and Literatures), W. Wesley Trimpi (English), Mary Wack (English)

The Medieval Studies Program is administered through Humanities Special Programs. There is no formal undergraduate degree program in Medieval Studies; rather the option exists for interested students to propose individually designed majors in Medieval Studies. Individually designed majors must be proposed to and approved by the Dean of Undergraduate Studies’ Advisory Committee on Individually Designed Majors. Guidelines may be found under the section “Program for Individually Designed Majors.” Students interested in planning a course of studies should consult the Chairman of Medieval Studies. Additional information about this option, as well as referral to faculty advisors, is available through the
fjumanities 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 introductory 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 Art 65, History 65.) An introduction to the culture and society of the Middle Ages in Western Europe from 1100 to 1500 exploring major events, works of art, and literature within the context of medieval life. The approach to medieval history, literature, and art is interdisciplinary and integrated with a struc-tured emphasis on the mutual interdependence of all aspects of culture and society from the 12th through the 14th century. Topics: how medieval people defined themselves and their world, their conceptions of reality, their relationships to God and nature, and the individual’s role in society. (DR)2

5 units, Win (Lewis) not given 1987-88

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 special character of each discipline’s medieval scholarship, common concern, and intellectual integration.

3 units (Lewis) not given 1987-88

**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.

**ART**

5. Introduction to Ancient Medieval Art.
103. Byzantine Art and Architecture.
104. Art and Architecture in Medieval Britain.
204A. Seminar: Medieval Manuscript Illumination.

**CLASSICS**

103. History of the Roman Empire.

**ENGLISH**

64B/164B. Arthurian Literature.
171A. Chaucer’s Canterbury Tales.
171B. Chaucer’s Troilus and the Dream Poems.
181A. The Development of the Heroic Ethos in Medieval Narrative, 750-1400.
205. Old English.
212A,B. Medieval to Renaissance: The Development of Literary Forms.
370. Seminar in Old English Prose.

**FRENCH**

130. French Literature I: Middle Ages and Renaissance.
Committee in Charge: Beverly Allen (Italian), John Bender (English), Russell Berman (German Studies), Regenia Gagnier (English), Barabara Gelpi (English), Diane Middlebrook (English), Kurt Mueller-Vollmer (German Studies), Marjorie Perloff (English), Paul Robinson (History), Renato Rosaldo (Anthropology), Hans Weiler (School of Education and Political Science).

Co-Chairmen: John Bender (English), Russell Berman (German Studies).

Faculties: Beverly Allen (English), John Bender (English), Russell Berman (German Studies), Henry Breitrose (Communication), Terry Castle (English), Wanda Corn (Art), Sandra Drake (English), Charles Dreikmeier (Political Science), Jay Fliegelman (English), Eckhart Förster (Philosophy), Estelle Freedman (History), Regenia Gagnier (English), Peter Galison (Philosophy), Barbara Gelpi (English), René Girard (French), Albert Guerard (English), David Halliburton (English), Van Harvey (Religious Studies) Shirley Heath (English/Linguistics), Arturo Islas (English), Diane Middlebrook (English), Thomas C. Moser (English), Kurt Mueller-Vollmer (German 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), Ann Swidler (Sociology), William M. Todd III (Slavic Languages), Ian Watt (English), Hans Weiler (German Studies), Marilyn Yalom (Institute for Research on Women and Gender).

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.
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 (LCI) 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 enlightenment. 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 LCI 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. These lists should be based primarily on one of the advisory reading lists in literature, but may include additional works in modern thought or drawn from the student’s special field of interest.

5. Teaching is an essential part of the program. All candidates are required to do four quarters of supervised teaching at half-time. During the first year, a candidate is expected to act as a reader for two courses or a section leader for one course, in the second year to teach two quarters of Freshman English, and in the third or fourth years to assist a faculty member as a section leader in a larger course.

   As preparation for teaching, students are required to take English 396, a two-unit course introducing students to the obligations and opportunities of graduate study, and 397A, a five-unit course on teaching composition.

6. Students must demonstrate, by the end of the third quarter of the first year, a reading knowledge of one foreign language comparable to that required by the Department of English; and by the beginning of the first quarter of the third year, an advanced reading knowledge of one other foreign language. An “advanced” reading knowledge means the ability to make a genuine scholarly use of the language: that is, to read prose of ordinary difficulty.

   Students may not take the University oral examination until they have completed the foreign language requirement.

7. **Annual review**—The program of each student must be approved by the Committee in Charge at the end of each academic year.

8. **Summary Requirement**—At the termination of his or her course work, and prior to the University 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 Chairperson, and by the Committee in Charge.

9. **University oral examination**—This examination, covering the student’s areas of concentration, will normally be taken in the third year of graduate study.

10. **Dissertation**—The fourth year will be devoted to the dissertation, which shall be a substantial and original contribution acceptable to the Committee on Modern Thought and Literature. The subject may be drawn from the literature of specialization, from the area of non-literary studies, or from a combination of the two.

**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.

**189A. Medicine and Culture in America**—(Enroll in English 189A, American Studies 215.)

5 units, Aut. (Burbick)

**221. History of Film**—(Enroll in Communication 141/241.)

4 units, Win. (Breitrose)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Enroll in:</th>
<th>Units</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>242.</td>
<td>Deutsche Geistesgeschichte II—(Enroll in German 242.)</td>
<td></td>
<td>3-5</td>
<td>Win (Wilke)</td>
</tr>
<tr>
<td>243.</td>
<td>Deutsche Geistesgeschichte III—(Enroll in German 243.)</td>
<td></td>
<td>3-5</td>
<td>Spr (Mueller-Vollmer)</td>
</tr>
<tr>
<td>245.</td>
<td>Deutsche Geistesgeschichte I—(Enroll in German Studies 241.)</td>
<td></td>
<td>3-5</td>
<td>Aut (Wilke)</td>
</tr>
<tr>
<td>245A.</td>
<td>Survey of Russian Literature in English Translation I: The Age of Experiment—(Enroll in Slavic Languages 145/245.)</td>
<td>4 units</td>
<td>Aut (Knapp)</td>
<td></td>
</tr>
<tr>
<td>245B.</td>
<td>Survey of Russian Literature in English Translation II: The Novel and Beyond—(Enroll in Slavic Languages 146/246.)</td>
<td>4 units</td>
<td>Win (Todd)</td>
<td></td>
</tr>
<tr>
<td>245C.</td>
<td>Survey of Russian Literature in English Translation after 1917: Invention of Tradition—(Enroll in Slavic Languages 147/247.)</td>
<td>4 units</td>
<td>Spr (Freiden)</td>
<td></td>
</tr>
<tr>
<td>246.</td>
<td>Poetics II: Theory and Analysis of the Lyric—(Enroll in German Studies 247/347.)</td>
<td>3-5 units</td>
<td>Spr (Bender, Wellbery)</td>
<td></td>
</tr>
<tr>
<td>250.</td>
<td>Classics of Modern Political Theory—(Enroll in Political Science 250.)</td>
<td></td>
<td>5 units</td>
<td>Win (Drekmeier)</td>
</tr>
<tr>
<td>251.</td>
<td>American Drama: 1920s to 1950s—(Enroll in Drama 254.)</td>
<td></td>
<td>4 units</td>
<td>Spr (Esslin)</td>
</tr>
<tr>
<td>252.</td>
<td>Essential of Political Theory—(Enroll in Political Science 254.)</td>
<td></td>
<td>5 units</td>
<td>Aut (Drekmeier)</td>
</tr>
<tr>
<td>254.</td>
<td>Yeats, Lawrence, Auden—(Enroll in English 257.)</td>
<td></td>
<td>5 units</td>
<td>Spr (Perloff)</td>
</tr>
<tr>
<td>255.</td>
<td>Theater of the Absurd—(Enroll in Drama 258.)</td>
<td></td>
<td>4 units</td>
<td>Win (Esslin)</td>
</tr>
<tr>
<td>256.</td>
<td>History of Theater: 19th and 20th Century—(Enroll in Drama 261.)</td>
<td></td>
<td>4 units</td>
<td>Aut (Eddelman)</td>
</tr>
<tr>
<td>257.</td>
<td>The Caribbean-Americas: An Introduction to Their Literature, Thought, and Cultural Worlds—(Enroll in English 262G.)</td>
<td>3-5 units</td>
<td>Aut (Wynter)</td>
<td></td>
</tr>
</tbody>
</table>

263A. Seminar in Feminist Studies—(Enroll in English 263A, Feminist Studies 103/203.) 5 units, Aut (Rich)

265. Writings of Thomas Mann—(Enroll in German Studies 265.) 3-5 units, Win (Gillespie)

266. The American Enlightenment—(Enroll in English 266.) 5 units, Win (Fliegelman)

277. Religious Existentialists—(Enroll in German Studies 179K, Religious Studies 277.) 5 units, Win (Harvey)

281. Encounters Between Modern Philosophy and Judaism: The Commandments—(Enroll in Religious Studies 281.) 5 units, Spr (Eisen)

282. Mimesis in Literature—(Enroll in French 281.) 4 units, Win (Girard)

283A. Literature and Science—(Enroll in French 283A.) 2 units, Spr (Serres)

284A. Literature and Philosophy: From Heidegger to Deconstruction—(Enroll in French 284A.) 4 units, Aut (Girard)

284B. Literature and Philosophy: The Logic of Specularity in the Humanities—(Enroll in French 284B.) 4 units, Win (Dupuy)

285B. Twain and James—(Enroll in English 285B.) 5 units, Aut (Halliburton)

287A. Literature and Art—(Enroll in French 287A.) 2 units, Aut (Serres)

290. History of Anthropological Theory—(Enroll in Anthropology 290.) 5 units, Win (Collier)

293. Minority Literature—(Enroll in German Studies 293.) 5 units, Spr (Berman)

294A. Feminism in France: Contemporary French Women Poets—(Enroll in French 294A.) 4 units, Spr (Newman-Gordon)

299. Colloquium on Postmodernism: Theory, Context, and Architecture—(Enroll in Art 299.) 2 units, Aut (Turner, Paul)

300. Graduate Seminar: Theory of Narrative—(Enroll in Slavic Languages 300.) 4 units, Spr (Todd)
301B. Comparative Early Modern Aristocracies: East and West Europe—(Enroll in History 239.)
5 units, Win (Kollmann)
303A. Colloquium: 18th-Century Satire—(Enroll in English 303A.)
5 units, Aut (Carnochan)
303B. Colloquium: High Life and Low Life: The Relation Between Polite and Popular Forms in 18th-Century Literature—(Enroll in English 303B.)
5 units, Win (Castle)
303C. Colloquium: Restoration and 18th Century Drama—(Enroll in English 303C.)
5 units, Spr (Donoghue)
304A. Colloquium: Love and Passion in the 19th Century English Novel—(Enroll in English 304A.)
5 units, Spr (Polhemus)
304B. Colloquium: Theories of Romanticism—(Enroll in English 304B.)
5 units, Spr (Lindenberger)
5 units, Win (Drake)
307A. Colloquium: Subjectivity and Value—(Enroll in English 307A.)
5 units, Win (Gagnier)
307B. Colloquium: Feminist Literary Criticism in the 1980s—(Enroll in English 307B.)
5 units, Win (B. Gelpi)
313. Research Seminar: Methods and Materials for the Study of Modern Literature—(Enroll in English 313.)
5 units, Spr (McPheron)
320. Seminar: The 90s: American Literature and Culture—(Enroll in English 320.)
5 units, Spr (Halliburton)
331A,B,C. Graduate Core Colloquium on Modern Europe—(Enroll in History 331A,B,C.)
15 units, Aut, Win, Spr (Brown, Spitz, Staff)
337. Graduate Colloquium: Modern European Culture and Intellectual History—(Enroll in History 437.)
5 units, Aut (Robinson)
341B. Graduate Colloquium: Topics in Culture and Society of Early Modern England—(Enroll in History 341B.)
5 units, Aut (Seaver)
349A. Graduate Colloquium: Africa Since 1945—(Enroll in History 349A.)
5 units, Win (Jackson)
349C. Seminar: Literary Hermeneutics—(Enroll in German Studies 349C.)
3-5 units, Aut (Mueller-Vollmer)
349R. Seminar: Romantic Archetypes—(Enroll in German Studies 349R.)
3-5 units, Aut (Gillespie)
354A. Seminar: 20th Century Visual Aesthetics—(Enroll in Drama 354A.)
5 units, Aut (Eddelman)
356. Seminar: Whitman and Dickinson—(Enroll in English 356.)
5 units, Win (A. Gelpi)
359. Graduate Seminar: Social History of the U.S. in the 19th Century—(Enroll in History 459.)
5 units, Aut (Degler)
360. Giambattista Vico and René Descartes—(Enroll in Italian 360.)
4 units, Spr (Harrison)
360C. Neoclassicism, Aesthetics, and Modern Criticism—(Enroll in English 360C.)
5 units, Spr (Trimpi)
5 units, Aut (Berman) MW
362. Seminar: Avant-Garde Poetics—The Intersection of Poetry and Theory—(Enroll in English 362.)
5 units, Win (Perloff)
363. Seminar: Ethnic/Feminist Autobiography—(Enroll in English 373.)
5 units, Spr (Islas)
366A,B. Seminar: The Idea of a Theater in the Renaissance—(Enroll in English 366A.)
5 units, Win, Spr (Orgel)
371. Pier Paolo Pasolini: The Poetics of Heresy—(Enroll in Italian 371.)
4 units, Win (Allen)
375. European Novel in the 19th Century: French and Others—(Enroll in Comparative Literature 375.)
5 units, Win (Frank)
380. Theory, Feminism, and the Third World—(Enroll in Comparative Literature 380.)
5 units, Spr (Spivak)
81. Novels into Film—(Enroll in Italian 381.)
4 units, Win (Springer)

85. Colloquium: Psychoanalysis and Theory
(Enroll in Comparative Literature 385.)
5 units, Win (Parker, Patricia)

85F. Seminar: Faulkner—(Enroll in English 385F.)
5 units, Aut (Moser)

88A. Seminar: Virginia Woolf—(Enroll in English 388A.)
5 units, Win (Ruotolo)

88B. Seminar: Joseph Conrad—(Enroll in English 388B.)
5 units, Aut (Watt)

85. 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

86. Introduction to Graduate Study—(Enroll in English 396.)
2 units, Aut (Fifer Moser)

87A. Rhetoric and Teaching Composition—(Enroll in English 397A.)
5 units, Aut (Fifer)

87B. Teachers Workshop I—(Enroll in English 397B.)
5 units, Win (Fifer)

87C. Teachers Workshop II—(Enroll in English 397C.)
5 units, Spr (Fifer)

86. 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 this department.
The department is housed in Braun Music Center, Dinkelspiel Auditorium, and the Knoll, including two theaters for concert and operatic productions, two rehearsal halls, and a small chamber hall. In addition to pianos, organs, harpsichords, and a variety of early stringed and wind instruments, students may use rare instruments from the Harry R. Lange Historical Collection.

The 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 programs:
   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.

2. All majors are required to demonstrate a minimum proficiency in piano by sight-reading works at the level of Clementi sonatas 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.

3. 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

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
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</thead>
<tbody>
<tr>
<td>Freshman English</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Music 21-23*</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Individual Instruction and/or</td>
<td>1-4</td>
<td>1-4</td>
<td>14</td>
</tr>
<tr>
<td>Ensemble</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Culture</td>
<td>3-5</td>
<td>3-5</td>
<td>35</td>
</tr>
<tr>
<td>Choice of Foreign Language,</td>
<td></td>
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<tr>
<td>Distribution requirement</td>
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<td></td>
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<tr>
<td>or Freshman Seminar</td>
<td>3-5</td>
<td>3-5</td>
<td>35</td>
</tr>
</tbody>
</table>

SECOND YEAR

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 24</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music 100-102 and 121</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Individual Instruction and/or</td>
<td>1-4</td>
<td>1-4</td>
<td>14</td>
</tr>
<tr>
<td>Ensemble</td>
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</tr>
<tr>
<td>Distribution Requirement</td>
<td>3-5</td>
<td>3-5</td>
<td>35</td>
</tr>
<tr>
<td>Elective (or Music 23 if not taken previously)</td>
<td>3-5</td>
<td>(3)</td>
<td>(9)</td>
</tr>
</tbody>
</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.

Students should complete the required foundation courses for the degree as soon as possible so that they may be free to take elective courses. The department offers advanced course work for undergraduates who wish to concentrate in composition, performance practice, or music history. Students who hope to go on to graduate work in music are encouraged to include a year of concentrated advanced work in music beyond the required courses.
THIRD YEAR

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 103-4 and 122</td>
<td>8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td></td>
<td></td>
<td>(4)</td>
</tr>
</tbody>
</table>

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, and to identify a concentration and complete a series of additional courses. Concentrations may be in performance, composition, or history. A concentration should be planned with the assistance of an advisor, and normally includes an additional year of lessons and ensembles, some work in a foreign language, courses in the area of concentration, and a senior project appropriate to the concentration (recital, composition, or research paper).

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.

Applicants for admission to graduate study should arrange to take the Graduate Record Examination, including the Advanced Music sections, and a department entrance test in theory. Prior to initial registration, the student should be prepared: (1) to demonstrate proficiency in piano equal to that specified in the A.B. program; (2) to demonstrate a reading knowledge of one foreign language chosen from French, German, or Italian; and (3) to take placement tests in theory and music history.

Students whose previous preparation proves insufficient must expect to spend more than the minimum time in residence.

None of Stanford's required undergraduate courses in music may be credited toward an advanced degree.

Only work that receives a letter grade indicator of "A", "B", or plus will be recognized as fulfilling the advanced degree requirements in music.

Doctoral candidates working in absentia on Ph.D. dissertations or D.M.A. final projects which require consultation with faculty members must continue enrollment in the University under the heading of Terminal Graduate Registration.

Teaching—All fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at half-time and one quarter at quarter-time.

MASTER OF ARTS

Residence—A minimum of three quarters of full-time study in residence is required.

Study Program—Students may concentrate in composition, 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, including Music 200, 240, and 299 plus three quarters of ensemble performance. Depending on the concentration, the Master of Arts project will be an investigative essay, a composition, or a demonstration of performance supported by a written commentary on the performance practices that are involved.

DOCTOR OF MUSICAL ARTS

The purpose of the Doctor of Musical Arts program is to offer advanced training in the practice of music. Students may concentrate in composition, or performance (including conducting)—the latter concentration to be centered on the investigation of performance practices from medieval to modern times. Each concentration will be given breadth through collateral studies in other branches of music and in relevant fields outside music as seems desirable.

Admission—In addition to completing entrance tests, an applicant will be asked to submit evidence of accomplishment in the proposed field of concentration.

Residence—If there are no deficiencies to be made up, this program may be completed in a minimum of two years of full-time study following the master’s degree. The candidate must spend at least three consecutive quarters in residence and must devote at least one quarter in residence to work on his or her final project.

Study Program—The candidate must complete, in addition to the master’s degree, a minimum of two years of full-time work which will be planned individually for each concentration. It must be emphasized, however, that the degree will be awarded on the basis of demonstrated achievement rather than on the accumulation of units.

In addition to such independent study and
formal course work as may be done, each program will include: (1) four term projects; (2) a final project; and (3) a public lecture-demonstration.

Candidates in performance practice will make an extensive study of historical styles of performance, technique, and repertory, leading to four demonstrations of their ability to give performances of music from different historical periods. Each demonstration is to be supported by a written document covering questions of analysis and performance practice. Candidates who major in voice or an instrument may present a public recital as one demonstration of the four required.

Candidates in composition will be expected to produce a number of original works demonstrating their ability to compose in a variety of forms and for the common media of vocal and instrumental music. Insofar as possible, the works submitted will be presented in public performance prepared by the composer.

Final Project—(1) Composition: an extended work for instruments, voices, or electronic media; (2) Performance: possibilities open to the candidate include (a) preparing a modern performing edition of an early score; and (b) writing an extended critical or historical essay on a selected problem or phase of performance practice.

Public Lecture-Demonstration—This is to be given during the last quarter of residence. It should be about one hour in length, dealing with some aspect(s) of the candidate's final work.

Foreign Language Requirements—All students are required to demonstrate a reading knowledge of French, German, or Italian. Concentrators in performance are further required by the end of their first year of doctoral study to demonstrate reading ability in a second language chosen from the three listed above.

Departmental Examinations—(1) A qualifying examination consisting of written and oral tests in the general field of music history, no later than the fifth quarter of full-time residence; (2) a written comprehensive examination in the candidate's special area of concentration, no later than the third quarter after passing the qualifying examination; (3) the University Oral Examination, to be taken prior to the actual writing of the dissertation at the beginning of the fourth year of residence.

COURSES
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, Aut (Bauman)
2B. The Concerto.
   3 units (Barnes)
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 (Staff)

DOCTOR OF PHILOSOPHY
General University regulations regarding this degree are discussed in the "Degrees" section in this bulletin.

Admission—In addition to completing entrance tests, an applicant is asked to submit some evidence of his or her work in the field of music history such as a term paper or a master's thesis.

Basic Requirements—Each candidate must complete a minimum of three years of full-time work. The student may proceed directly to the Ph.D. without taking the A.M. en route. The program will normally include: (1) seminars in musical notation, analysis, performance practice, and musicology; (2) readings in music theory; (3) dissertation research to be taken in the third year of residence.

Foreign Language Requirements—A reading knowledge of French or Italian, and German, plus any other language necessary to research in the candidate's field of specialization. The examination will consist of the translation into idiomatic English of excerpts in prose and poetry. The examination in one language must be taken prior to the student's first registration. The second language must be certified before the beginning of the second year of residence.

Departmental Examinations—(1) A qualifying examination consisting of written and oral tests in the general field of music history, no later than the fifth quarter of full-time residence; (2) a written comprehensive examination in the candidate's special area of concentration, no later than the third quarter after passing the qualifying examination; (3) the University Oral Examination, to be taken prior to the actual writing of the dissertation at the beginning of the fourth year of residence.
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, Spr (Bauman)

4D. The Operas of Mozart—(DR:2)
3 units (Berger)

4E. The Music of Debussy and Ravel.
3 units (Staff)

5A. Music in America—(DR:2)
3 units (Cohen) alternate years, given 1988-89

5C. Music and Culture at the Court of Louis XIV.
3 units (Marshall)

5D. French Musical Culture from Leonin to Boulez—(Enroll in French 60.)
3 units, Aut (Marshall)

4 units, Spr (Good)

18. Jazz History.
3 units, Aut (Staff)

19. Introduction to Music Theory—A preparatory course in the fundamentals of music notation, basic sight reading, sight singing, ear training, keyboard harmony, and melodic, rhythmic, harmonic dictation. 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, Win (Nadel)

20B. Advanced Jazz Theory.
3 units, Spr (Nadel)

FOUNDATION FOR A.B. MAJOR

21. Introduction to the Language and Structure of Western Music—The elements of melody, rhythm, harmony, and texture studied through analysis, composition, and exercises in practical musicianship. 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 (Mahrt, Bates)
Win (Barnes)

22. Elements of Music—A continuation of 21, emphasizing contrapuntal writing: modal and species counterpoint. Use of keyboard ear training and sight singing underlie all written work. Lecture and laboratory sections. Prerequisite: 21.
4 units, Win (Bauman)
Spr (Bauer)

23. Functional Harmony—Advanced tonal harmonic analysis, four-part writing, bass and harmonic harmonizations, including modulation, secondary dominants, augmented sixth chords, and Neapolitan sixth chords. Prerequisite: 22; pass minimum proficiency test in piano, or two quarters prior and concurrent enrollment in 12; or consent of instructor.
4 units, Aut (Barnes)
Spr (Bauer)

24. Elementary Tonal Counterpoint—Two- and three-part imitative counterpoint, two- and three-voice inventions, analysis of more complex contrapuntal forms, canon and fugue. Use of keyboard, ear training and sight singing will underlie all written work. Prerequisite: 23.
4 units, Win (Bauer)

25. 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. No prior compositional experience required. Prerequisite: 24 or permission of instructor.
3 units, Spr (Bauer)

100. Music History: Medieval and Renaissance—Prerequisites: 21, 22.
4 units, Aut (Mahrt)

101. Music History: Baroque—Prerequisites: 21, 22, 100.
4 units, Win (Houle)

102. Music History: Classical — Prerequisite: 24.
4 units, Spr (Bauman)

103. Music History: Romantic—Prerequisite: 102.
4 units, Aut (Berger)

104. Music History and Theory: Modern—Prerequisite: 103.
4 units, Win (Smith)

121. Harmonic Materials of the 18th and Early 19th Centuries—Prerequisite: 24.
4 units, Spr (Ratner)

122. Harmonic Materials of the 19th and Early 20th Centuries—Prerequisite: 121.
4 units, Aut (Bauer)

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.

123. Composition—Individual projects in creative work. May be repeated for credit. Prerequisite: Consent of instructor.

125. Modal Counterpoint.
3 units (Berger)

126. Tonal Counterpoint—Prerequisite: 103.
3 units (Staff)

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, Spr (Barnes)
225. 4 units (Barnes)

HISTORY AND LITERATURE

Unless otherwise stated, prerequisite for any course in this section is 103.

140. Studies in Medieval and Renaissance Music—Prerequisite: 100.
140E. The Music of Guillaume Dufay.
4 units (Mahrt)

4 units (Staff)

4 units (Houle)

142A. String Quartets of Beethoven.
4 units (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, Spr (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 Stravinsky.
4 units (Barnes)

144D. Music Since 1945.
4 units (Berger)

150A. History of Musical Instruments.
4 units (Myers)

150C. History of Musical Esthetics—Aesthetic 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 (Marshall)

153B. Organ Music (Bach to Ligeti).
4 units, Win (Marshall)

4 units, Spr (Chafe, Staff)

4 units, Win (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.

51. Choral Repertory (1500-1750).
   4 units (Ramsey)

52. Choral Repertory (1750 to Present).
   4 units, Aut (Dunn)

PERFORMANCE

GROUP INSTRUCTION

5. 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 (Bedenbaugh)

5C. Voice Class—For credential candidates, music majors, and non-majors who are members of departmental performing organizations.
   1 unit, Aut, Win, Spr (Wait)

5D. 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 (Staff)

72A. Piano Class—For intermediate students.
   (Bedenbaugh, Gandolfi)

72B. Organ Class—For beginning organ students who have keyboard skills.
   (Marshall)

73. Voice Class.
   (Wait)

74. Stringed Instruments Classes.
   (Harrison, Kleyman)

74A. Violin.
   (Kleyman, Leybin, Toth)

74B. Viola.
   (Kleyman, Zaslav)

74C. Violoncello.
   (Harrison)

74D. Contrabass.
   (Tramontozzi)

74E. Viola da Gamba.
   (McGaughey)

74F. Classical Guitar.
   (Ferguson)

74G. Harp.
   (Chauvel)

74H. Baroque Violin.
   (Martin)

75. Woodwind Instruments.

75A. Flute.
   (Blaisdell, Hawley)

75B. Oboe.
   (Matheson)

75C. Clarinet.
   (Dufford)

75D. Bassoon.
   (Olivier)

75E. Renaissance Wind Instruments.
   (Myers)

75F. Saxophone.
   (Stein)

76. Brass Instruments Classes.
   (Staff)

77. Percussion Class.
   (Cirone)

INDIVIDUAL INSTRUCTION

72, 73, 74, 75, 76, 77, 272. 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 repertoire lists for each instrument are available at the Music Department office.
   3 units, Aut, Win, Spr

   172A/272A. Piano.
   (Baller, Barth, Bedenbaugh, Gandolfi, Sparrow)

172B/272B. Organ.
   (Marshall)

172C/272C. Harpsichord.
   (Fabrizio)

172E/272E. Early Piano.
   (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.
   (McGaughey)

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.
   (Olivier)

175E/275E. Renaissance Wind Instruments.
   (Myers)

175F/275F. Saxophone.
   (Stein)


176A/276A. French Horn.
   (Klingelhoffer)

176B/276B. Trumpet.
   (Burkhart)

176C/276C. Trombone.
   (Williams)

176D/276D. Tuba.
   (Cooley)

177/277. Percussion.
   (Cirone)

PRACTICES

130. Orchestral Conducting—Prerequisite: 127.
   130A. 3 units, Win (Toth)
   130B. 3 units, Spr (Toth)
131. Choral Conducting.
   131A. 3 units (Ramsey)
   131B. 3 units (Ramsey) alternate years, given 1988-89

169. Introduction to the Study of Performance Practices—Dance instruction for 16th and 18th-century dances; performance of the renaissance chanson (research technique, solmization, modal analysis, musica ficta, instruments, ornamentation); performance of French music in the 18th-century (articulation, phrasing agreements, rhythmic analysis, use of the computer in research); analysis as a technique of performance practice studies in 19th-century music. Prerequisite: 23, 100, 101.

   4 units, Aut (Houle)

180. Diction for Singers.
   180A. Italian.
   1 unit, Spr (Staff)
   180D. English.
   1 unit, Win (Staff)

191. 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, Aut (Toth)

231. Advanced Choral Conducting.
   4 units, Aut, Win, Spr (Dunn)

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. May be repeated for credit. Prerequisite: 169.
   269A. Medieval.
   4 units (Mahrt)
   269B. Renaissance.
   4 units, Win (Marhrt)
   269C. Baroque.
   4 units, Spr (Houle).
   269D. Classic.
   4 units, Win (Ratner)
   269E. Romantic
   4 units, Spr (Barth)

ENSEMBLE

All courses listed in this section may be repeated for credit, with a maximum of 24 units allowed toward graduation. Membership in these organizations is not limited to students who register in the courses for credit and is open to both men and women. An audition, however, is required for admission to any University musical organization. Audition schedules will be announced in advance of each registration period.

   1 unit, Aut, Win, Spr (Cirone)

158. Contemporary Performance Ensemble.
   1 unit, Aut, Win, Spr (Bauer) 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, Win, Spr (Dunn)
   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 (Dunn, Wait)
   T 4:15-5:30, Th 7-8:30 p.m. and Sunday 10-12

165. Stanford Chorale—Small vocal ensemble specializing in performance music of all periods for the chamber chorus.
   1 unit, Aut, Win, Spr (Dunn) 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

170A. Piano Accompanying.
   1 unit, Aut, Win, Spr (Staff)

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 or 279 while not enrolled in either of those classes.
1 unit, Aut, Win, Spr (Staff)

GRADUATE RESEARCH AND SPECIAL STUDIES

200. Music Bibliography—Use of bibliographical materials in graduate study; introduction to methods of research.
4 units, Aut (Nagy)

211. History of Music Theory.
211A. Ancient Through Renaissance.
4 units, Aut (Cohen)
211B. Baroque Through Modern.
4 units, Win (Cohen)

240. Proseminar in Music History—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 (Bauman)

241. Seminar in Analysis for Performance.
4 units (Houle, Mahrt)

299. Master of Arts Project.
4 units, any quarter (Staff)

300 Seminar in Musical Notation.
300A. 4 units, Aut (Mahrt)
300B. 4 units, Win (Mahrt)
300C. 4 units, Spr (Mahrt)
alternate years, given 1988-89

310. Seminar in Music History and Analysis.
4 units, Aut, Win, Spr (Bauer, Berger, Smith)

320. Seminar in Research.
4 units, Aut, Win, Spr (Houle, Mahrt)

alternate years, given 1988-89

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 (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

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: Eike Gebhardt, Manfred Görtemaker, Hans-Dieter Jacobson, Frederick Klinger, Gero Lenhardt, Franz Neckenig, Don Okimoto, Junger Schutte, Peter Schulze, Alexander Shuller, Carl Weber

Stanford Program in Florence
Director: Giuseppe Mammarella
Assistant Director: Carla Lekai
Language Program Coordinator: Joan M. McConnel
Faculty: Lucia Benini, Franca Celli, Roberto D’Alimonte, Paola Cori, Patrizia Guarnieri, Fred Light, Donatella Della Porta, Douglas Russell, Giovani Scichilone, Wilfred Stone, Maria Todorow, Carlo Trigilia, Alessandra Venturini

Stanford Program in Haifa
Director:

Stanford Program in Krakow
Directors: Grzegorz Babinski, Andrzej Kopiszewski
Faculty: Andrzej Bryk, Don Donham (Stanford), Halina Niec, Emil Orzechowski, Bronislaw Oryzanowski, Jacek Wasilewski

Stanford Program in Oxford
Director: Geoffrey Tyack
Associate Director: Pamela Murray

Faculty: Rosemarie Allen, Michael Bratman, Terry Castle, John Durant, Robert Gordon, Martin Holmes, Ruth Mateer, David Miles, Syed Rizva, Trevor Rowley, Katherine Worth

Stanford Program in Paris
Director: Albert Eslen

Stanford Program in Salamanca
Director: Isabel Criado

Stanford Program in Tours
Director: Paul LeMau
Assistant Director: Claude Doubinsky
Assistant Director: Anne Durand
Faculty: Jean Noel Billard, Gerald Chia, Olivier Dufresne, George Frederickson, Annie Galinie, Andre Gorgues, Nancy Green, Michelle Jomaron, Guy LeBoucher, Françoise Perdoux, Robert Sauzet

Overseas Studies believes an academic period abroad should be a normal part of every student’s educational options, and we offer study centers at Berlin, Florence, Krakow, Oxford, and Tours, with a variety of courses from art to politics. Courses meeting Distribution Requirements 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 at 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 for Stanford credit.

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, Sao Paulo, Lima, Nairobi, and Cairo.

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 all aspects of their program abroad, from academic preparation to securing a passport. Courses offered abroad carry regular University credit. Those that also receive credit toward a departmental major are indicated immediately.
after the course title. Students may also petition departments for major credit for other courses; be sure and save all work and syllabi for the course. 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. The Political Economy of Advanced Industrial Democracies: Japan, U.S., and Western Europe—Seminar on the political economies of advanced industrial democracies (Japan, the United States, and Western European countries, especially the Federal Republic of Germany). The organization of the private sector, the role of the state, and the administration of industrial policy. Comparisons of the private sector in terms of market and organization, the ways in which the market mechanism functions within organizational structures in capitalist economies. The role of the state in terms of its relationship to society, and whether the state deserves to be called "strong" or "weak." The relationship between the state and the private sector through industrial policy. (DR:5)
5 units, Aut (Okimoto)

2. Technology and Organizational Culture—Seminar hosts speakers from German institutions on the ways in which culture and technology interact to produce distinctive organizational forms. Prospective interns are alerted to the customs and mores of German industrial organizations. Mandatory Pass/NC.
1 unit, Aut (Okimoto)

3. Urban Sociology: 750 Years of Berlin—What cities have been in the past and what they are becoming. The city, not just Berlin, is changing as a socio-geographic phenomenon; the social form of the city is examined in its historical transformation from the medieval period to the present. The ways cities have been and are being lived in and how the interactions specific to them are changing. The pressures under which cities have given way. Suburban and urban cultures with a qualitatively different logic and self-perception.
3 units, Aut (Lenhardt)

4. Industrial Revolution and its Impact on Art, Architecture, and Theory—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. In fine arts, we observe the dominance of different forms of realism and a movement toward abstraction, as in the reaction of painting to photography. 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. The interaction between these two theoretical demands. 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 technological and scientific development motivates aesthetic redefinition. (DR:2)
5 units, Aut (Neckenig)

5. Sexuality in Germany and the U.S.: A Comparative Perspective—The attitudes toward sex, gender, and behavior in Germany and the U.S. differ significantly. Sexuality is a biological given and the product of social history in a specific cultural context. The sexual cultures of Germany and the United States in the context of historical traditions. Themes: sexuality in the ancient world, the Judeo-Christian and Islamic traditions; the Middle Ages and the Protestant Reformation, the writings of pilgrims (Cotton Mather) and the representatives of the baroque (Casanova) and 20th century theorists (Freud, Foucault, and Simon). Sexual traditions in Western culture: sexual identity in its socio-psychological variations, male and female subcultures, homosexuality, pornography, images from Tom Mix and Marilyn Monroe to the SS Officer, and convergencies between the US and German experience. The contemporary experience in national comparison; male and female subcultures, gender identity, marriage and the family, pornography, sexuality and Nazism, and de-sexualization, and AIDS.
5 units, Aut (Shuller)

7. The German Question—The Federal Republic of Germany (FRG) and the German Democratic Republic (GDR), their bilateral relationship, the origins, history, and current problems of both German states and the comprehensive dimensions of "the German question" and its national and international implications. The intricate interrelationship between the two German states, the cobweb of relations within Europe and between both major powers in the West and the East, the United States and the Soviet Union. The roles which both German states play in their respective alliance systems. Reunification of Germany, its feasibility and its likelihood.
5 units, Win (Klinger)

8. Comparative Economic Systems—An overview of existing economic systems in the Mar-
ket-Oriented Economies (MOE) of the industrialized West, in the Centrally Planned Economies (CPE) of the socialist bloc, and in Less Developed Countries (LDC). What are the assumptions and goals of each? How do they work? What gaps exist between claims and reality? What are the consequences for society, for power, politics, and policies? Will there be a major change of the Soviet command system toward a managed market economy or will the reforms become an adjustment toward more efficiency within the traditional command system? Emphasis on the economic reforms initiated by Soviet party chief Gorbachev in the Soviet Union and important questions about economic systems.

5 units, Win (Jacobsen)

9. Research Seminar on Institutional Culture —Objective: to teach students how to interpret their experiences in the institutions where they will be interns. Part I: the methods social scientists use to research institutional cultures focusing on German educational institutions. Part II: students design a research project related to their internship institution. Additional credit available for students who complete the research project during their internships.

4 units, Win (Lenhardt)

10. Split Images: German Film Culture, East and West—The emergence in the postwar period of two German new 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.

5 units, Win (Kramer)

11. Psychoanalysis and Social Theory in Modern Europe—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 both these phenomena within the social and cultural history of "Central Europe." Emphasis on combining texts with a development of historical understanding. Authors include: Adorno, Freud, Horkheimer, Marcuse, and Fromm.

5 units, Spr (Wolf)

12. Modernism and Grosstadt: Turn of the Century Culture in Berlin—19th century Ber-
developments of politics and culture within the divided city and the consequent emergence of two quite different ideas about the arts and letters. Local artists and writers speak to the class. (DR:2)

4 units, Spr (Weber)

101A. German Theater—(Also listed 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)

102. Brecht's Berliner Ensemble: Seminar—A study of Brecht's experiments in the 1950s, his methods of directing and techniques of drama. The development of company; the Berliner Ensemble, that represented a turning-point in the history of 20th century theater. Visits to the Berliner Ensemble and discussions with former collaborators of Brecht are part of the seminar. (DR:2)

4 units, Spr (Weber)

120X. New Ways of Seeing — (Also listed 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— (Also listed 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)

125. Introduction to German History: Politics and Culture from the Middle Ages to the Unification of Germany, 900-1870—(Also listed 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, highlighting contrasts. History as an interdisciplinary project, drawing on artistic, literary, and theoretical documents and artifacts. (DR:5)

4 units, Win (Neckenig)

140X. The German Federal Republic in the International System—(Also listed as Political Science 140X.) 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)

230B. Berlin: History and Culture, 1870 to the Present—(Also listed as History 230B.) Berlin's role in Germany's recent history, an interdisciplinary approach including on-site examination of Berlin art, historical sites, and contemporary culture. (DR:5)

4 units, Aut (Neckenig)

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 from such areas as history, literature, politics, and economics.

3-4 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.

3-4 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)
3. An Introduction to Italian Economy—(Also listed as Economics 166X.) Italian economic development since WW II. A historical perspective on the domestic economy. References to the international and European setting describe their impact on the Italian economy and provide a comparative framework of analysis. The relationship between economic variables and economic theories. The balance of payments, the monetary and fiscal policies, the labor market issues, trade-union role, institutional constraints, characteristics of the labor force. The effects and the policies implemented after the oil shocks (1973, 1981, 1986) and the falling dollar price help interpret the present and future direction of the Italian economy.

4-5 units, Win (Venturini)


3-5 units, Aut (Guarnieri)

5. The Political Economy of Small Firms in Italy—The phenomenon of small-firm development in the Italian economy. Introduction includes: the economic and technological conditions of small-firm development in Italy, the socio-cultural and political conditions that foster their growth, and the problems of localism and the role of regional governments in small-firm development.

3-5 units, Aut (Trigilia)

6. Economics of Industry and European Industrial Structure—A micro-economic analysis of the foundations of and recent developments in industrial structure, the differences between the organization of industry in Europe and the U.S. and the differences in policy approaches in Europe and the U.S.

3-5 units, Spr (Bianchi)

7. Terrorism in Italy and Europe—The political and ideological roots of Italian and European terrorism in comparative perspective; the intellectual climate and political evolution of terrorism in France, Germany, and Italy since the 1960's. Changes that took place within the European Left in that decade and in European society as a consequence of the new social and intellectual values generated by the movement of 1968. The explanation of Italian terrorism as a manifestation of economic tensions caused by the transition from an agrarian to a post-industrial society.

4 units, Win (Della-Porta)

101. Forster and Lawrence in Italy—(Also receive English Department credit.) E. M. Forster and D. H. Lawrence share a profound spiritual kinship, that kinship becomes emblematic in their love of Italy. For Forester, Italy was a source of primitivistic energy and value and a useful rebuke to the sturdy, upper-middle-class world he was in impotent rebellion against. For Lawrence it served as a validation of that chthonic underworld of unconscious experience which he felt fatally repressed in the England of his upbringing—and to which he returned before writing *Lady Chatterley's Lover.* (DR:2)

4 units, Win (Stone)

102. Modern Italian Novel—Purpose is to read and study eight novels that afford a glimpse of the achievements of the Italian novel in this century, and to examine these texts from a thematic and technical point of view. (DR:2)

4 units, Win (Stone)

103. Art as Public Policy: Renaissance to the Present—Italy's Roman heritage, Florence in the 15th century, cultural renewal in the form of the Baroque during the Counter-Reformation in Rome, the Rococo and archeological discoveries, the decline of the 19th Century, and modernism and futurism in the 20th Century. (DR:2)

4 units, Spr (Russell)

104. Seminar in Art and Theater—Visual styles of historical periods in Western art and theater. The Classical, Medieval, Renaissance, Baroque, Romantic, Realistic, Symbolist, and Modern periods are used to show how one could take a visual idea from the art of the time and develop it into a visual metaphor for a modern theater production.

2-4 units, Spr (Russell)

110X. Contemporary Italian History: Politics—(Also listed as Political Science 110X.) A close look at the Italian political system and how it functions as seen by following the day to day political events of government through the news media. Guests for lectures and discussions will be current political figures. (DR:5)

4-5 units, Win (D'Alimonte)

111A. Tuscan Art from Giotto to Leonardo—(Also listed 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—(Also listed as Art 111B.) The stylist trends, iconography, and social history of Italian art, concentrating on Michelangelo and Raphaello, but including Bron...
zino, Vasari, Titian, Tintoretto, and Caravaggio. Emphasis on classical influence on the artists studied. (DR:2)

4 units, Win (Todorow)

125X. Comparative European Politics — An 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 W. 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.

4 units, Spr (D'Alimonte)

126X. Italian Political System: Part I—(Also listed as Political Science 126X.) Part I: 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. Part II is taught Winter Quarter, in Italian, at the University of Florence.

4 units, Aut (D'Alimonte)

127X. Il Sistema Politico Italiano: Part II—The Italian political system as it has emerged and developed from the end of WW II to the present. Part I: general trends of political and economic development and contrasts to 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.

4 units, Win (D'Alimonte)

135A. U.S. and Western Europe After WW II—(Also listed as History 135A, Political Science 121X, and counts toward the International Relations major.) The economic, political, military, and cultural relations between the United States and Western Europe. The different American policies toward Europe from 1945 to 1982 within the framework of East-West relations. The European answer at political and economic levels. Provides an understanding of European points of view toward American policy. (DR:5)

5 units, Aut (Mammarella)

198F. Art and Culture of the Greek World — (Also listed as Anthropology 198F.) 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 (Scichilone)

ITALIAN LANGUAGE PROGRAM

Intensive Italian—Grammar, conversation, and composition. Students enroll in Intensive Italian at the appropriate level during their first quarter in Florence.

80. Intermediate Italian.

5 units, Aut, Win, Spr (J. Mammarella, Guarnieri, Benini, Celli, Gori)

90. Advanced Italian.

5 units, Aut, Win, Spr (J. Mammarella, Guarnieri, Benini, Celli, Gori)

Italian Language Continuation Courses—Grammar, conversation, and composition are in the context of a literary or social issues theme. Students enroll in Language Continuation at the appropriate level during their second and third quarters in Florence.

5 units, Aut, Win, Spr (J. Mammarella, Celli, Benini, Gori)

KRAKOW

1. East-West Relations: Central Europe between the Superpowers—(Also listed as History 119V, Political Science 136X, and for International Relations major.) An alternative understanding of contemporary political divisions and the paths toward reformation in infra-European relationships. The actions of the Superpowers as constraints upon the reintegration of Europe. The historical impediments toward a reconstituted Europe and the increasing networks of contacts that open the possibility of greater European autonomy in the international system. Topics: the historical problems and residual effects of multi-ethnicity; national partition and empire in pre-war Central Europe; the policies toward the East adopted by the Western European states and the Atlantic Alliance in the post-war period; the internal relationships among the Socialist-bloc nations as these affect their capacities and desires for engaging in increased European interaction. Security, economics, and human rights and the formal and informal processes that may lead away from a bifurcated Europe.

4 units, Spr

2. The Polish Working Class since 1945—(Also listed as Sociology 140W, Political Science 116X.) The social and political position of the Polish working class in recent years. The emergence of the working class in the 19th century and its political role in the inter-war years. The post-war industrialization of Poland and general
strategies for economic development in socialist societies. Topics: the technological gap between East and West; problems of social mobility for workers; the education of workers in relation to their technical qualifications, their values and aspirations; and class self-identification. Theoretical problems of research on class structure under current Polish conditions. The role of the working class in the crises of the 1980's, including the roots of the Solidarity movement, and the social, political, and technological limits of its advancement.

4 units, Spr

3. Special Topics in Polish Literature, Film, and Theater—(Also listed as Drama 142D.) Poland in film, 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.

3 units, Spr

4. Polish History—(Also listed for the International Relations major.) The history of 19th and 20th century Poland as a foundation for the more detailed coursework. There will be a set of six background lectures all students will be expected to attend. These will not involve extensive reading assignments or evaluation.

2 units, Spr

5. The Socialist Economies of Poland and the COMECON States: Evolving Structures—(Also listed for the International Relations major.) Since WW II the Polish economy has had a system of centralized planning and an administered price-wage structure. Movements for comprehensive economic reforms and interactions with Western markets have introduced a potential for greater flexibility and presented a range of incentives and options for managers. Issues: the complex set of choices and constraints facing Polish enterprises in internal markets, exporting to other Socialist countries, or experimenting with global exchange systems. The increasing interactions with the West in financial and investment flows, technology transfers, and services; their feedback effects on the heretofore autonomous administration of the Polish domestic economy. The theory and practice of economic reform in Poland contrasted with alternative proposals for change in other socialist states, Hungary and the Soviet Union.

4 units, Spr

6. Polish Identity and the Change in National Ideology—(Also listed as Sociology 148W.) The continuing formation and repression of an independent Polish national state during the last three centuries has made the preservation of Polish nationality the focus of cultural identity. The major aspects of this struggle: the effect of Romantic images in the formation of a national consciousness; the cultural role of the Catholic Church and non-Catholic religious groups; folk and regional culture; relations with the Polish emigrant communities; attitudes toward ethnic minorities; contemporary ideological orientations toward nationality; the role of the state and mass media in identity creation and reformation.

3 units, Spr

7. Polish language Classes—Polish language classes at the Jagiellonian University are taught at introductory and continuing levels, taken for three or five units, depending on the desired level of intensity. 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 requirement for participating in the Polish summer program. All non-language classes in Krakow are taught in English, however, a minimal familiarity with the language will enrich the quality of your involvement with Polish society. Knowledge of French, German, and Russian are useful, though a reliance upon these languages requires a sensitivity to the historical and political nuances of Polish life.

3 or 5 units, Spr

OXFORD

Two types of independent work will be available to students. Stanford home campus faculty who are teaching at the Oxford Program will offer Directed Readings each quarter. In addition, students may take one tutorial per quarter with Oxford University tutors.

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. Weekend trip to South Wales to sites of national and historic interest, including a coal mine, country houses, the Welsh Folk Museum. Pass/No Credit.

2 units, Aut (Tyack)
2. The Political Economy of the European Economic Community—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.
5 units, Aut (Allen)

3. Modern Drama: Lectures and Workshop—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 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 include 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.
5 units, Win (Worth)

4. International Economics—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)

20. An Introduction to Moral Theory: Personal Morality—(Also listed as Philosophy 20.) Questions of value and personal moral dilemmas: What makes acts right? What makes some consequences of some actions better than others? To what extent can disagreements on such matters be rationally settled? Why be moral, anyway? Are there moral constraints on the conduct of war? Is suicide always wrong? Readings will come from both classical and contemporary philosophers, including Bok, Lying; Feldman, Introductory Ethics; Gorovitz, ed., Mill; Kant, Foundations of the Metaphysics of Morals; Sterba, ed., Justice. (DR:3)
4-5 units, Spr (Bratman)

101. The 18th Century English Novel in its Social Context—(Also listed as English 131B.) The major works of English prose in the 18th century in their social context: the establishment of a new middle-class "mass culture," secularization, privatization, and the new cultural importance of women. (DR:2)
5 units, Aut (Castle)

102. High Life and Low Life: Relations between Polite and Popular Forms in 18th Century Literature—The complex relationship between elite and popular forms in the 18th century literary imagination, the criminal biography, travel literature, political tracts, newspapers. The literary representations of the new urban subculture and exemplary types, the criminal, the hack, the whore, and the madman. The dialectic between high and low cultures and its changing social and ideological conditions. (DR:2)
5 units, Aut (Castle)

5 units, Win (Gordon)

104. Seminar in Modern Anglo-American Legal Thought—Seminar on middle-level legal theory, law review articles, and treatises dealing with specific legal subjects. Topics: "Classical" legal thought, including Anson, Dicey, Pollock, Langdell, and Williston; Holmes and his followers, legal realism and its English variants, successors and reactors to realism; and neo-formalism. Prerequisite: Consent of instructor; open to Oxford University faculty and students.
5 units, Win (Gordon)

132X. The British Empire and the Commonwealth—(Also listed as History 144V.) 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.
4-5 units, Spr (Rizzi)

346. Seminar on Mind and Action—(Also listed as Philosophy 346.) Discussion of selected problems in the philosophy of mind and action. Topic: Intention, Rationality, and Moral Theory.
3 units, Spr (Bratman)
138X. British Foreign Policy and International Relations, 1935-1985—(Also listed 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.
4-5 units, Win (Holmes)

142V. Archeology and the Making of the British Landscape—(Also listed as History 142V.) The relationship between man and his habitat in Britain from the Iron Age to c 1500. The background physical geography of the British Isles and the nature of archeological evidence. The links between archeology and history as conventionally understood. Changes in religion and ritual, in man's attitude toward death, and in the nature of social and political examination of surviving monuments.
4-5 units, Aut (Rowley)

143W. The Making of Modern Britain, 1870 to the 1970s—(Also listed as History 143YV.) The development of Britain from the high-water mark of her power in the 1870s to her more modest position in today's world. How modern Britain came into being. The stages of this evolution chronologically: economic decline, the world wars, the abdication of Empire. Internal developments which have contributed most to the creation of Britain today: the use of organized labor, the creation of a democratic franchise, the growth of central government, the establishment of a Welfare State, and the gradual uneven improvement in the living standards of the people. The history of Anglo-Irish relations which have lead to the present impasse. (DR:5)
5 units, Aut (Tyack)

169. Darwin's Century: Science and Belief in the Victorian Age—The changing relationship between scientific and religious beliefs in the 19th century in relation to the emergence of evolutionary theories of the origin of species and societies.
5 units, Win (Durant)

176X. History of English Architecture—(Also listed 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)

179. British Urban History from the 16th to the 20th Centuries—Social, architectural, and political development of British cities since the early modern period.
5 units, Spr (Tyack)

254Z. Contemporary British Theater—(Also listed as English 254Z.) The 'classics' of modern drama and contemporary plays, the works of the most interesting theater directors, together, these make you 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. Plays based upon available productions Spring Quarter.
4-5 units, Spr (Mateer)
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, Aut (Doubinsky)

01. French Literature Survey: 19th Century — (Also listed as French 101.) 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, Win (Doubinsky)

02. Survey of French Literature: 20th Century — (Also listed as French 102.) 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 texts, and by detailed analysis of significant excerpts. (DR:2)

4 units, Spr (Doubinsky)

111X. La politique francaise contemporaine — (Also listed 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:2)

5 units, Spr (Doubinsky)

115T. L'Existentialisme Litteraire — (Also listed as French 115T.) The literary expression of existentialism through the study of representative works. The exploration of the feeling of the absurd, the exaltation of the spirit of rebellion, the discovery of a new humanism and a relatively optimistic moral. Readings on Camus and Sartre.

4 units, Win (Doubinsky)

119. Introduction to French Art: Romanesque to Renaissance — (Also listed as Art 119.) 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.

4 units, Aut (Doubinsky)

120X. French Foreign Policy — (Also listed for the International Relations major and as Political Science 120X.) 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)


4 units, Spr (Dufresne)

128X. Les Problemes contemporains de la croissance economique — (Also listed as Economics 128X and for credit in 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 — (Also listed as History 130A.) 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)

132V. The Social History of Modern France: 1871 to Present — (Also listed as History 132V.) Examines the central issues in the social history of France from the Commune to May, 1968. Discussion of original texts and important historiographical questions. Selected syllabus: Marx, Civil War in France; Edwards, The Communards of Paris; Girardet, Le Nationalisme Francois, 1871-1914; Ferro, The Great War; Fanon, The Wretched of the Earth; Lefebvre, The Explosion.

4 units, Aut (Green)

135. Social History of Modern France from the Third Republic to the Present — Issues in the social history of France since the commune. Emphasis on historiography and original texts.

4 units, Win (Green)
139. France and Europe and the Economic Crisis—(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 interdependency within the EEC and the defective functioning of the international monetary system. Theoretical solutions and concrete policy options.
5 units, Win (Leboucher)

140X. France and the Third World—(Also listed as Political Science 140.) 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 both Maghreb (Tunisia, Algeria, Morocco) and Black Africa. DeGaulle's policies, French policies, and cooperation agreements through the present de-stabilizing 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)

141. French Theater: The Avant-garde—Ionesco, Beckett, and Genet as a way of understanding the cultural mutation that overtook Western societies in the aftermath of WW II.
4 units, Spr (Perdoux)

LANGUAGE PROGRAM

70, 80, 90. Intensive French—Grammar, conversation, and composition, emphasizing rapid acquisition of verbal skills necessary to use the French language in daily life.

70. Elementary French.
6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

90. Advanced 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)

127. Colloquium on Translation — A practical approach to the problems of expression in English and French and of translation from one language to the other. Examples taken mostly from contemporary sources.
4 units, Spr (LeMoal)

PHILOSOPHY

Emeriti: (Professors) John D. Goheen, Stuart Hampshire (on leave), Georg Kreisel, John L. Mothershead, Jr., James O. Urmson
Chair: Michael Bratman
Director of Graduate Study: Julius Moravcsik
Director of Undergraduate Study: John Perry
Professors: Jon Barwise, Michael Bratman (teaching overseas, Spring), Nancy Cartwright (on leave), Solomon Feferman, Dagfinn Føllesdal (Spring, Summer only), Julius Moravcsik, David Nivison, John Perry, Patrick Suppes (on leave Spring), Thomas Wasow
Associate Professors: Peter Galison, Wilbur Knorr (on leave Autumn)
Assistant Professors: John Dupré, John Etchemendy, Eckart Förster (on leave), Richard Pruitt, Jean Roberts
Lecturers: Nathan Tawil, Ezio Vailati, Julie Ward
Acting Assistant Professors: William Beardsley, Daniel Conway, Edward Zalta
Consulting Associate Professors: David Israel, C. Raymond Perrault, Brian Smith
Visiting Professor: Mott T. Greene
Visiting Assistant Professors: Margaret Morrison, Alan Strudler
Fellow: Kathie Jenni

OFFERINGS

Philosophy concerns itself with fundamental problems. Some of these are rather abstract and deal with such issues as the nature of truth, justice, value and knowledge; others are more concrete and their study may help guide our conduct or enhance our understanding of other subjects. In addition, philosophy examines the efforts of past thinkers to understand the world and our experience of it.
Although it may appear to be an assortment of different disciplines, there are features common to all philosophical enquiry. These include an emphasis on methods of reasoning and the way in which our judgments are formed, on criticizing and organizing our beliefs, and on the nature and role of fundamental concepts.
Students of almost any discipline can find something in philosophy which is relevant to their own specialties. For those interested in the sciences, philosophy provides a framework within which the foundations and scope of a scientific theory can be studied, and it may even suggest directions for future development.
Since philosophical ideas have had an important influence on human endeavors of all kinds—artistic, political, even economic—students of the humanities will find their understanding deepened by some acquaintance with philosophy.

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, situated in the Philosophy Building, contains an excellent working library and ideal conditions for study.

Both the graduate students and the undergraduate majors in philosophy have associations for discussion of philosophical issues and reading of papers by students, faculty, and visitors. These associations 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**

The 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 for the sub-major, to be taken according to requirements 1-5 below. Substitutions for the listed courses are allowed only by written permission of the undergraduate advisor for History and Philosophy of Science. Students are encouraged to consider doing Honors work in philosophy with an emphasis on the history and philosophy of science. Interested students should see the description of the honors thesis in Philosophy and consult their advisors for further information.

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 five 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 two units of senior tutorial for the Spring Quarter. Two copies of the essay must be turned in to the Honors Committee by the end of the fourth full week of the Spring Quarter.

The Honors Committee will review the applications for Honors, assign tutors and second readers, and make the final determination 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 3 courses in each must be completed with a letter grade 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:
      1) Logic and Philosophy of Science: Philosophy 57, 60, 159, 160A, 162-169.
      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 five 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 IN THE JOINT MAJOR
Students pursuing a joint major in Philosophy and Religious Studies may also apply for Honors by the following procedure for Honors in one or the other department.

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. (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
There are two sorts of programs leading to the degree of Master of Arts in Philosophy. One is a general program providing a grounding in all branches of the subject. The other provides a special training in one branch. A suitably qualified applicant may arrange a specialized program in any subject, analogous to those in the philosophy of science or philosophy of language described below, provided that the department offers sufficiently intensive teaching in the special subject.

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.

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 nine units of philosophy by nine 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 six units of directed reading in philosophy may be allowed. There is no dissertation requirement. A special program may require knowledge of a foreign language. 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 on 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 is primarily in philosophy may be required to take additional courses in linguistics.

#### COURSE REQUIREMENTS

1. Philosophy of Language: Two approved courses in the philosophy of language numbered 180 or higher.
3. Logic: At least two approved courses numbered 160A or higher.
4. A graduate seminar in metaphysics or epistemology.
5. An approved graduate level course in mathematical linguistics or automata theory.

### 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 philosophy. The six out of seven requirement 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 Eastern 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 Quarter 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 meeting 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 “Departmental Oral,” based on at least 30 pages of written work, in addition to the proposal. 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 completed, there is a second exam, called the “University Oral Exam.” A portion of this exam will consist of a student presentation 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 the University Oral count as the Department Oral.

SPECIAL GRADUATE PROGRAMS

The department recognizes that some students may need to spend a large amount of time preparing themselves in some other discipline related to their philosophical goals or in advanced preparation in some area within philosophy. In such circumstances, the department is willing to grant an exemption to some of the Ph.D. program requirements. Such an exemption is not automatic; a program must be worked out with an advisor and submitted to the department 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 seminars in the special area (usually at least 12 units).
3. A justification of the program that considers both intellectual coherence and the student’s goals.

The department believes there is plenty of room for normal specialization within the program 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 relevant 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 science and perhaps history of science, can design an individual program of study in close consultation with an advisory committee from the faculty. Such students will be exempted 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 Studies to establish eligibility, and select a suitable 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 Department 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 section “Humanities Special Programs” 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. Readings 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)

5 units, Aut (Moravcsik) MWF 10 plus 2 hour section

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, Win (Perry) MWF 10 plus 2 hour section

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 (Kerman) MTWThF 9 Spr (Staff) MTWThF 9

60. The Growth of Scientific Knowledge—(Same as History of Science 60.) Introduction to the philosophy of science by way of the historical analysis of philosophical-scientific debates. Theory change and experiment e.g. Hempel, Kuhn, Lakatos, Popper, and Hacking. Case studies of Copernican and Einsteinian revolutions with historical scrutiny. Readings from philosophers, historians, and the original texts. A writing focus course. (DR:3)

5 units, Spr (Galison) MWF 11 plus section

62. Introduction to the History of Biology—(Same as History of Science 62.) The changing nature of the biological sciences, addressing what was considered good biology at different times through history (including now) and what sorts of factors brought about the changes? Focuses on cell theory, evolution, heredity, and development in the 19th and 20th centuries, with a brief introduction to earlier periods.

4 units, Aut (Greene) 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 applies them 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 (Zalta) TTh 3:15

77. Ethics in International Relations—Addresses fundamental issues about 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 contemp-
orary international affairs: nuclear warfare and deterrence, world hunger and economic justice, and environmental pollution. Readings from classical and contemporary sources.

4 units, Spr (Jenni) MWF 10

78. Medical Ethics—(Same as Human Biology 173.) How ethical theory and the rules of moral reasoning can be applied to issues in clinical medicine and biomedical research. Topics: guidelines for genetic engineering and experimentation on humans, surrogate motherhood, and "just" management of the AIDS epidemic, euthanasia, the "just" allocation of scarce medical resources, or transplants, etc.

4 units, Aut (Zalta) MWF 2:15

79. Philosophy of Law—Topics: source and limits of the state's right to punish criminals, foundations of the law of torts and contracts, the role of moral and economic concepts in legal reasoning. Readings from legal and philosophical sources.

4 units, Win (Strudler) TTh 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, our knowledge of other minds, the nature of personal identity. Provides background for advanced work. A writing focus course. Prerequisite: One course in philosophy other than 57.

5 units, Aut (Bratman) MWF 1:15

Spr (Beardsley) MWF 9

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.

4 units, Win (Gelber) MWF 10

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, Aut (Beardsley) MWF 9

103. 19th Century Philosophy—Ideas and conceptions that shaped 19th century philosophy. Fichte, Hegel, Marx, Kierkegaard, Nietzsche.

4 units, Spr (Conway) TTh 11-12:15

104. Introduction to Chinese Philosophy—(Same as Philosophy 46.) For philosophy majors.


4 units, given 1988-89


4 units, given 1988-89


4 units, Spr (Pruitt) MWF 1:15

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, Win (Moravcsik) MWF 1:15

111/211. Plato—(Graduate students register for 211.) A survey of Plato's metaphysics and epistemology.

4 units, given 1988-89

111A/211A. Plato's Epistemology—(Graduate students register for 211A.)

4 units, Aut (Moravcsik) TTh 2:15-3:30


4 units, given 1988-89

119. Spinoza and Leibniz—A comparative study of the two philosophers, 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, given 1988-89
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 1988-89

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, Sum (Follesdal)

135/235. Hermeneutics—Graduate students register for 235.) (Same as Religious Studies 185.)
5 units, Spr (Follesdal, Harvey) MW 3:15

138A. Ancient Period—(DR:3; also satisfies Area 6 when taken in sequence with 138B.)
4 units, Win (Knorr) MWF 2:15
138B. Middle Ages to Newton—(DR:3; also satisfies Area 6 when taken in sequence with 138A.)
4 units, given 1988-89
138C. Newton to Einstein—(DR:3)
4 units, Spr (Knorr) MWF 2:15

140. Topics in the History of Mathematics: from Antiquity to the 17th Century—(Same as History 138D, History of Science 140, Math 181.) 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, Spr (Knorr) TTh 10-11:15

145. Scientific Revolution—(Same as History 139, History of Science 145, VTSS 132.) 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.
4 units, Aut (Galison) MWF 1:15

152. The Darwinian Revolution and Modern Geology—(Same as History of Science 152.) The Darwinian Revolution transformed biology by establishing a new perspective for the study of organic forms, heredity and genetics. It also had consequences for earth history and planetary science: the Darwinian Revolution from both a biological and geological viewpoint, including the age of the earth, paleontology, continental drift, biological inheritance, and genetic theory.
4 units, Aut (Greene) MWF 10

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, given 1988-89

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, 2:15 on 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.
3 units, Aut (Wasow) MWF 9

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, Aut (Devlin) MWF 9
Win (Etchemendy) MWF 9

160B. Computability and Logic—(Same as Symbolic Systems 160B.) 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 undecid-
ability of arithmetic, culminating on his Incompleteness Theorem. Also other undecidable problems. Prerequisite: 160A.

4 units, Spr (Devlin) MWF 9

161. Semantics of Computation—An introduction to the basic concepts and tools used in the semantical analysis of programming languages and embedded computational systems like robots. Topics: denotational and operational semantics, and the theory of situated automata. Prerequisite: 160A, B. Concurrent enrollment in 160B with permission of instructor.

4 units, given 1988-89

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.

3 units, Win (Suppes)


4 units, Win (Galison) MWF 1:15

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, Spr (Morrison) TTh 11

166. Introduction to Philosophy of Social Science—(Same as Education 211.) Begins by focusing upon the differences various writers have noted between the natural and social sciences, and moves to topics in the social sciences: explaining human action, the functional explanation of social phenomena, holistic versus reductionist orientations. Examples are used from contemporary social science research literature to illustrate the relevant issues. For majors in the social sciences and beginning graduate students in related areas such as education.

3 units, Win (Phillips) Th 7-10 p.m.

167. Philosophy of Biology—Philosophical issues on biology focusing on sociobiology. Part 1: epistemological issues underlying sociobiology—the nature of human nature; biological determinism; analogies between humans and other animals; and the application of games theory to evolutionary speculations. Part II: specific areas of sociobiological theory and possible ethical and political significance: the biology of altruism, and the biological basis of gender differences.

4 units, Win (Dupre) MWF 1:15

168. History and Philosophy of 20th Century Physics—(Same as History 139A, History of Science 168, VTSS 133.) 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-particleduality? 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.

4 units, Win (Imhoff) TTh 11-12:15

ETHICS, AESTHETICS, AND SOCIAL AND POLITICAL PHILOSOPHY

170. Ethical Theories—Three approaches to moral theory: utilitarianism, deontology, and virtue ethics. Prerequisite: 20 or two other courses in philosophy.

4 units, Spr (Imhoff) MWF 11

171. Political Philosophy—Recent work in social justice: libertariansim, contractarianism, utilitarianism, and communitariansim; the limits of state interference with individual freedom; and the role of the state in promoting individual and social goals.

4 units, Aut (Strudler) MWF 10

176. Representation, Invention, and the Ordinary World—Seminal ideas regarding representation and interpretation in post-WW II American philosophy and avant-garde arts. Quine, Goodman (philosophy); W.C. Williams, Wallace Stevens (poetry); R. Bauschenberg, J. John (painting, modernism/postmodernism; Marcel Duchamp, John Cage; relationship between art and life; conceptions of art; dada, neo-dada.

4 units, Aut (Pruitt) TTh 11-12:15

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 concern to feminists: affirmative action, pornography, abortion.

4 units, Spr (Roberts, Dupre) TTh 2:15-3:30
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 (Etchemendy) TTh 2:15-3:30

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, Spr (Follesdal) TTh 8:35-9:50

184. Theory of Knowledge—Some central problems of epistemology, including the analysis of knowledge, the quest for certainty, and the objects of knowledge, belief, and perception.
4 units, Aut (Hilbert) MWF 11

186. Philosophy of Mind.
4 units, Spr (Perry) MWF 2:15

188. Science and Knowledge—The nature of causation and the role of causal explanation in both scientific and non-scientific contexts. Traditional approaches to causation (those of 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, Win (Morrison) MWF 10

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, Spr (Etchemendy) W 3:15-5:05

194. Undergraduate Seminars in Philosophy—A series of advanced undergraduate seminars. Enrollment limited to 16 in each seminar. Preference is given to undergraduate majors. Students should sign class lists in Philosophy Department office during the pre-registration period. For those in the Philosophy Honors program, these seminars serve as a preparation for writing an Honors thesis.

194A. Practical Ethics—Sexual morality, suicide, the treatment of animals, our obligations to strangers, and capital punishment. The aim is to subject to scrutiny assumptions shaping conventional perceptions of these issues: assumptions about "natural" sex, about the relative moral status of human and non-human animals, and about the right to pursue happiness. Readings from contemporary sources.
3 units, Aut (Jenni) T 1:15-3:05

194B. Kant's Critical Philosophy—An introduction to Kant's critical philosophy emphasizing the development of his account of transcendental idealism as presented in Critique of Pure Reason. The influence of Leibniz and Hume and Kant's views on the nature of experience, human understanding, and objectivity. Details of Kant's categorical framework with the differences between phenomena and noumena, and analytic and synthetic judgments.
3 units, Aut (Morrison) Th 1:15-3:05

194C. Getting the Picture—Some theories of pictorial representation. Readings from philosophy, psychology, art history. Possible authors: Nelson Goodman, Richard Wollheim, Svetlana Alpers, Frank Stella, Ernst Gombrich, Michael Boxandall. Focus is on the pictorial representation of space.
3 units, Win (Prutt) T 1:15-3:05

194D. Moral Foundations of Private Law—An examination of attempts by judges, lawyers, and philosophers to justify or criticize leading doctrine in private law. Issues include the nature of responsibility, harm, and fault: the source of legal rights, and the proper role of the judiciary in setting social goals. Focus is on private law, especially torts. Readings from legal and philosophical sources.
3 units, Win (Strudler) Th 1:15-3:05

194E. Nonexistent Objects: A Contemporary Perspective on the Russell-Meinong Debate—Survey of the recent literature surrounding Russell's refutation of Meinong's theory of nonexistent objects. If fictional, mythical, and dream objects don't exist, how can they figure into our thoughts? How could they frighten us as some dream objects do? What are we referring to by using the pronoun 'they'? What do we mean when we say 'The ancient Greeks worshipped Zeus' and 'Sherlock Holmes still inspires detectives'?
3 units, Win (Zalta) T 1:15-3:05

194F. The Golden Rule—Survey of Golden Rule type concepts in popular moral and religious thought, and in philosophical ethics in different ages and civilizations. Attention to R. M. Hare and his critics, to contemporary German writers, to Confucian ethics, and to Freudian criticisms of the "Love Commandment."
3 units, Spr (Nivison) T 1:15-3:05
194G. Aristotle’s Ethics.
  3 units, Spr (Roberts) W 1:15-3:05

194H. Problems from Locke.
  3 units, Spr (Hilbert) Th 1:15

194F. Emotion and Reason—Is emotion opposed to reason? Would an ideally rational agent (an intelligent robot) lack emotion entirely? Or would such an agent suffer from a fatal defect: an inability to care about anything, including its own welfare? How recent theories of emotion in philosophy and artificial intelligence bear on these questions.
  3 units, Aut (Nash) M 10-11:50

196. Tutorial—Senior year.
  5 units, any quarter (Staff) by arrangement

197. Individual Work for Undergraduates.
  any quarter (Staff) by arrangement

PRIMARILY FOR GRADUATE STUDENTS

207. Pragmatism and the Idea of Experience—(Same as 107.) For graduate students.

211A. Plato’s Epistemology—(Same as 111A.) For graduate students.

218. Graduate Seminar on Descartes—A close reading of *Meditations* examines Descartes’ philosophy, particularly his philosophy of mind.
  3 units, Win (Beardsley) Th 2:15-4:05

219. Graduate Seminar on Nietzsche—Nietzsche’s “critical” writings of 1885-88, and his attempt to justify his genealogical method with the epistemic framework of his own perspectivism. Advanced undergraduates may enroll upon approval of instructor.
  3 units, Aut (Conway) W 1:15-3:05

231. Kant’s Critique of Practical Reason—(Same as 131.)
given 1988-89

235. Hermeneutics—(Same as 135.) For graduate students.

236. Seminar on Some Problems in Kant’s Theoretical Philosophy—A study of central topics in Kant’s *Opus Postumum* in relation to the *Critique of Pure Reason*, the *Metaphysical Foundations of Natural Science*, and some of his shorter writings.
  3 units, Spr (Forster) Th 3:15-5:05

237A, B, C. Methods in History and Philosophy—(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 address 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, Morrison) T 4:15-6:05

239. Teaching Methods in Philosophy.
  1-3 units, any quarter (Staff) by arrangement

240. Individual Work for Graduates.
  any quarter (Staff) by arrangement

242A, B, C. Seminar in the Philosophy of Science.

242A. Topic: Representation Theory.
  3 units, Aut (Suppes) M 3:15-5:05
  Win (Suppes) M 3:15-5:05

255. Seminar on Liberty, Equity, and Social Choice Theory—(Same as Political Science 267.)
  3 units, Win (Hammond, Ferejohn, Suppes) M 4:15-6:05

264. Philosophy of Science—Core seminar in philosophy of science for first and second year students in the Philosophy Ph.D. program.
  4 units, given 1988-89

270. Moral Philosophy—Core seminar in moral philosophy for first and second year students in the Philosophy Ph.D. program.
  4 units, Win (Bratman) MW 3:15-5:05

271. Graduate Seminar in Political Philosophy—Justice, impartiality, and individual interests. Possible authors: Brian Barry, Joel Elster, Michael Sandel, and Bernard Williams.
  3 units, Spr (Strudler) F 1:15-3:05

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

281. Philosophy of Language—Core seminar in philosophy of language for first and second year students in the Philosophy Ph.D. program.
  4 units, given 1988-89

282. Seminar on Thought and Language.
  3 units, Aut, Win, Spr (Moravcsik) by arrangement

283. Meaning and Experience—(Same as 183.) For graduate students.

284. Literature and Philosophy: The Logic of Specularity in the Humanities—(Same as French 284B.)
  2 units, Win (Dupuy)

285. Semantics and the Logic of Natural Language—(Same as Linguistics 231.) Treats a sub
stantial 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.

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

299. Intensional Semantics—(Same as 189.) For graduate students.

302. Locke and Hume on Personal Identity—How Locke and Hume treat the problem of personal identity and the self.

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

304. Philosophical and Educational Thought of John Dewey—(Same as Education 304.) A careful analysis of several 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

312. Graduate Seminar in Aristotle’s Ethics.

3 units, Win (Roberts) T 3:15-5:05

326. Epistemological Problems of Artificial Intelligence—(Same as Computer Science 326.) Formalisms for representing what a general intelligence program must know about the common sense world including facts about causality, ability, knowledge, and action. Modes of rigorous and conjectural reasoning, especially non-monotonic reasoning. Approximate theories and counter-factuals. Connections with philosophy, especially philosophical logic and epistemology. Some familiarity with first order logic is assumed.

3 units, Win (Lifschitz) TTh 2:45-4

331. Seminar in Confucian Ethics—(Same as Asian Languages 331, Religious Studies 331.) Prerequisite: Consent of instructor.

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


3 units, Spr (Bratman) at Oxford


3 units, Aut (Barwise) TTh 9:35-10:50

Win (Scowcroft)


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

393A,B. Set Theory—(Same as Math 293A,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, models constructed by forcing, and models which admit atoms and non-well founded sets. Prerequisites: 160A or equivalent.

393A. 3 units, Aut (Staff)

393B. 3 units, Win (Staff)

394A,B. Topics in Logic—(Enroll in Mathematics 294A,B.) 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, Win (Feferman)
Spr (Scrowcroft)


3 units, Aut (Etchemendy) 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
Associate Professors: Blas Cabrera, Savas G. Dimopoulos, Robert B. Laughlin
Assistant Professors: Bryan Lynn, C. Jeff Martoff, Zein-Eddine Meziani, Peter F. Michelson, Ann E. Nelson
Professor (Research): John A. Lipa
Acting Professor: Douglas D. Osheroff
Acting Assistant Professors: Karsten Danzmann, Jack L. Ritchie
Consulting Professor: 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 20-GeV electron accelerator and a 6-GeV electron-positron storage ring. A 29 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, Michelson, and Schwettman are on the staff of the Laboratory. The staffs of the other branches of the W. W. Hansen Labora-
tories 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 solid state physics. Opportunities for research are also available 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 51, 53, 54, 55, 56, 57, 105, 106, 107, 110, 111, 120, 121, 122, 130, 131, 132, 161, 170, 171, 200, 201 and Mathematics 41, 42, 43, 44, 130, 131, and any additional Math course numbered 100 or higher. Physics 61, 62, 63, 64A, and 64B can replace all of the Physics 50 series requirements. Students who have taken Physics 55 or its equivalent may substitute Physics 167 or 172 for 161. 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 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 II (based on Physics 61, 62, and 63) is deemed preferable for students who have had physics and a year of calculus in high school. In this sequence, Mathematics 41 and 42 are not required. Sequence I (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, 42, and 43.

Sample programs in physics and mathematics under the two sequences are shown below. Students should consult their advisors about the course distribution requirements in other areas. The sequence of courses during the first two years is relative 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.
## 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</td>
<td>Intermediate Mechanics</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Physics 105, 106, 107</td>
<td>Intermediate Physics</td>
<td></td>
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<td>3</td>
</tr>
<tr>
<td>Physics Laboratory Seminars</td>
<td></td>
<td>2</td>
<td>2</td>
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<tr>
<td>Physics 120, 121, 122</td>
<td>Intermediate Electricity and Magnetism</td>
<td></td>
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<td>3</td>
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<tr>
<td>Math. 106. Complex Variables</td>
<td></td>
<td>(3)†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 131, 132. Partial Differential Equations I and II</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>
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</thead>
<tbody>
<tr>
<td>Physics 130, 131, 132</td>
<td>Quantum Mechanics</td>
<td></td>
<td></td>
<td>3</td>
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<tr>
<td>Physics 161, Optics</td>
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<td>3</td>
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<tr>
<td>Physics 167. Essential General Relativity</td>
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<td>(3)†</td>
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<tr>
<td>Physics 170, 171, 172</td>
<td>Thermodynamics, Kinematic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
<td>3</td>
<td>3</td>
<td>(3)†</td>
</tr>
<tr>
<td>Physics 210, 211, 212</td>
<td>Advanced Mechanics (Particle, Continuum, Statistical, and Gravitation)</td>
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<td>(3) 3†</td>
</tr>
<tr>
<td>Math. 113, 114, or 120</td>
<td>Linear Algebra and Matrix Theory or Modern Algebra</td>
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<td>(3) 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</td>
<td>Advanced Physics Laboratory</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Physics 220, 221</td>
<td>Classical Electrodynamics</td>
<td></td>
<td></td>
<td>(3)†</td>
</tr>
<tr>
<td>Physics 230, 231, 232</td>
<td>Quantum Mechanics</td>
<td></td>
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<td>(3 3 3)†</td>
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</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 3 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 should 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 3 quarters at full tuition or its equivalent). Among the departmental requirements are a letter grade indicator of “B” in courses 130, 131, 132, 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 section “Degrees” 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, passing the final examination, or by satisfying the current instructor of prior knowledge of the material.


All Ph.D. candidates must also take the following mathematics courses or have taken their equivalent previously: 106, 113, 114, 130, 131, 132. A minimum letter grade indicator of “B”
During the last five quarters is required in the courses taken toward the Ph.D. degree. Prior to making an application for Ph.D. candidacy, each student is required to pass a written comprehensive examination on undergraduate and first year graduate physics. This exam is given annually on the Thursday and Friday preceding the start of the Autumn Quarter. The examination should be taken at the end of the Summer Quarter after the first year graduate courses have been taken. After completion of the thesis he or she must take the University oral examination (defense of thesis). The Physics faculty believes that it is valuable for a scientist to have facility with a foreign language for cultural reasons and in order to establish better contact at meetings in foreign countries.

The Physics Department does not require a minor, but students are advised that the following mathematics courses have been found useful for graduate study in physics, especially for theoretical work: 206, 210, 220, 254, 256.

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.

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 physics. The Advanced Freshman Series (61, 62, 63, 64A, 64B) is for the well-prepared student who wishes to advance rapidly in physics.

The Twenty and Fifty Series are similar in content and objectives. Both 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). The second digit indicates the general subject matter: laboratory (0), mathematical physics and mechanics (1), electricity
(2), atomic and quantum physics (3), nuclear physics (4), high energy physics (5), structure of matter (7), independent study and research (9).

All undergraduates are offered help with physics problems in the departmental counseling and tutoring center called the Reference Frame. The center is staffed Monday through Friday, 9 a.m. to 5 p.m. and 7 p.m. to 9 p.m. except Fridays when it closes at 3 p.m.

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, Win (Weinstein) TTh 2:15-3:30


3 units, Aut, not given 1987-88

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 (Susskind) TTh 2:15-3:30 discussion by arrangement


3 units each quarter, Aut, Win, Spr (Adams, Fetter, Osserman) not given 1987-88

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, with the emphasis on present knowledge and current problems. Likely topics: classical mechanics, relativity, and quantum mechanics. (DR:7)

3 units, Aut (Yearian) 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 (Staff) MTWFTh 10-12
plus one hour discussion by arrangement

22. Mechanics and Heat Laboratory—Concurrent or prior registration in 21 is required. Mandatory P/NC grading.

1 unit, Aut (Meyerhof) by arrangement
Sum (Staff) 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 (Schawlow) MWF 10 or 11
Sum (Staff) MTWFTh 10-12
plus one hour discussion by arrangement

24. Electricity and Optics Laboratory—Concurrent or prior registration in 23 is required. Mandatory P/NC grading.

1 unit, Win (Schawlow) by arrangement
Sum (Staff) 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 (Yearian) 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 (Yearian) 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 41 or 20 and continuation in Mathematics 42, or consent of instructor. (DR:7)

4 units, Win, (Cabrera) lee 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

54. Electricity and Magnetism Laboratory—
Concurrent or prior registration in 53 is re-
quired. Mandatory P/NC grading.
1 unit, Spr (Michelson) by arrangement

55. Light and Heat—Reflection and refraction
of light, lens systems; light and electromagnetic
waves; temperature, properties of matter, intro-
duction to kinetic theory of matter. Prerequi-
sites: 53 and Mathematics 23 or 43, or consent of
instructor. (DR-7)
4 units, Aut (Little) lec MWF 9 or 10
discussions by arrangement

57. Modern Physics—Relativity, experimental
basis of quantum theory, Schrödinger equation,
atomic structure, nuclear structure, high
energy physics, elementary particles. Prerequi-
site: 55. (DR-7)
3 units, Win (Jaros) TTh 11-12:15

58. Modern Physics Laboratory—Concurrent
or prior registration in 57 is required. Manda-
tory P/NC grading.
1 unit, Win (Jaros) by arrangement

61,62,63. Advanced Freshman Physics—An
introduction to some topics in Newtonian me-
chanics, special relativity, electricity and mag-
netism, atomic physics, and quantum mechan-
ics from an advanced viewpoint. Lectures and
small discussion sections. Designed primarily
for students contemplating a major in Physics.
Prerequisites: High school physics and calculus;
prior or concurrent registration in Math 43
(Aut), Math 44 and 130 (Win), Math 100 or
higher and 131 (Spr) or equivalent. Physics 61,
62, and 63 are all (DR-7)
61. 4 units, Aut (Dimopoulos) TTh 9-10:50
62. 4 units, Win (Ritchie) TTh 9-10:50
63. 4 units, Spr (Chu) TTh 9-10:50

64A,64B. Intermediate Physics Laboratories—
Experimental work in mechanics, heat, elec-
tricity and magnetism, optics, atomic and nu-
clear physics. One set of apparatus for each
experiment is available so that one or two stu-
dents perform a given experiment during a
particular laboratory session. Prerequisite: 61.
64A. 1 unit, Win, Spr (Ritchie)
by arrangement
64B. 1 unit, Win, Spr (Ritchie)
by arrangement

105,106,107. Intermediate Physics Labora-
tory Seminars — A year-long series of mini-
courses in important experimental techniques
between two weeks and eight weeks, depend-
ning on the subject matter. Must be taken in
sequence. Topics: electronics, detectors and
radioactive sources, optics and lasers, statistics
and data handling, microwaves, low tempera-
tures 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, or 100; concurrent registration in the
120 series.

105. Laboratory Seminar I: Electronics—
(DR-8)
3 units, Aut (Phillips) 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—Mechan-
ics of systems of particles and rigid bodies.
Coordinate transformation and vectors; New-
tonian mechanics; linear and nonlinear oscilla-
tions; Hamilton’s principle, Lagrangian and
Hamiltonian dynamics; central forces, planary
motion; collisions; non-inertial reference
systems; rigid body dynamics; coupled oscilla-
tions; and introductory fluid mechanics. Pre-
requisites: 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, dielec-
trics. Special relativity and transformation be-
tween electric and magnetic fields. Maxwell’s
equations. Static magnetic fields, magnetic ma-
terials. Electromagnetic radiation, plane wave
problems (free space, conductors and dielectric
materials, boundaries). Dipole and quadrupole
radiation. Wave guides and cavities. Prerequi-
sites: 53 and prior or concurrent registration in
110; concurrent or prior registration in Mathe-
matics 130 and 131 with Physics 120 and 121,
respectively. Recommended: Concurrent or
prior registration in Mathematics 101.
120. 3 units, Aut (Mesziani) MWF 11
121. 3 units, Win (Mesziani) MWF 11
122. 3 units, Spr (Mesziani) MWF 11

130,131,132. Quantum Mechanics — The ori-
gins of quantum mechanics, wave mechanics
and the Schrödinger equation, Heisenberg’s
matrix formulation of quantum mechanics, solu-
tions 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 statis-
tics 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 (Martoff) TTh 1:15-2:30
131. 3 units, Win (Martoff) TTh 1:15-2:30
132. 3 units, Spr (Martoff) TTh 1:15-2:30

149. Technology and National Security—(Same as VTSS 149.) The technology of strategic nuclear armaments and their implications for the present and future security of the United States and its allies. Subjects: nuclear weapons and their effects, long-range delivery systems, their survivability and accuracy, and related topics—strategic reconnaissance, early warning systems. Questions analyzed: strategic stability, verification of compliance with arms control agreements, and the relation of strategic defense and nuclear deterrence. 3 units, Spr (Postal, Drell)

161. Intermediate Optics — Electromagnetic waves, superposition, interference, Fraunhofer and Fresnel diffraction, crystal optics, matrix optics, laser beams and resonators, guided waves, quantum aspects of light. Prerequisite: 122. 3 units, Aut (Schaclow) MWF 11

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

168. History and Philosophy of 20th Century Physics—(Enroll in History of Science 168, Philosophy 168, History 139A, VTSS 133.) 4 units, Win (Galison)

170,171. Thermodynamics, Kinetic Theory, and Statistical Mechanics—Derivation of laws of thermodynamics from basic postulates; determination of relationship between atomic substructure and macroscopic behavior of matter. Temperature, equations of state, heat, internal energy, entropy, reversibility, applications to various properties of matter, absolute zero and low-temperature phenomena. Distribution functions, transport phenomena, fluctuations, equilibrium between phases, phase changes, the partition function for classical and quantum systems, Bose-Einstein condensation and the electron gas. Cooperative phenomena including ferromagnetism, the Ising model and the lattice gas. Irreversible processes. Prerequisites: 55 or admission to Advanced Sequence, and Mathematics 130.

170. 3 units, Aut (Danzmann) MWF 9
171. 3 units, Win (Little) 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, ferromagnetism, magnetic resonance. Prerequisite: 171. 3 units, Spr (Kapitulnik) MWF 9

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.

200, 201. Advanced Physics Laboratory—Experiments in atomic physics, nuclear physics, solid state physics, low-temperature physics, optics, and particle physics. Students are urged to take 200 no later than Autumn Quarter and 201 no later than Winter Quarter of their senior year. Prerequisites: 105, 121, and 131.

200. 3 units, Aut, Win, Spr (Hanna) Sum (Staff) by arrangement
201. 3 units, Aut, Win, Spr (Hanna) Sum (Staff) by arrangement

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. Prerequisites: 132 or permission of the instructor. 3 units, Aut (Suskind) 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.

210. Advanced Mechanic and Gravitation—Lagrangian and Hamiltonian dynamics of particles (review) and continua; useful methods of mathematical physics; Tensor analysis; special
relativity (review), the energy-momentum tensor, and curvature. Einstein’s equations; weak fields, tests of general relativity, spherically-symmetric solutions. Prerequisites: 111 and 122.

3 units, Aut (Wagoner) MWF 9


3 units, Win (Wagoner) MWF 9

212. Continuum and Nonlinear Mechanics—Simple nonlinear mathematical models: phase-plane analysis, attractors, transition to chaos. 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, Riemann invariants and characteristics, convective instability, astrophysical applications. Prerequisites: 210 and 211.

3 units, Spr (Wagoner) MWF 9

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


230. 3 units, Aut (Laughlin) MWF 11
231. 3 units, Win (Laughlin) MWF 11
232. 3 units, Spr (Laughlin) MWF 11

240,241. Nuclear Physics—Strong, weak, and electromagnetic forces in nuclei; properties of nuclei; nuclear models, nuclear structure; nuclear reactions; constituents of nuclear matter. Prerequisites: 132 and 231, or equivalents.

240. 3 units, Aut (Hanna) not given 1987-88
241. 3 units, Win (Hanna) not given 1987-88


3 units,Spr (Bloom)

260. Research Activities at Stanford—Review of research activities in the Department of Physics at a level suitable for entering graduate students. Registration required by all entering students.

0-3 units, Aut (Meyerhof) TTh 12:15-1:05


271. 3 units, Aut (Harrison)
272. 3 units, Win (Harrison)


3 units, Spr (Beasley)

274. Electronic Structure—(Enroll in Applied Physics 271.)

3 units, Spr (Harrison) MWF 9

290. Literature of Physics—Intensive study of literature of any special topic. Chiefly prepara-
tion, 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

299. Teaching of Physics—Techniques of teaching physics by means of lectures and laboratories. All teaching assistants in Physics are required to register for this course.

0-3 units, Aut (Student)

315. Computational Physics—(Enroll in Applied Physics 315.)

3 units, Spr (Danzmann)


3 units, Aut (Chu) MWF 2:15


3 units, Spr (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.

not given 1987-88


300. 3 units, Aut (Peskin) MW 11-12:30

331. 3 units, Win (Peskin) MW 11-12:30

332. 3 units, Spr (Peskin) MW 11-12:30

336. Special Topics in Theoretical Physics: Particle Theory.

3 units, not given 1987-88


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

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 $p\bar{p}$ 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^2θ_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 (Lynn) MWF 9-10

354. 3 units, Aut (Wiedemann)
355. 3 units, Win (Wiedemann)

356. Topics in the Physics of Particle Accelerators—(Enroll in Applied Physics 356.)
3 units, Spr (Miller, Wilson)

357,358,359. Theoretical Physics of Particles and Fields—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 1987-88: Autumn—Chiral symmetry and effective Lagrangians. Winter—Superstrings. Spring—Lattice gauge theory. Prerequisite: 332.
357. 3 units, Aut (Nelson) TTh 1-2:30
358. 3 units, Win (Susskind) TTh 1-2:30
359. 3 units, Spr (Sharpe) TTh 1-2:30

368. 3 units, Win (Dimopoulos) TTh 11-12:30
369. 3 units, Spr (Dimopoulos) TTh 11-12:30

3 units, Spr (Fetter) TTh 1:15-3:05
alternate years, not given 1988-89


389. Research Orientation—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

390. Research—All work is in experimental or theoretical problems in research, as distinguished from independent study of non-research character listed as 190 and 290. Open only to graduate physics major students, with consent of instructor. If taken under supervision of a faculty member outside the department, Physics Graduate Study Committee approval is required.

any quarter (Staff) by arrangement

POLITICAL SCIENCE 551

Emeriti: (Professors) Gabriel A. Almond, Thomas S. Barclay, Heinz Eulau, Robert A. Horn, Nobutaka Ike, Hubert R. Marshall, Robert C. North, Kurt Steiner, Robert A. Walker, Robert Ward

Acting Chairman: Richard A. Brody


Associate Professors: Terry M. Moe, Daniel I. Okimoto (teaching overseas Autumn), Condoleezza Rice

Assistant Professors: Judith L. Goldstein, Saguiv A. Hadari, Nina P. Halpern, Terry L. Karl, Scott D. Sagan

Professor (Teaching): David J. Danelski

Courtesy Professors: Steven H. Chaffee, Lawrence Friedman, Roger Noll

Courtesy Associate Professor: Keith Krehbiel

Affiliated Professors: Michael W. Kirst, Robert L. Rabin

Affiliated Associate Professors: Joanne Martin, Joel Samoff

Affiliated Assistant Professor: Jonathan Bendor

Lecturers: Jennifer B. Ring, James P. Steyer

Acting Associate Professor: Coit D. Blacker

Visiting Professors: Isidoro Cheresky, Franklin Griffiths, Wolf-Dieter Narr, Hanspeter Neuhold

Visiting Associate Professors: Amy Bridges, Christen Jönsson
Visiting Assistant Professors: David Lake, David Lalman

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: 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.

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 bases.

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 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 (letter grade indicator 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.

(* 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.)
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). For details concerning these tests, see the 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 section "School of Education" 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 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.

2. The Ph.D. candidate is required to demon-
strate 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. Examinations will normally be 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 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. The faculty will review these proposals. A list of students, their proposals, and their thesis committees will be circulated to the faculty, and approved at a regular faculty meeting.

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 will begin TA normally after the sixth quarter and completed 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.

SUMMER SESSION

During the Summer Quarter, the Political Science Department offers a variety of courses and seminars. The specific offerings depend on the faculty available during the Summer Quarter.

COURSES

The department uses the following course numbering system:

1-99 Introductory Courses
100-199 Advanced Courses and Undergraduate Seminars (may be open to graduates)
200-299 Undergraduate-Graduate Seminars
300-400 Graduate Seminars

Course information is accurate when Courses and Degrees goes to press; however, students should be aware that there are sometimes changes and should check the Time Schedule each quarter for up-to-date information.

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)

10. American National Government—Introductory survey of the processes and institutions of American government and politics: voting and elections, parties, interest groups, Congress, the Presidency, the Supreme Court, the federal bureaucracy, and domestic and foreign policy making. (DR:5)
   5 units, Win (Manley)

20. Introduction to Comparative Politics—Introduces a number of approaches to the comparative study of political systems: structural-functionalist, cultural-historical, and Marxist. Examines several major political systems (the U.S.S.R., Britain, and France), with examples of the comparative analysis of selected political phenomena: political parties. (DR:5)
   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 Peru, China, and Nigeria. Recommended: Anthropology/History 21. (DR:5*)
   5 units, Spr (Abernethy, Van Slyke, Varese)

35. International Politics — 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, and the normative and policy implications of different theories. Enrollment limited to 450. (DR:5)
   5 units, Aut (Holloway)

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 undergraduate-graduate 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.

It should be noted that public administration courses numbered 206-210 are undergraduate-graduate seminars and are open equally to undergraduates and graduates. There are, however, prerequisites for some of these courses. Students interested in enrolling in them should check the course descriptions.

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—An overview of the domestic policy-making process. Prerequisite: 10.
   5 units, Spr (Brady)
5 units, Win (Moe)

107. Organizational Decision Making — (Same as Sociology 163.) Business decision making in complex organizations, universities, schools, hospitals, business firms, and public bureaucracies. Information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications.
5 units, Spr (March) given 1988-89

108. Organizational Leadership — (Same as Sociology 165.) 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, Aut (March)

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, Spr (Weiler) given 1988-89

111N. Introduction to a Political System: The Federal Republic of Germany — A case study of the political conflicts and challenges in advanced industrial democracies.
5 units, Win (Narr)

112C. Transition to Democracy in Latin America — The political, economic, and social forces in the change (or lack of it) from authoritarian to democratic regimes in Latin America focusing on Argentina, Brazil, and Chile.
5 units, Win (Cheresky)

113A. Politics and Development in Latin America — 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)

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.
5 units, Spr (Karl)

115. Government and Politics in China — The politics in the People's Republic of China, emphasizing the historical background of the communist revolution, political development after 1949, and the politics of post-Mao reforms. (DR:5*)
5 units, Win (Halpern)

116. Politics and Society in the Predominantly English-speaking Countries: Australia, Britain, Canada, United States — (Same as Sociology 147.) Comparative analysis of social and political institutions in the major English-speaking nations, Australia, Britain, Canada, and the United States. The four, coming out of similar cultural and political traditions, have diverse status patterns, party systems, union organization, 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, Aut (Lipset) given 1988-89

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, Aut (Schmitter)

116B. European Politics and Society (II) — Continuation of 116A. The "rebuilding" of bourgeois Europe and the rise of Fascism and National-Socialism following WW I, and national reconstruction and regional integration in the
aftermath of WWII. 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: 118A.

5 units, Win (Schmitter)

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 United States, the U.S.S.R., and countries of the developing world.

5 units, Win (Schmitter)


(DR:5*)

5 units, Aut (Samoff)

118J. 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, Win (Fagen)

119. The Soviet Union: Politics and Society Since 1917—(Same as History 123A.) 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, Spr (Dallin)

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, Spr (Weiler)


5 units, Win (Narr)

124. Seminar: Latin American Dependency—Basic concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency 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, Spr (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 is an introduction to international relations and thus provides a desirable background for more advanced work.

The courses in international relations offered by the Political Science Department can generally be divided into two groups: those dealing with global political, military, and economic problems; and those dealing with the foreign relations of specific nations or geographic regions. Students concentrating in international
relations are encouraged to select their courses from both these groups.

Students with interests in international relations are encouraged to refer to the “International Relations” section 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, Spr (Triska)

131N. Institutionized Multilateral Diplomacy—Procedural aspects and substantive issues of the Conference on Security and Cooperation in Europe and the Multilateral Balanced Force Reductions negotiations against the background of the ambiguities of East-West relations.

5 units, Win (Neuhold)

133. Peace Studies—(Same as Sociology 108.) 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, North, Ross)

TTh 2:15-4:05

133R. U.S. and Soviet National Security Policies: The Responsibilities of Empire in the Nuclear Age—The formulation and execution of national security policy in the United States and the U.S.S.R. Emphasis is on the creation and rapid growth of the national security apparatus after 1945 and the attempt to balance domestic concerns with expanding international responsibilities. Several cases of security policy formation and conduct provide an analytical basis for comparison of weapons procurement, nuclear arms control, and crisis management. Prerequisite: 138A.

5 units, Aut (Griffiths)

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, Aut (Griffiths)

138A,B,D. Arms Control and Disarmament—138A is a general survey of international security relations since 1945, the revolutionary development of nuclear weapons, the arms competition and efforts at arms control, and disarmament in post WW II. The political, technological, and conceptual problems of national security policies and arms controls. The analyses of strategic military doctrines and negotiations on strategic and regional military forces: including SALT, START, INF, and space-based weapons. Taught by an interdisciplinary faculty. 138A is a prerequisite to 138B. 138B is a seminar with limited enrollment, on the substantive and procedural aspects of arms control negotiations. Core faculty is assisted by guest speakers with negotiating experience. 138A and 138B are prerequisites for 138D. 138D is a research and tutorial course, supervised by members of the arms control faculty.

138A. Arms Control.

5 units, Win (Blacker)

138B. Seminar: Arms Control.

5 units, Spr (Blacker)

138D. Topics in Arms Control.

5 units, Aut (Lewis, Blacker) given 1988-89

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 instructor.

5 units, Spr (Halpern)

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, Win (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; three units additional credit for optional workshops treating selected issues in more depth. (Sequential registration not required.)

1-4 units, Aut, Win, Spr (Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor) lectures W 7:30-9:30 p.m. workshops by arrangement

142L. Seminar: Theories of International Conflict—A survey of some of the major approaches to the study of international conflict.
5 units, Spr (Lalman)

143H. Seminar: The Makers of Modern Strategy—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.
5 units, Aut (Sagan)

144W. Seminar: Conflict and Cooperation in International Relations—Recent developments in international relations theory relevant to issues of conflict and cooperation between states. Emphasis is on cooperative behavior in security issues; also theories from international political economy. Theories derived from structural realism, liberalism, game-theory, regime theory, and others. Applications to historical case-studies: international trade, arms control, U.S.-Soviet detente. Prerequisite: 35 or equivalent.
5 units, Aut (Sagan)

5 units, Spr (Sagan)

146. Seminar: Foreign Policy in the Third World—The economic, cultural, political, and military behavior of the Soviet Union and its allies in the Third World: Latin America, Africa, the Middle East and Asia. The ways in which the competition between East and West affects states and regions in the Third World and the constraints upon the Soviet behavior posed by, and Soviet opportunities in, states and regions in the Third World. Emphasis on contemporary Soviet foreign policy.
5 units, Win (Triska)

149. Directed Reading/Research in International Relations—Advanced individual study in international relations.
any quarter (Staff) by arrangement

POLITICAL THEORY

152H. Reading Political Theory—Close readings of key texts in political theory, from Plato to Arendt, as an introduction to the art of interpretation and the tradition, its continuity and diversity.
5 units, Aut (Hadari)

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, Spr (Drekmeier)

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, Aut (Drekmeier)

156H. Equality and Liberty—The interaction of these two crucial political values through conceptual analysis and the comparative study of Tocqueville’s and Marx's reflections on the subject.
5 units, Win (Hadari)

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)

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 part 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, Aut (Ring)

169. Directed Reading/Research in Political Theory—Advanced individual study in political theory.
any quarter (Staff) by arrangement

AMERICAN POLITICS

175. Politics and Public Policy—National public policy-making from the New Deal to the present. Competing theories about the rise and development of liberal democratic capitalism are assessed within the context of domestic policy-making by Congress and the Presidency. The role of the national government in the modern American political economy through the examination of selected public policies dealing with employment, economic development, social welfare, and equality. Prerequisite: 10. (DR. 5)
5 units, Spr (Manley)

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.
5 units, Spr (Manley)

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 American Studies 176, 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 25. Students must register for both quarters.
2 units, Win plus 3 units, Spr (Barton, Foster-Simons) MWTh 2:15

185V. City Politics—City politics in the United States: the dominant issues of the last several decades, selected current policy debates.
5 units, Win (Bridges)

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) given 1988-89

192. Seminar: Political Psychology—An introduction to the principal topics in political psychology: consistency theory, preference estimation, personality, and categorization.
5 units, Aut (Sniderman)

192V. Seminar: The Women's Movement—Contemporary feminist arguments about the status of women in society; women in politics.
5 units, Spr (Bridges)

193. Seminar: Civil Rights and the Constitution—Substance, procedure, and political consequences of civil rights law in the United States. 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, Spr (Manley)

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 at registration times. These sheets should be checked for indications of class size and other specific enrollment information.

GENERAL

201A,B. Seminar: Economy of Political Institutions—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 (Krehbiel, Baron)
201B. 5 units, Spr (Krehbiel, Baron)

203A,B. Political Data Analysis I and II—203A: an introduction to fundamentals of research design, measurement, computing, and parametric and non-parametric statistics. Lectures, discussions of examples in political science literature, and computer assisted analyses of political data sets. 203B: special problems encountered in quantitative analyses of political data and methods for alleviating those problems. Lectures, computational assignments, and critiques of major political research.

203A. 5 units, Win (Moe)
203B. 5 units, Spr (Moe)

204. Seminar: Introduction to Positive Political Theory—Concepts and analytical techniques from the theory of games, decision theory, and social choice theory, and their use in modeling political institutions. Open to graduate students in the social sciences and to juniors and seniors with consent of instructor. 5 units, Aut (Ferejohn)

PUBLIC ADMINISTRATION

209. Directed Reading in Public Administration.

any quarter (Staff) by arrangement

COMPARATIVE POLITICS

215. Japanese Political Economy—(Same as Anthropology 222.) 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.

5 units, Win (Okimoto, Rohlen)

220P. Workshop on 'The State'—Critical discussion on recent theories of the state, bringing them to bear on more discrete and tangible topics such as class relations, social-political coalitions, growth of public expenditure, neo-corporatism, and welfare politics.

5 units, Win (Schmitter)

221. Education and Political Change—(Same as Education 306B.) Introduction to the analysis of the relations between education and politics from a comparative perspective. Attention to: 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.

5 units, Win (Samoff) TTh 2:15-4:05 and by arrangement

221N. Seminar: The Theoretical Use and Misuse of Max Weber—An Introduction to Political Sociology.

5 units, Spr (Narr)

221S. Education and Radical Change: African Experiences—(Same as Education 395.) Education and radical change: schools as the targets of protest; education as a core element in development strategy. The education system in South Africa, the efforts of South African students, and the educational system as a mechanism for organizing broader changes. Also, efforts of educators in those African states that achieved majority rule.

5 units, Spr (Samoff) alternate years, not given 1988-89

222. Decolonization in Asia and Africa, 1940-80—A comparison of the dynamics of decolon-
ization and "new state" formation. Factors affecting the timing, speed, nature, and extent of violence in the decolonization process, and the character of the regime ruling the new state. Case studies: India/Pakistan, Indonesia, Indochina, Ghana, Algeria, Zimbabwe, Angola, and Zimbabwe.

5 units, Spr (Abernethy)

226. Political Order in Changing Societies—(Same as Sociology 247.) The conditions which appear related to the emergence and institutionalization of democracy and the factors making for instability and breakdown. After examining the analytical and theoretical literature, the seminar looks at a number of case studies in Europe, America, and the Third World.

5 units, Spr (Lipset, Diamond) given 1988-89

228A. Seminar: The U.S. and the U.S.S.R. as Regional Powers—Research on the progressive alienation between restive, frustrated social forces and obsolete political structures in Eastern Europe and in Latin America. The dilemma of the two regional powers and how to deal with social change without harming their regional interests.

5 units, Win (Triska)

229. Directed Reading in Comparative Politics.

any quarter (Staff) by arrangement

INTERNATIONAL RELATIONS

236A,B. Graduate Research Seminar: Soviet Defense Policy and Military Affairs—The development and current status of the Soviet armed forces. The external and internal factors that have shaped Soviet military power and conditioned its use in support of policy. Theoretical approaches to understanding Soviet policy. The second quarter offers the opportunity to write a research paper. Prerequisite: Consent of instructor.

5 units, Win, Spr (Holloway)

237J. Seminar: The Superpowers.

5 units, Win (Jönsson)

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, Aut (Lake)


5 units, Aut (Griffiths)

242N. Seminar: Neutrality and Non-Alignment—A comparison of the status and foreign policy of the neutral states of Europe (Switzerland, Austria, Sweden, Finland) and some "borderline neutrals": (Ireland, Malta, Costa Rica); similarities and differences between these states and the members of the Non-Aligned Movement.

5 units, Spr (Neuhold)

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, Win (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)

248. Seminar on International Cooperation in Educational Development—(Same as Education 207X.) 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.

5 units, Spr (Wieder) alternate years, given 1988-89

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, Win (Drekmeier)

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, Aut (Drekmeier)

262H. Seminar: Theories of Justice—A critical, comparative survey of outstanding analyti-
ical and communitarian theories of justice (Rawls, Nozick, Dworkin, Cohen; Sandel, Walzer, MacIntyre, Lyotard).

5 units, Spr (Hadari)


5 units, Win (Hadari)

267. Seminar on Equity and Social Choice Theory—(Same as Philosophy 255.) Recent work in the theory of social choice and related literatures in economics, philosophy and political science that bear on equitable allocation and on rights.

3 units, Win (Hammond, Ferejohn, Suppes) M 3:15-5:05

269. Directed Reading in Political Theory. any quarter (Staff) by arrangement

AMERICAN POLITICS

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)

298. Directed Reading in American Politics. any quarter (Staff) by arrangement

GRADUATE SEMINARS

Seminars numbered 300 and above are limited to graduate students. Instructors should be consulted before enrolling.

300. Thesis. any quarter (Staff) by arrangement

301. Seminar: Case Studies and Theory Development—The use of single and comparative case studies as a research strategy for the development of theory. In addition to reading and discussing general descriptions of the research strategy that appears in literature, a number of studies that have employed some variant of this approach in an effort to identify the requirements for making successful use of this research strategy are examined. Students have the opportunity to develop research designs in substantive problems of interest to themselves, employing "controlled comparison" and the method of "structured, focused comparison."

5 units, Win (George)

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)

307. Organizational Analysis—(Same as Business 470, Sociology 367.) 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, Win (Martin)

311. Seminar: Classics in Comparative Political Analysis—Primarily for political science graduates who have chosen a field specialization in comparative politics. Reviews, through short essays and critical discussions, books that have contributed to our understanding of the similarities and differences between politics, Plato and Aristotle, and including Montesquieu, Marx, Barrington Moore, and Robert Dahl. Works selected vary each year, mostly from a standard "classics" compiled by the comparative politics staff.

5 units, Aut (Karl, Schmitter)

313. Seminar: Development and the International System—Participants address key issues raised by external constraints and influences on development in the Third World. Emphasis is on the interaction between national and international factors.

5 units, Spr (Fagen)

322. The Institutions of Violence—Seminar on societal and political instruments of violence including revolutionary change, the role of the military, and para-military organizations (police).

5 units, Spr (Rice)

323. Seminar: Latin American Politics and Development in Comparative Perspective—Analysis of major theoretical approaches to the study of Latin American politics and development, modernization, dependency, bureaucratic-authoritarian, corporatist, "new pluralism" perspectives; relevant empirical studies about Latin America; comparative theoretical and empirical perspectives on Latin America.

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)

327A,B. Seminar: Introduction to Graduate Research on Soviet Politics and Society.

327A. 3 units, Win (Dallin, Staff)
327B. 3 units, Spr (Dallin, Staff)

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

332. Research on Decision Making and Strategic Interaction in International Relations.

5 units, Spr (George, Sagan)
by arrangement

333A,B,C. Graduate Research on International Conflict and Cooperation.

5 units, Aut, Win, Spr (George)


5 units, Aut (Sniderman)

INSTITUTE OF POPULATION AND RESOURCE STUDIES

Faculty: Marcus W. Feldman, Director (Biology), W. Brian Arthur (Food Research), Kingsley Davis (Hoover), 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 of 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 specialities.

For the convenience of students interested in population studies, offerings at Stanford are listed below.

COURSES

ANTHROPOLOGY


5 units, Win (Yanagisako) not given 1987-88

164. Ecological Anthropology—(Same as Human Biology 134.)

3 or 5 units, Aut (Durham) not given 1987-88

168. Medical Anthropology.

5 units, Aut (Barnett)

250. Nutritional Problems of Developing Nations—(Same as Food Research 250, Human Biology 110.)

3 units, Win (Martorell)

260. Topics in Urban Anthropology.

5 units (Yanagisako) not given 1987-88

275. Demographic Anthropology.

5 units, Spr (Skinner) not given 1987-88

BIOLOGICAL SCIENCES

175. Biology of Natural Populations.

4 units, Spr (Mooney) given 1988-89

183. Colloquium on Population Studies—(Same as Food Research 188/288, Human Biology 60.)

1 unit, Win (Arthur, Feldman, John)


3-5 units, Spr (Ehrlich)

283. Theoretical Population Genetics.

3 units, Aut (Feldman) given 1988-89

286H. Theoretical Ecology.

6 units, Sum (Roughgarden) given 1988-89


1-3 units, Aut, Win, Spr (Ehrlich, Holm)


1-3 units, Aut, Win, Spr (Ehrlich, Feldman, Holm, Mooney, Roughgarden, Thomas, Vitousek, Watt)


1-3 units, Aut, Win, Spr (Feldman)


1-3 units, Aut, Win, Spr (Roughgarden)
**ECONOMICS**

5 units, Win (Yotopoulos)

133. Population Perspectives in the Third World—(Same as Food Research 136/236, Human Biology 136, Sociology 153.)
5 units, Win (Wilson)

249. Economic Demography.
5 units, Spr (Arthur)

**FOOD RESEARCH INSTITUTE**

5 units, Win (Yotopoulos)

137/237. Human Populations: Birth, Death, and Disease—(Same as Human Biology 137.)
5 units, Aut (John)

138/238. Introduction to Epidemiology—(Same as Biology 138, Human Biology 186.)
5 units, Aut (John)

286. Demographic Methods.
5 units, Aut (John)

287. Economic Demography.
5 units, Aut (John)

386. Seminar: Demography.
3 units, Aut (Arthur, John)

**GENETICS**

205. Human Population Genetics and Genetic Epidemiology.
3 units, Aut (Cavalli-Sforza) not given 1987-88

**HUMAN BIOLOGY**

120. Human Nutrition.
4 units, Aut (Martorell, Bray)

148. Environmental Policy.
3 units, Spr (Ehrlich, Anne)

150A. Biosocial Aspects of Birth Control—(Same as Chemistry 137A.)
6 units, Win (Djerassi)

**MATHEMATICS**

126. Introduction to Mathematical Models in Population Studies—(Same as 226, Biology 179.)
3 units (Feldman, Karlin) given 1988-89

**PSYCHOLOGY**

Emeriti: (Professors) Edith M. Dowley, Ernest R. Hilgard, Douglas H. Lawrence, Eleanor E. Maccoby, Robert B. Sears

Chairman: Herbert H. Clark


Associate Professors: Ellen Markman, Barbara Tversky, Brian A. Wandell

Assistant Professors: Laura L. Carstensen, Anne Fernald, Susan K. Nolen-Hoeksema, Michael Pavel, George A. Quattrone, Paul Rosenbloom, Daniel A. Weinberger


Lecturers: Lyn Carlsmith, Carol L. Young-Holt

Visiting Professors: Rogers Elliott, Russell Fernald

The Department of Psychology comprises facilities and personnel housed in Jordan Hall, where it maintains extensive laboratory and shop facilities. Several of the laboratories are equipped with computers and others are linked directly to the University’s Computer Center. The 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; and including the possibilities of obtaining departmental 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 will participate in a weekly seminar concerned with general methods and issues in psychological research. At the same time, students will plan their research under the supervision of an appropriate faculty member. During Winter and Spring Quarters, students will be primarily involved in completing the research and writing the dissertation. Students will 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 only to students who are concurrently enrolled in another doctoral or professional program at Stanford. This is a two-year program requiring at least 27 units in psychology beyond the equivalent of an undergraduate major, as well as sufficient additional units to make up a program totaling 45 or more units. In partial fulfillment of this unit requirement, Psychology 252 must be selected as well as two other courses from the content areas, one to be selected from 209, 210, 214, and 215, and one to be selected from 211, 212, 213, and 254. The balance of the 45 units may be satisfied by a master’s thesis if both the student and advisor feel that is appropriate. For basic University requirements for the A.M. and Ph.D. see the “Degrees” section of this bulletin.

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 205 (Cognition), 207 (Pro-seminar for First-Year Graduate Students), 252 (Analysis of Data), and 253 (Statistical Theories, Models and Methodology). In addition, the student must take at least one core course selected from Group H and one core course selected from Group S (listed below).

GROUP H
205. Cognition
206. Physiological Psychology
209. Perception
210. Cognitive Psychology
214. Psycholinguistics
215. Mathematical Psychology
218. Mathematical Representation of Structures in Psychological Data

GROUP S
211. Advanced Developmental Psychology
212. Social Psychology
213. Personality
216. Abnormal Psychology
254. Personality Change

It is expected that the student will spend at least one-half of the time in research from the beginning of the first year of graduate study to the completion of the Ph.D. The student will normally take no more than nine units of course work each quarter. At the end of the first year of graduate study, the student must file with the department a written report of his or her first-year research activities.

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 H and at least two from Group S. The student may meet these requirements either by taking the courses listed above, or by special examination. Further course work
prior to admission to doctoral candidacy should be arranged under the guidance of the student's advisor.

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 central issues within the specialty area, and review the pertinent literature(s). Typically, the analysis would have the kind of scope found in the opening chapters of the more traditional dissertations, although the exact format and scope of the paper would be a joint decision made by the student and the advisor.

At this same time, the student would select two faculty members to read the paper and give feedback and commentary on it. These should be two faculty members most likely to serve on the later Orals Committee of the dissertation.

A portion of the paper, revised as appropriate, could then become the first section of the actual dissertation proposal. Thus the student will receive additional feedback on CADA at the oral examination itself.

If the student should radically change the area of the dissertation research after CADA has been written, the procedure will not have to be repeated for the second dissertation topic. It is still expected, of course, that the student will be knowledgeable about the literature and problems of any research topics being pursued for the dissertation; it is only the formal CADA procedure which need not be repeated.

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 1st.

If the student fulfills the academic promise displayed upon entrance, he or she is invited to continue to the doctorate.

The first-year evaluation is made primarily on the basis of three factors:
1. The quality of research carried out in the first year.
2. Performance in courses (especially required courses).
3. Recommendations of the advisor (including a commitment on the part of that advisor to continue in that role.)

Second-year evaluation—A similar evaluation is conducted at the end of the second year of graduate training. The same criteria are involved in the second year as the first year; however, the student is not required to file a paper with the department. Students who do not make satisfactory progress during the second year may be dropped from the program.

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 nine units of course work per quarter.

FELLOWSHIPS, SCHOLARSHIPS, AND ASSISTANTSHIPS

Research and teaching assistantships, United States Public Health Service traineeships, and some University Fellowships are available. The type of support offered may vary from year to year. The department, of course, depends on the fact that a number of its students receive outside awards. Qualified applicants are asked to take the initiative in applying for predoctoral fellowships from the National Science Foundation, the Danforth Foundation, Ford Foundation, and the United States Public Health Service among others. Applications may be made by college seniors planning to work for a higher degree. Students should apply early in the fall of their senior year. For information concerning application forms and procedures, consult representatives from the financial awards office of your home institution.

TEACHING REQUIREMENT

The department views experience in supervised teaching as an integral part of its graduate program. Regardless of the source of financial support, all students are expected to participate in four quarters of teaching. Students will be discouraged from holding teaching assistantships during their first year. The student typically progresses from closely supervised teaching to more and more independent work. Typically, this might involve giving a section in statistics or a lab course in the student's special area initially, then serving as a teaching assistant in introductory psychology, next co-teaching a small advanced course, and finally giving a supervised but essentially independent seminar.

Ph.D. MINOR

Candidates for the degree of Doctor of Philosophy in other departments who elect a minor in psychology will be expected to complete at least the equivalent of an A.B. in Psychology, of which at least 15 units must be taken as a graduate student at Stanford. Of these 15 units in the department, at least two courses must be from those numbered 200 or above. These two courses may be cross-listed courses. The program to be followed will be adapted to the needs of each candidate and will be under the direction of the department's committee on minors.

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 in-
tended 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, 1988.

**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 include cognition and cognitive development, personality development, motivation, emotional adjustment and psychopathology, social behavior, learning, perception, and the physiological basis of behavior. Winter Quarter is recommended for Psychology majors, Spring Quarter for non-majors. (DR:4)

   4 units, Aut (Markman) MWF 11
   Win (Staff) MWF 10
   Spr (Zimbardo) TTh 1:15-2:30

1A. **General Psychology Discussion Section**

   Optional supplement to Psychology 1. Small discussion groups led by graduate teaching assistants. Prerequisite: Concurrent enrollment in 1.

   1 unit, Aut, Win, 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 (Thomas) 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 (Wandell) 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 both physiology and performance. Prerequisites: 102 or equivalent, calculus. (DR:7)

   3 units, Win (R. Fernald, Wandell) TTh 3:15-4:45

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 content of image data (assembly line part inspection, object recognition). Prerequisites: 102 or equivalent, calculus.

   3 units, Spr (Wandell) alternate years, given 1988-89

104. **Special Laboratory Projects**—Independent study. Offered for pass/no credit. Can be repeated for credit. Prerequisites: 102 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.

   4 units, Win (B. Tversky) MW 1:15-3:05

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

108. **Basic Neuropsychology**—An orientation in those facts of brain anatomy and physiology relevant to the analysis of behavioral processes.
Transport and Intracellular Messengers—

Attention and deposition-into-memory of those which produce our perception of color, brightness, movement, and shape, and the selective attention and deposition-into-memory of those events. Prerequisite: 1 or equivalent.

4 units, Spr (Ganz) TTh 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 also available if taken for 5 units. Prerequisite: 1 or equivalent. (DR:4)

3-5 units, Aut (Flavell) MWF 11

114. Introduction to the Nervous System: Ion Transport and Intracellular Messengers—(Graduate students register for 228.) Ion channels, carriers, and ion pumps, and their regulation by intracellular messengers in a variety of cell types. Laboratory demonstrations and brief hands-on introductions to some techniques (e.g. patch clamping). Limited enrollment. 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.

3 units, Aut (Carstensen) TTh 10-11:15

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 (Young-Holt, Staff) TTh 4-5:30 and by arrangement

118. Developmental Practicum—Supervised experience with young children at Bing School, Stanford’s Child Development Laboratory School. Four units involves 7 hours per week in Bing classrooms throughout the quarter; five 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 of 118. Prerequisite: 111 or 117 or consent of instructor.

4-5 units, Aut, Win, Spr (Young-Holt, 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 11

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.

3-4 units, Spr (Quattrone) MW 1:15-2:45

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. are examined. Fairy tales are discussed from several viewpoints including the psychoanalytic represented by Bruno Bettelheim. Prerequisite: 1 or 117.

3 units, Win (B. Shepard) TTh 1:15-3:05

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, Win (Elliott) MWF 11

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 American's 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, sensory and perceptual development, cognitive development in infancy, parent-infant interaction, infant social cognition, the development of affect, and preverbal communication.

3 units, Aut (Fernald) TTh 1:15-2:30

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 mini-experiments, with infants and preschoolers, at the Center for Infant Studies in the Department of Psychology and at the Bing School and design an independent research study as a final project. Limited enrollment. Prerequisites: 111 or 120 or 130, and consent of instructors.

4 units, Win (Fernald, Flavell, Markman) TTh 11-12:30

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, Win (Weinberger) MWF 10

134. The Affective Disorders—(Graduate students register for 234.) Reviews current evidence on the experience of depression and mania in adults and children, including gender differences, socioeconomic class differences, and culture differences in depression. Evaluates 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 11-12:15

135. Seminar in Cross-Cultural Counseling—(See 235.)

136. Abnormal Psychology—Genetic, psychodynamic, behavioral, and social psychological aspect of positive and negative abnormalities. Approaches to behavior change, including drugs, institutionalization, psychotherapy, and behavior modification. Prerequisites: 1 or equivalent.

4 units, Aut (Nolen-Hoeksema) TTh 11-12:15

136A. 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 1988-89

138. Carl Jung and Analytical Psychology—An introduction to C.G. Jung, focusing upon 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

145. Psychological Foundations of Education—(Same as Education 215.) Introductory application of psychological principles to educational practices.

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

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, Win (R. Fernald) TTh 1:15-2:30

150. Neuroethology—Neuroethology is an emergent discipline in which methodologies from the study of the nervous system and brain are applied to scientific questions derived from careful ethological observations of animals in their natural habitats. Prerequisite: 4 units of elementary biology.

3 units, Win (R. Fernald) W 1:15-3:30

152. Statistical Analysis of Data—(Graduate students register for 252.) (Same as Education 250A.) Analysis of variance and covariance; co
153. Statistical Theory, Models, and Methodology—(Graduate students register for 253.) 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

155. Human Abilities—(Same as Education 255.) The nature, development, and measurement of intellectual abilities. Prerequisites: 1 and Statistics 60 or Psychology 60, or equivalent.
3 units, Win (Finn) MWF 11-12:30

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: Statistics or Elementary Probability Theory.
3 units, Aut (A. Tversky) TTh 11-12:15

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 videotape 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—Overview of 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. Prerequisites: 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.) After initial conferences, instructions and introductions, there will be exercises in role-playing with critique and evaluation of their impact. Each student undertakes a personal project on some aspect of behavior modification of goal achievement using role-playing as an aid. Class open to Psychology and Drama majors. Limited enrollment. Prerequisite: Consent of instructors.
4 units, Win (Zimbardo, Ryan) given 1988-89

175. Applications of Social Psychology—(Formerly Psychology 80.) 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 1-2:30

176. The Person and the Situation—(See 276.)

177. Social Psychology of Physical Deviance and Disability—(Same as Human Biology 177.) The issues and problems faced by the handicapped with a three-pronged approach. The biological basis of various handicaps with the psychosocial problems and stigmas associated with them. Also, the legal and political issues concerning the handicapped.
4 units, Win (Hastorf) TTh 11-12:15,

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) Th 3:15-5

180B. Undergraduate Seminar: Cognition and Control—Prerequisite: Consent of instructor.
3 units, Aut (Rosenhan) Th 2:15-4:45

180C. Psychology of Women and Violence—(Same as Feminist Studies 133.) Current psychological studies of rape, spouse battering, child sexual abuse, sexual harassment, and pornography. Discussion of relevant psychological theories and modes of therapy for survivors and perpetrators. Open to all. Recommended: 1 or equivalent.
3 units, Aut (Hodell) Th 2:15-5:05

182. Senior Honors Seminar—Limited to students in the Senior Honors program. Autumn Quarter: students participate in a weekly seminar 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 (L. 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 experience of the individual affected and his her family. Also, the roles of the doctor, therapist, the special ed. 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.) 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 (L. Carlsmith) Th 7:30-9:30 p.m. and by arrangement
186. Undergraduate Seminar: The Social Psychology of Women Without Men—(Same as Feminist Studies 186.) (Graduate students register for 238.) The psychological and physical health of women who live without men focusing on widows, lesbians, and religious orders of women. Their social interaction, attitudes, and behavior organization. Prerequisite: 116.
3 units, Win (Carstensen) TTh 10-11:15

187. Computational Models of Cognition—Computational models of information processing covering relevant current research in Artificial Intelligence and Cognitive Psychology. Computer simulations test psychological theories. Applications of psychological research to building Artificial Intelligence 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, Win (Pavel) by arrangement

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 (Levine) alternate years, given 1988-89

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. Covers animal and human research and deals with behavioral and physiological function. Prerequisite: Consent of instructor.
3 units, Win (Levine) TTh 4:15-5:05 alternate years, not given 1988-89

191. Undergraduate Seminar: Behavior Change — The social learning approaches to personal and social change. Prerequisite: Consent of instructor.
3 units (Bandura) given 1988-89

192. Undergraduate Seminar: Aggression—The causes and modifications of individual and collective aggression. Prerequisite: Consent of instructor.
3 units, Spr (Bandura) M 2:15-4:05

194. Undergraduate Seminar: Development of Children's Knowledge About the Mind—Prerequisite: Consent of instructor.
3 units (Flavell) alternate years, given 1988-89

195. Undergraduate Seminar: History of Psychology—The development of psychological theory from a historical perspective. Major systematic positions: Gestalt theory, behaviorism, and psychoanalysis. Prerequisite: Consent of instructor. Recommended: 3 courses in psychology.
3 units, Aut (Hastorf) W 1:15-3:45

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 1:15-3:45

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: 2 and consent of instructor.
3 units, Win (Ganz) TTh 10-11:15

198. Undergraduate Seminar: Social Perception—For advanced, research-oriented, undergraduates. How do people integrate the information from a person's behavior, its situational context, and the person's group-membership to form impressions of personality? Not a survey course; attention to theoretical developments and research programs on the cutting edge of the field. Prerequisite: Consent of the instructor.
3 units, Win (Quattrone) W 1:15-3:45

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 popula-
tions. A practical goal is to design effective resistance strategies.

3-4 units (Zimbardo) 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

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—Advanced treatment of visual perception. Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Aut (Ganz) TTh 1:15-2:30

210. Human Memory and Learning—A survey of major topics in human memory emphasizing information-processing approaches: pattern recognition, short-term memory, the organization of long-term memory, imagery, forgetting, retrieval processes, prose memory, emotional memory, autobiographical memory, and skills. Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Win (Bower) TTh 1:15-2:45

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 11-12:30

214. Psycholinguistics—(Same as Linguistics 246.) Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) TTh 1:15-2:30

215. Mathematical Models of Psychological Processes—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, Win (Pavel, A. Toersky, Wandell) TTh 11-12:30, alternate years, not given 1988-89

216. Abnormal Psychology—Selected literature in abnormal psychology approached from a cognitive and interpersonal perspective. Attempts to integrate psychoanalytic, cognitive, and behavioral views of the nature, origin, and treatment of abnormal behavior. Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Win (Horowitz) WF 11-12:30

218. Mathematical Representation of Structures in Psychological Data—(Undergraduate 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) Th 3:15-5:05

219. Graduate Seminar on Selected Topics in Cognition—(Undergraduates register for 165.) Prerequisite: Consent of instructor.

3 units, Spr (B. Tversky) Th 3:15-5:05

223. Cognitive Architecture—(Same as Computer Science 325.) The issues involved in designing a cognitive architecture. Topics: the role of the architecture in the construction of general artificially-intelligent system, the role of the architecture as a large-scale psychological model, existing (and proposed) cognitive architectures, and the evaluation of architecture.

Prerequisites: Advanced undergraduate standing and either 106, 166, Computer Science 122, or equivalent experience.

3 units (Rosenblum) alternate years, given 1988-89

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 ima...
225. Psychology and Law Proseminar—(Same as Law 345.) A survey of 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 (Rosenhan) not given 1987-88

228. 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

230. Sex Roles and Socialization—The effects of traditional sex roles on the behaviors, attitudes, opportunities, and health of males and females; several theories of the origins and acquisition of social norms for behavior, especially sex roles; and the apparent changes currently taking place in sex roles and in socialization.
3 units (Nolen-Hoeksema) not given 1987-88

4 units (Thoresen) MW 9-11

234. The Affective Disorders—(See 134.)

235. Seminar in Cross-Cultural Counseling—(Same as Education 233; undergraduates register for 135.) How the New World experience has affected the adaptive strategies, acculturation patterns, family structure, predominant stresses, 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 models, alternatives to individual counseling interviews, and the process of culturally adapting counseling interventions. Major emphasis on multicultural and clinical competence with diverse ethnic minority groups. Mixed lecture-discussion format, with alternating Wednesdays from 1:15-3:05 set aside for discussions and simulations.
3 units, Spr (LaFromboise) M 1:15-3:15

236. Graduate Seminar on the Development of Children's Knowledge About the Mind—Prerequisite: Graduate standing in psychology or consent of instructor.
3 units (Flavell) alternate years, given 1988-89

237. 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, Win (Krumoltz, La Fromboise) M 3:15-5:05, alternate years, not given 1988-89

238. The Social Psychology of Women without Men—(See 186.)

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, Win (Flavell) M 3:15-5:05

240. Language Acquisition I—(Same as Linguistics 240.) Review of present knowledge of processes of language acquisition from a linguistic point of view, and recent and past literature. Prerequisite: Linguistics 10 or 230, or consent of instructor.
4 units, Aut (E. Clark) MW 2:15-3:30

241. Language Acquisition II: Theories of Meaning Acquisition—(Same as Linguistics 241.) Examines proposals about and constraints on meaning acquisition.
4 units, Spr (E. Clark) by arrangement

242. Conceptual Organization and Development—Theories and research in conceptual organization and development critically evaluated. The acquisition of categories and of 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 (Markman) alternate years, given 1988-89
243. General Developmental Seminar — Pre-requisite: 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, Spr (Carstensen) W 10-12:30

245. Approaches to Intonation — (Same as Linguistics 218.) Linguistic and psycholinguistic approaches to the study of intonation. Topics: acoustic analysis of prosodic features; cross-language comparison of intonation systems; syntactic, semantic, and discourse functions of intonation; prosody and speech processing; intonation and the expression of affect.
1-4 units, Spr (Fernald, Leben) by arrangement

246. Graduate Seminar: The Development of Communication — An ethological approach to the study of early language development, concerned with the phylogeny and ontogeny of human communication. Topics: the evolution of social behavior and language, primate communication systems, the development of pragmatics in infancy, and the progression from preverbal to verbal communication.
3 units (Fernald) not given 1987-88

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, Spr (Haertel) MW 3:15-5:05

249. Problems in Measurement — (Same as Education 353.) Survey of alternative mathematical models used in test construction, analysis, and equating. Emphasizing applications of item response theory (latent trait theory) to measurement problems including estimation of item parameters and person abilities, test construction and scoring, tailored testing, mastery testing, vertical and horizontal test equating, and detection of item bias. Prerequisites: 152 and 248, or Education 250B and 252, or equivalent. (PSE)
3 units, Aut (Haertel) MW 10-11:30

250. Individual Counseling Methods — (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 alternate years, given 1988-89

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. Prerequisites: Statistics 160 or Psychology 60; consent of instructor.
4 units, Win (Finn) 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 — Pre-requisite: Graduate standing.
3 units (Bandura) given 1988-89

255. Graduate Seminar: Selected Topics in Personality and Abnormal Psychology — Pre-requisite: 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 Con- strual 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)
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 and consent of instructor. 3 units, Spr (Bower) Th 10-12

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 recent work in the application of brain-style computational models to psychological phenomena and to applications in artificial intelligence. 3 units, Aut (Rumelhart) TTh 9-10:15

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) by arrangement

272. Special Topics in Psycholinguistics—May be repeated for credit. Prerequisite: Consent of instructor. 3 units, Win (H. Clark) by arrangement

275. Graduate Research—Research of intermediate nature, whether or not to be used toward master's thesis, 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) T 3:15-5:05

280. Doctoral Research—For dissertation. Prerequisite: Consent of instructor. (Staff) by arrangement

282. Research Seminar on the Representation of Similarity Relations—Reviews and contrasts two conceptions of similarity: the dimensional geometric model and the feature-matching model and their implications to psychological theory and to the representation of proximity data. 1-3 units (A. Tversky) alternate years, given 1988-89

283. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 386, Business 694, Operations Research 366.) The analysis of decision making from both normative and descriptive perspectives, particularly in the face of uncertainty. 1-2 units, Win (Arrow, A. Tversky, Wilson) by arrangement

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, (Pavel) alternate years, given 1988-89

289A. 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. See listing in Time Schedule. Prerequisite: Consent of the instructor. 1-3 units, Spr (Pavel) by arrangement

292. The Soar Cognitive Architecture—(Same as Computer Science 429.) In depth examination of the foundational concepts, structure, applications, and use of the Soar architecture. Topics: cognitive architecture, problem solving, learning, knowledge representation, expert systems, psychological modeling, and implementation techniques. This is both a concepts (reading) and practice (programming) course. Prerequisite: Computer Science 123, or equivalent. 3 units, Spr (Rosenbloom) TTh 1:15-2:30

305. Research Seminar in Cognitive and Mathematical Psychology—Can be repeated for credit. Prerequisite: Consent of instructor. 1 unit, Aut, Win, Spr (Staff) F 3:15-4:30

307. Research Seminar in Integrative and Cellular Neurobiology—Current research in neurobiology. 1-3 units, Spr (Wine) F 1:15-3:05

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

309. Research Seminar in Social Perception—Covers the material in 193 at an advanced
level. Prerequisites: Graduate standing and consent of the instructor.

2 units, Aut (Quattrone) W 1:15

315. Proseminar in Social Psychology—Enrollment limited to graduate students in Social Psychology Training Program. 1-3 units (Zimbardo) not given 1987-88

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. Attempts to apply existing knowledge about child development to the resolution of policy issues in each of these areas and to design 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, Maccoby) T 4-6

355. Jury Decision Making—The institution of the jury from a variety of perspectives. The social and historical forces, and important legal decisions shaped the jury into its current form. The psychological aspects of the jury decision making process. The importance of individual differences among jurors, the process of jury behavior, and the general competence of juries. 3 units, Aut (Rosenhan) T 2:15-5

PUBLIC POLICY PROGRAM

Director: Roger Noll
Associate Director: John Ferejohn
Affiliated Faculty: David Brady (Political Science), Timothy Bresnahan (Economics), Bruce Bueno de Mesquita (Hoover), 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), Geoffrey Rothwell (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.
The 25-unit sequence of five-unit core courses, which students should plan to complete by the end of their junior year (see below for descriptions).

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.

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.

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—(Enroll in Political Science 101P.) The domestic policymaking 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—(Enroll in 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, both 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 110.) A critical analysis of philosophical and ethical issues in science- and technology-related public policy conflicts. Beyond sensitization to underlying philosophical issues, develops the capacity for rigorous critical analysis of complex, value-laden policy disputes. Topics: the nature of ethics and morality; the nature 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. 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 (food and development aid, immigration, and repatriation of artistic patrimony.) (DR:3)

5 units, Aut (McGinn) MTW 2:15-3:30 plus two-hour section by arrangement

104. Economics and Public Policy—(Enroll in Economics 150.) The reasons for, the varieties of, and the consequences of government policies in economic affairs. The means of policy formation 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—(Enroll in 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)

150. Washington D.C.: Issues and Players—Designed 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 will assist them to become effective interns.

2 units, Win (Milton)

151. Policy Making for California State Government—An overview of the major institutions, actors, and policymaking processes for California state government. Designed for students who plan to work in Sacramento. Focus is on the recent history and current status of legislative policymaking, electoral campaigns, and coalition building between the executive and legislative branches.

1 unit, Spr (Kirst)
182. Public Policy Internship Seminar—Academic supervision and sponsorship of learning achieved through an internship with a local government or human service organization. Instruction and practice in skills that enhance academic learning from an internship. Relates issues and events encountered to theoretical perspectives on the management of and inter-relationships among public sector programs and institutions, particularly the local and regional level. Seminar may be taken prior to, concurrent with, or following an internship. Students may obtain assistance in obtaining internships through the Public Service Center, Owen House. Prerequisite: Permission of instructor. 3-5 units, Win (Stanton) M 3:15-5:05

198. Directed Readings in Public Policy. 1-5 units (Staff) by arrangement

199. Honors Thesis. 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 (Rothwell)
200B. 1 unit, Win (Rothwell)
200C. 1 unit, Spr (Rothwell)

RELIGIOUS STUDIES

Chairman: Edwin M. Good
Professors: Lawrence V. Berman, Amos Funkenstein (History and, by courtesy, Religious Studies), René Girard (French and Italian and, by courtesy, Religious Studies), Edwin M. Good, Van A. Harvey, David S. Nivison (Asian Languages, Philosophy, Religious Studies), Lewis W. Spitz (History and, by courtesy, Religious Studies)

Associate Professors: Arnold M. Eisen, Bernard R. Faure (on leave 1987-88), Lee H. Yearley (on leave 1987-88)

Assistant Professors: Carl W. Bielefeldt, Hester Gelber, Timothy P. Jackson

Lecturers: Philip J. Ivanhoe, Paul H. Mosher

Consulting Professor: Robert G. Hamerton-Kelly

Acting Assistant Professors: Anne C. Klein, Alan Sponberg

Mellon Fellow: Leigh E. Schmidt

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, indicated by course numbers and units:

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)

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 18 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
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 Undergraduate 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 information is contained in the Handbook of Graduate Religious Studies, available from the departmental secretary.

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 nine 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, Jewish 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 Examination; (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 Examination. 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; three prescribed essays; and a record of the student's performance on the
Candidacy Examination in the sixth quarter of graduate study.

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 qualifying examination on the subject matter deemed relevant for the student's dissertation.

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 section "Humanities Special Programs" in this bulletin.

COURSES

Courses listed below numbered 1C-89 expect work at an introductory level. Those numbered 101-199 expect work at an intermediate undergraduate level. Those numbered 201-289 are for advanced undergraduates and graduate students.

INTRODUCTORY

1C. Comparative Religious Thought. 4 units (Staff) not given 1987-88

1D. Religions of the East—(Formerly Religious Studies 12.) (DR:3*)
4 units (Bielefeldt) not given 1987-88

1E. Eastern and Western Conceptions of the Self—(Formerly Religious Studies 40A.)
4 units (Yearley) not given 1987-88

3 units (Staff) not given 1987-88

14. Introduction to Buddhism—An introduction to the history, thought, and practice of Buddhism. Fundamentals of Buddhist thought as taught during its first centuries in India, changes of emphasis and style in the later Indian Mahayana; various forms of Mahayana as it traveled to Tibet, China, and Japan. Readings center on primary source materials and traditional expositions of them. Limited enrollment. (DR:3*)
4 units, Aut (Klein) MWF 1:15
Win (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, Win (Bielefeldt) MWF 1:15 plus section by arrangement

23. Judaism—The historical development of Jewish religious thought and practice, from the Biblical period to the present. Focus on texts reflecting that development: scriptural, liturgical, midrashic, legal, historical, and philosophical. Limited enrollment. (DR:3)
4 units, Aut (Eisen) TTh 8:30-9:50

24A. Christianity—(DR:3).
4 units (Gelber) not given 1987-88

27. Islam—Forms of Islam from the beginning to the present day: interpretations of Muhammad and the Koran; the legal, mystical, and rationalistic foci of Islamic thought, feeling, and behavior; modern movements of reform and their contact with the West. Comparison and contrast with forms of Christianity and Judaism. Limited enrollment. (DR:5)
4 units, Aut (Berman) MWF 1:15 plus section by arrangement

42. Philosophy of Religion—(Same as Philosophy 42.) Classic questions in philosophy of religion: the existence of God, the problem of evil, free will and determinism, the ethics of belief, faith versus reason. Readings include traditional and modern texts. (DR:3)
4 or 5 units, Spr (Gelber) MWF 1:15

50. Religion in America—Puritanism, church-state related issues, the Enlightenment, the growth of new religions (i.e., Mormonism); interrelationship of religion in America with aspects of culture: slavery, gender roles, ethnicity, and capitalism.
4 units, Spr (Schmidt) MWF 10 plus section by arrangement

52F. Readings in Philosophy and Religious Studies —(Same as German 52F.)
3-4 units (Staff) given 1988-89

55. Introduction to Chinese Philosophy—(Same as Philosophy 46, Asian Languages 46) The history of Chinese philosophy to 200 B.C and a brief introduction to Classical Chinese used by early philosophers. Limited enrollment. (DR:3*)
4 units, Aut (Ivanhoe, Nivison) MWF 10

65. Introduction to Christian Ethics—Theme in major ethical thinkers. Love, law, sin, free
dom, and salvation as understood by Augustine, Aquinas, Luther, Kierkegaard, and Barth.

4 units, Win (Jackson) MWF 1:15

TOPICS IN RELIGION

116. Japanese Buddhism—The history and teachings of Buddhism in Japan with emphasis on the early and medieval periods. (DR:3*)

5 units, Spr (Bielefeldt) MWF 10

119. Hindu and Buddhist Meditation.

5 units (Staff) not given 1987-88

121A. The Hebrew Bible—The Hebrew Bible, studied as literature, i.e., as narrative, poetry, essay, oracle, and other forms. The ways in which the Biblical materials present themselves. Must complete 121B for credit. (DR:2; 121B must be completed)

4 units, Win (Good) MTWTh 9

121B. The Hebrew Bible—(See 121A.) Prerequisite: Completion of 121A. (DR:2; 121A must be completed)

2 units, Spr (Good) MTWTh 9

122. Mystics and Intellectuals in the Middle Ages—Comparison and contrast of mystics and intellectuals selected from Christianity, Islam, and Judaism.

4 units, Spr (Berman) MW 11-12:15

126. Age of the Reformation—(Same as History 110.) (DR:3)

5 units, Win (Spitz) MTWTh 9

131. Founders in Myth and History—Abraham, Jesus, and Muhammad as historical figures and their mythical images. Limited enrollment. (DR:3*)

4 units, Win (Berman) MWF 10

plus section by arrangement

132A. Jesus and the Origins of Christianity—The origins of the Christian movements in Judaism and their initial spreading into the gentile world. The portrayal of the life and work of the founder in the earliest sources.

5 units, Spr (Hamerton-Kelly) MWF 11

140. Religious Ethics.

5 units (Staff) not given 1987-88

141. Renaissance Humanists and Reformers—(Same as History 213.)

5 units (Spitz) not given 1987-88

147. Modern Christian Thought.

5 units (Harvey) not given 1987-88

148. Social Theory and Religion.

5 units (Eisen) not given 1987-88

150. Systems of Buddhist Thought.

5 units (Bielefeldt) not given 1987-88

158A. Buddhism and the Feminine—Conjunctions and disjunctions between Buddhist and feminist perspectives. Using gender as an analysis, investigates Buddhist material on selflessness, compassion, and feminine imagery in meditative ritual. Readings in primary Buddhist texts in translation and contemporary feminist theory.

5 units, Aut (Klein) MW 4:15-6:05

161. Modern Jewish Thought.

5 units (Eisen) not given 1987-88

161A. Jewish Intellectual History: Modern—(Same as History 106B. See 161B.)

5 units, Spr (Funkenstein) MTWTh 11


5 units, Win (Funkenstein) MTWTh 11

162. Ethics, "Abominations," and "Liberations"—Moral abominations and liberations and their distinctive place in ethical reflection. Why specific practices do or do not qualify as instances. The nature of moral reasoning, and issues such as cannibalism, abortion, the Holocaust, gay liberation, and feminism.

5 units, Win (Jackson) TF 11-12:15

165. Religious Ritual.

5 units (Eisen) not given 1987-88

167. Medieval and Renaissance Religious Philosophy—(Same as Philosophy 101.) Survey of 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, and Luther.

5 units, Win (Harvey) MWF 10

171. Augustine.

5 units (Staff) not given 1987-88

174. From Kant to Kierkegaard.

5 units (Harvey) not given 1987-88


5 units, Aut (Jackson) MW 11-12:15
185. Hermeneutics—(Same as Philosophy 135/235.) The problems and hermeneutical theories from Schleiermacher to the present. 5 units, Spr (Harvey, Føllesdal) MW 2:15-4:05

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

SEMINARS FOR
UNDERGRADUATES
AND GRADUATES

212. Interpreting Classical Chinese Texts—(Same as Asian Languages 230.) The issue of interpretation in texts of early Confucianism and Taoism as they have been interpreted throughout Chinese history. The critical importance of historical and philosophical issues to interpretation. Prerequisite: Consent of instructor. 5 units, Win (Icanhoe) TTh 4:15-6:05

215. Religions of Modern Japan. 5 units (Staff) not given 1987-88

222. Forms of Interpretation—Analysis of rational and mystical forms of interpretation of authoritative texts. Criteria for characterizing and distinguishing these forms. Selections from the works of thinkers and mystics: Plotinus, Philo, Proclus, Meister Eckhart, Ibn Arabi, Moses de Leon, Ibn Rushd, Maimonides, and Thomas Aquinas. 5 units, Spr (Berman) MW 2:15-4:05

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) M 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 1987-88

230A. Topics in Ch'an and Zen—The introduction of Zen to Japan. Prerequisite: Consent of instructor. 5 units, Win (Bielefeldt) MW 4:15-6:05

232C. The Crucifixion. 5 units (Gelber) not given 1987-88

233. The City of Rome (A.D. 64-1300)—The archaeology of ideas. Religion, politics, and culture in Rome from late Classical to the high Middle Ages, studied from architectural and artistic remains, inscriptions, documents, and contemporaneous texts. 5 units, Spr (Mosher) MW 3:15-5:05

234. Human Violence and the Bible—Interpretation of selected Biblical passages from the point of view of the mimetic theory of violence and the role of sacrifice and scapegoating in religion and culture. 5 units, Spr (Hamerton-Kelly) TTh 4:15-6:05

234B. The Virgin Mary and Images of Power. 5 units (Gelber) not given 1987-88

235. Tibetan Wisdom Texts. 5 units (Klein) not given 1987-88

236. Buddhist Meditation Texts—Texts and topics from the Buddhist contemplative tradition emphasizing East Asia. 5 units, Spr (Bielefeldt) MW 1:15-3:05

236A. Buddhism and the Play of Wisdom. 5 units (Klein) not given 1987-88

237. Halevi and Maimonides. 5 units (Berman) given 1988-89

239. The Golden Rule—“Do not do to others what you do not want for yourself” (Confucius), and similar “principles” in the Hebrew-Christian and other traditions; their meaning in their religious and cultural contexts; their implications and analogs in various systems of ethics. 5 units, Spr (Nivison) MW 3:15-5:05

241A. Luther and the Radicals—(Same as History 213A.) 5 units, Aut (Spitz) T 2:15-4:05

245. Comparative Religious Ethics. 5 units (Yearley) not given 1987-88

249. Theories of Religion—An exploration of the theory that religion can best be interpreted as a projection or human construction, a defense against the fear of death. Prerequisite: 42 or consent of instructor. 5 units, Aut (Harvey) TTh 2:15-4:05

252. Revivalism in American Culture—Historical and anthropological exploration. Topics the Great Awakenings, rituals of camp meeting and other evangelistic events, emergence of fundamentalism, the evangelical tradition in Afro-American culture, Catholic forms of renewal, and televangelism. Readings in primary and secondary literature. 5 units, Win (Schmidt) T 2:15-5:05

254. Confucianism Since Wang Yang-ming—(Same as Asian Languages 144.) 5 units (Nivison) not given 1987-88
257. Buddhist Theories of Knowledge.
5 units (Klein) not given 1987-88

5 units (Bielefeldt) not given 1987-88

260. Contemporary Jewish Thinkers.
5 units (Eisen) not given 1987-88

262. Sociology of Religion—(Same as Sociology 280.)
5 units (Swidler) not given 1987-88

263. The Book of Job.
5 units (Good) not given 1987-88

269. Francis of Assisi.
5 units (Gelber) not given 1987-88

5 units, Aut (Jackson) TTh 4:15-6:05

273. Aquinas' Ethics.
5 units (Yearley) not given 1987-88

274A. Sigmund Freud.
5 units (Yearley) not given 1987-88

274D. Friedrich Nietzsche.
5 units (Harvey) not given 1987-88

277. Religious Existentialists—(Same as German Studies 179K.) The influence of Heidegger's early philosophy (Being and Time) on Christian theology. Prerequisite: Consent of instructor.
5 units, Win (Harvey) MW 4:15-6:05

281. Encounters Between Modern Philosophy and Judaism: The Commandments—Challenges to the meaning and purpose of mitzvot by thinkers such as Spinoza and Kant, and redefinitions proposed by Mendelsohn, Hirsch, Krochmal, and Kaplan. Prerequisite: Consent of instructor.
5 units, Spr (Eisen) TTh 4:15-6:05

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

288. Life in Light of Death: Cross-Cultural Perspectives—Cross-cultural views of death from narrative literature, philosophical essays, religious scripture, historical studies, and contemporary cinema. What these works can teach us about death and life. Prerequisite: Consent of the instructor.
5 units, Aut (Sponberg) TTh 2:15-4:05

GRADUATE STUDENT 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.
6 units upon completion of 302B, Aut (Staff) given 1988-89

302B. Problems in the Interpretation of Religion—(See 302A.) Prerequisite: Consent of instructor; completion of 302A.
Win (Staff) given 1988-89

304A. Theories and Methods in the Study of Religion—Required of all graduate students in Religious Studies; may be repeated for credit. Examination of approaches to study of religion (historical, sociological, anthropological, and psychological) through the writings of classical and contemporary thinkers. Prerequisite: Consent of instructor. Consult instructor about meeting time.
6 units upon completion of 304B, Aut (Eisen) Sec. 1 MW 10-12, Sec. 2 MW 2:15-4:05

304B. Theories and Methods in the Study of Religion—(See 304A.) Prerequisites: Consent of instructor, completion of 304A. Consult instructor about meeting time.
Win (Eisen) Sec. 1 MW 10-12, sec. 2 MW 2:15-4:05

GRADUATE COURSES, RESEARCH, AND TEACHING

Topics of directed research (numbers ending in 9) vary each year according to student initiatives and faculty research interests.

319. East Asian Religions.
(Bielefeldt, Klein, Nivison, Yearley) by arrangement

(Berman, Good, Hamerton-Kelly) by arrangement

331. Confucian Ethics—(Same as Asian Languages 331, Philosophy 331.) Prerequisite: Consent of instructor.
3-5 units, Spr (Nivison) TTh 2:15-4:05
339. Medieval Western Religions.  
(Berman, Gelber, Mosher, Yearley)  
by arrangement

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—Exploration of four areas central to philosophy of religion: necessity and contingency, freedom of the will, divine command morality, and mystical experience. Key ancient and medieval texts serve as springboards to modern readings. Open to interested undergraduate students. Prerequisite: Consent of instructor.  
5 units, Spr (Gelber) TTh 2:15-4:05

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 Essays and Examination—Prerequisite: Consent of graduate director.  
12 units, Spr (Staff) by arrangement

2-9 units (Staff) by arrangement

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 (Drama), Lazar Fleishman (Slavic), Joseph N. Frank (Comparative Literature and Slavic), Alexander L. George (Political Science), John Gurley, Emeritus (Economics), David J. Holloway (Political Science), Alex Inkeles (Sociology and Hoover Institution), Mark Mancall (History), Richard Schubach (Slavic), Lawrence Stahlberger, Emeritus (Slavic), William M. Todd (Slavic), Jan F. Triska (Political Science), Joseph Van Campen (Slavic), Wayne S. Vucinich, Emeritus (History)  
Associate Professors: Karol Berger (Music), William S. Eddelman (Drama), Gregory Freidin (Slavic), Sabine MacCormack (History), Conolezze Rice (Political Science)  
Assistant Professors: Monika D. Frenkel (Slavic), Nina P. Halpern (Political Science), Liza Knapp (Slavic Languages), Nancy S. Kollman (History), John M. Litwack (Economics)  
Affiliated Professors: Donald L. Carpenter (Stanford Electronics Laboratory), Sidney Drell (Physics/SLAC), John W. Lewis (Political Science)  
Lecturers: Frances Foster-Simons (Law), Barbara Voytek (Anthropology), Wojciech Zalewski (Slavic and Stanford Libraries)  
Acting Associate Professor: Coit D. Blacker (Political Science)  
Visiting Professors: Jacques Catteau (Slavic), Franklyn Griffiths (Political Science), Christer Jonsson (Political Science), Norman Naimark (History)  
Visiting Lecturers: Alexander Golitzin (Slavic), Jasmina Moskovljevic (Slavic), James von Geldern (Slavic)  
Instructor: Vera M. Henzl (Linguistics)  
Affiliated Staff: Dorothy Atkinson (AAASS), Robert Conquest (Hoover Institution), John B. Dunlop (Hoover Institution), Joseph D. Dwyer (Hoover Institution)

PROGRAM OF STUDY

The Center for Russian and East European Studies administers a coterminal A.B./A.M.
and an A.M. program in Russian and East European Studies. The program is established 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 specialize in Russian and East European Studies as preparation for careers in government, law, journalism, business, or teaching at other than the college or university level.

The degree program is administered by a master's committee of faculty members constituted as a subcommittee of the Committee on Russian and East European Studies. The master's committee reviews each student's program and advises him or her as to the distribution of courses most appropriate to his or her interests and preparation.

The basic prerequisite for admission to the coterminal program is completion of a minimum of one year's study of Russian language (First-Year Russian). Two years of the language (Second-Year Russian) or the equivalent are to be completed before the awarding of the A.M. degree. In individual cases, Polish may be substituted.

To qualify for simultaneous awarding of the A.M. degree, the student must, in addition to completing university requirements for the A.B. degree:

1. Petition the master's committee for admission to the program no earlier than the beginning of the eighth quarter of undergraduate work and no later than the end of the 11th quarter of undergraduate study. The petition, to be accepted, must be approved by both the master's committee and the chairman of the department in which the student is a candidate for the A.B. degree.

2. Include in the petition a schedule of the proposed program, by quarter, to its completion. The student should seek the advice of members of the master's committee in drafting this schedule.

3. Complete 15 full-time quarters or the equivalent, or three quarters after completing 180 units.

4. Complete, in addition to the 180 units required for the bachelor's degree, a minimum of 40 units for the master's degree. These units must be distributed as follows:
   (a) A minimum of five graduate courses in the program field, three of which are to be taken in at least two departments other than that of the undergraduate major.
   (b) The remaining courses required to make up the 40 units may include advanced undergraduate courses and may be taken in various departments, but all are to be in the Russian or East European field.

Note—At some time prior to completing the A.M. unit requirements, the student should take the basic undergraduate courses in Modern Russian History, Modern Russian Literature, Soviet and East European Politics. This course work may be applied to the units required for the A.M. only when doing so does not interfere with completion of language or graduate course requirements. Ordinarily, a student admitted to the program will do course work on both Soviet and East European topics. Students wishing to specialize in one or the other alone may do so subject to the prior approval of their programs by the master's committee.

5. Apply for each degree at the appropriate time.

COURSES

For courses, please consult the quarterly Time Schedule.

SLAVIC LANGUAGES
AND LITERATURES

Emeriti: (Professors) Edward J. Brown, Jack A. Posin, Lawrence L. Stahlberger; (Assistant Professor) Elisabeth Stenbock-Fermor
Chairman: William Mills Todd III
Professors: Joseph A. Van Campen (on leave Spring), Lazar Fleishman (on leave Autumn), Joseph Frank, Richard D. Schupbach (on leave, 1987-88), William Mills Todd III
Associate Professor: Gregory Freidin
Assistant Professor: Monika Frenkel (on leave, 1987-88)
Lecturer: Wojciech Zalewski (Curator, Russian and East European Collection, Stanford Libraries)
Visiting Professor: Jacques Catteau
Visiting Assistant Professor: Liza Knapp
Visiting Lecturer: Father Alexander Golitzin

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 32 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, 169, 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 32 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 general 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 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 a 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, 187 or 188, and 167-168.
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 a LGI of "B" or better on a thesis or project conducted under the close supervision of a member of the professorial staff.

**RECOMMENDED**

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, 25L, 35L; 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 nine must be in language courses, and the remaining nine may be distributed in accordance with the needs and interests of the individual student, with the advice and approval of the student’s departmental advisor.

It should be noted that no credit toward the A.M. degree will be allowed for first- or second-year courses in non-Slavic languages required for the Ph.D. degree.

**Final Examination**—Students not enrolled in the Ph.D. program may either submit an A.M. thesis or take a final examination. In the latter case, regardless of the area of specialization, the student will be required to demonstrate on a written examination (1) command of the phonology, morphology, syntax, and lexicology of contemporary Standard Russian sufficient to allow him or her to teach beginning and intermediate courses at the college level, (2) an ability to read contemporary Standard Russian sufficient to permit him or her to be a reliable guide to students studying contemporary Russian poetry or literary prose; and (3) sufficient familiarity with Russian literature of either the 19th or 20th century to handle successfully survey courses dealing with his or her chosen period.

The examination should be passed at the end of the final quarter or required course work.

**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 requirements will result in termination of enrollment for the Ph.D degree. The terminated student may, at the discretion of the faculty, be given the opportunity to take the A.M. written examinations. If successful, the student will then be awarded the A.M. degree, but will not be accepted as a candidate for the Ph.D. degree.

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 "Advanced Degrees" section of 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, of one of these languages. The reading examination in one of these languages must be passed by the end of the first year of study. The reading examination in the second language must be passed by the end of the second year of study. Both language examinations must be passed before the candidate takes the University oral examination, i.e., before the end of the third year.

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.

SLAVIC LANGUAGES AND LITERATURES

GENERAL COURSES

Courses in this category may be of interest to students in other literatures, in comparative literature and in Russian area studies. These courses are primarily for undergraduates; however, by special arrangement with the department they can be taken for graduate credit.

145/245. Survey of Russian Literature in English Translation I: The Age of Experiment — (Graduate students register for 245.) Part I of a three-quarter survey of the Russian prose tradition covering 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 Queen of Spades, 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 (Knapp) 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 (Todd) 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, Sinavsky, 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
513. Leo Tolstoy—Major works in English translation including War and Peace, Anna Karenina, and Resurrection. Discussions correlate materials from Tolstoy’s social and religious thought. Some comparative reference to the European novel in general, English and French. Open to all students. (DR:2)

4 units, not given 1987-88

154. The Russian Drama—A survey of major Russian plays in English translation from Fonvizin to Mayakovsky, including Gogol and Chekhov. Attention to tradition and innovation in the development of Russian dramatic comedy. Open to all students. Readings and lectures in English.

4 units, not given 1987-88

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 (Staff) 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 (Mueller-Vollmer) 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 (Mueller-Vollmer) MTWThF 9 and 1:15


3 units, Aut (Van Campen) MWF 12 and 1:15

51A. Second-Year Russian: Conversation Emphasis is on the development of “oral proficiency”.

2 units, Aut (Lifschitz) TTh 10 and 11

52. Second-Year Russian—Continuation of 51 with focus on vocabulary building, syntax, and the reading of selected texts from 20th century authors.

3 units, Win (Van Campen) MWF 12 and 1:15

52A. 2 units, Win (Lifschitz, Staff) TTh 10 and 11

53. Second-Year Russian—Continuation of 52. Reading centers on selected texts from 19th-century authors.

3 units, Spr (Staff) MWF 12 and 1:15

53A. 2 units, Spr (Lifschitz) TTh 12 and 1:15

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 (Mueller-Vollmer) MWF 11

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

ADVANCED AND GRADUATE

167-168. Fourth-Year Russian Seminars I-II—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 poetic works.

4 units, Aut (Freidin) TTh 10-11:50

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, Spr (Staff) MW 1:15-3:05

177. Advanced Russian—Reading, conversation and composition.

3 units, Aut (Lifschitz) TTh 3:15

178. Advanced Russian—Reading, conversation and composition.

3 units, Win (Lifschitz) TTh 3:15

179. 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 2:15-4:05
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, Tютчев, Nekrasov, Fet, Soloviev, Nadson. Lectures and discussions in Russian. Open to graduate students.
4 units, Win (Freidin) MW 11-12:30

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, Spr (Fleishman) MWF 11

189. Old Russian Literature—
Russian literature, culture, and thought from the earliest times through the 17th century (some readings in the original).
4 units, Aut (Todd) MWF 11

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, (Schupbach) not given 1987-88

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, Win (Goltz) by arrangement

195. Advanced Topics in Russian Grammar I:
Phonetics and Phonology and Introduction to Morphology of Russian—Comparison of the structure of contemporary standard Russian.
3 units, Aut (Schupbach) alternate years, given 1988-89

196. Advanced Topics in Russian Grammar II:
Morphology—Russian inflectional morphology emphasizing the predictability of desinences and semantics of grammatical categories.
3 units, Win (Van Campen) alternate years, given 1988-89

197. Syntax—
Selected topics in Russian syntax (agreement, government).
3 units, Spr (Schupbach, Van Campen) alternate years, given 1988-89

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 184. 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, Aut (Van Campen) MWF 2:15

212. Reading of Old Church Slavic and Old Russian Texts.—Prerequisite: 211.
3 units, Win (Van Campen) MWF 2:15

213. History of the Russian Literary Language—
The major structural and semantic changes from the 10th to the 19th centuries. Prerequisites: 211 and 212.
3 units, Spr (Fleishman) MWF 2:15

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 (Brown) not given 1987-88

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, both Russian and European.
4 units (Todd) not given 1987-88

222. Early Soviet Prose: Osip Mandelstam, Isaak 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 1987-88

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, Win (Freidin) W 3:15-5:05

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, Aut (Todd) not given 1987-88
4 units (Freidin) not given 1987-88

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 poetics.
4 units (Fleishman) not given 1987-88

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 1987-88

229. Russian Versification—History and theory of Russian versification from the 17th to the 20th century.
4 units (Fleishman) not given 1987-88

230A. Russian Formalism and Structuralism—The Russian Formalists’ contribution to literary criticism and theory; the relationship of Russian Formalism to critical movements in the West; the Prague School, and the Soviet Structuralists. No knowledge of Russian is required.
4 units (Brown) not given 1987-88

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 (Brown) T 2:15

230C. Introduction to Archival Research in Russian Literature and History.
3 units (Fleishman) not given 1987-88


277. Gogol—His fiction, drama, and essays emphasizing problems of structuration and refraction of cultural contexts. Open to undergraduates with advanced training in Russian.
4 units (Todd) not given 1987-88

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 (Frenkel) not given 1987-88

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, Todd, Van Campen) by arrangement

300. Graduate Seminar: Theory of Narrative—Studies of narrative (fictional, historical, sacred) as verbal structure, representation, rhetorical, 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, Spr (Todd) MW 1:15-3:05

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 (Todd) not given 1987-88

300B. Graduate Seminar—The theme of utopianism in Russian literature from Dostoevsky through the late 20’s.
4 units, Spr (Catteau) by arrangement

300C. Introduction to Archival Research in Russian Literature and History.
3 units (Fleishman) not given 1987-88

375. European Novel in the 19th Century: French and Others—(Enroll in Comparative Literature 375, French 359A.) The main types
of European fiction beginning with the Gothic
and historical novel. The rise of Realism and
Naturalism in the works of Stendhal, Balzac,
Flaubert, Dickens, Dostoevsky, Zola.
5 units, Win (Frank) TTh 3:15-5:05
For additional offerings in literature, see
Comparative Literature.
Students interested in languages not listed
for a specific language department should con-
tact the Special Language Program, Depart-
ment of Linguistics.

SOCIOMETRY

Emeriti: (Professors) St. Clair Drake, Dudley
Kirk
Chairman: Joseph Berger (on leave, Autumn)
Professors: Bernard P. Cohen, Elizabeth G.
Cohen, Sanford M. Dornbusch (on leave, Spring), Alex Inkeles (on leave), Seymour
Martin Lipset (on leave), James G. March,
John W. Meyer, W. Richard Scott, Nancy B.
Tuma, Morris Zelditch, Jr.
Assistant Professors: Carol Conell (on leave),
Jerald R. Herting, Leonard Hochberg,
Henry A. Walker
Courtesy Professors: Bruce Bueno de Mes-
quita, Jeffrey Pfeffer
Courtesy Associate Professors: James Baron,
JoAnne Martin, Francisco Ramirez
Courtesy Assistant Professors: Larry Diamond,
Donald Palmer (on leave Autumn)
Senior Lecturer: Ruth Cronkite
Consulting Associate Professor: Janet Johnston
Visiting Professor: Shmuel Eisenstadt

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 (categorical), or doc-
toral levels. 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.

UNDERGRADUATE
PROGRAMS

Courses in the undergraduate program of
instruction are organized around six areas of
concentration as follows:
1. Applied Sociology
2. Social Psychology and Interpersonal Proc-
esses
3. Family Structures and Processes
4. Organizational Behavior
5. Comparative Social and Political Institutions
6. Research Methods

Each of these areas 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.

AREAS OF CONCENTRATION

Applied Sociology—This field of study
emphasizes the contributions which sociolog-
ical knowledge, theory, and methods, can make
to the solution of social problems. Problem
areas considered include deviance, poverty,
mental illness, alcoholism, and problems in the
definitions of sex roles and the relations among
ethnic groups. Courses emphasize the special
skills involved in applying sociological explana-
tions and the special methodologies used in
evaluation and policy-relevant studies. Careers
linked to this area of study include social work,
parole and probation, clinical sociology, evalua-
tion, and policy research positions.

Social Psychology and Interpersonal Proc-
esses—This field of inquiry focuses on the social
organization of individual identity, beliefs, and
behavior; and upon social structures and proc-
esses 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 empha-
size 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.

Family Structures and Processes—This area
focuses attention on one of our most important
and rapidly changing social institutions. Courses within this area give attention to the
variety of structural forms exhibited by families,
both historically and cross-culturally, as well as
to the vital processes encompassed within this
setting, including socialization and social sup-
port. Courses also deal with internal and exter-
nal forces generating changes in these systems,
and with the emergence of “alternatives” to
conventional family systems. Careers which
relate to this topic include couple and family
counseling, social work, and law.

Organizational Behavior—This area encom-
passes 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; 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.

Research Methods—This field of study emphasizes the acquisition of research and analytical skills relating to the collection, reduction, and interpretation of data. Students are encouraged to acquire facility with a variety of research gathering techniques (participant observation, survey research, laboratory studies) as well as to acquire competence in the processing of data, including the acquisition of statistical and computer skills. Direct involvement in a research project is required as a part of this training. Careers related to this type of training include positions as data analyst, jobs in planning and evaluation departments, and in applied research organizations.

COURSE OFFERINGS

Most of the courses offered by the department can be categorized as primarily oriented to one of the six areas of concentration; a few courses are relevant to more than one area. Within the four substantive areas, one or more Foundation Courses are identified which provide a general introduction to the area or some portion of it. Courses, classified by area, are as follows:

1. Applied Sociology
   Courses: 100-118, 145, 150, 154
2. Social Psychology and Interpersonal Processes
   Foundation Courses: 5, 120, 121
   Other Courses: 104, 106, 107, 118, 127, 220-230, 242B
3. Family Structures and Processes
   Foundation Course: 142
   Other Courses: 104, 107, 111, 145, 154, 222
4. Organizational Behavior
   Foundation Course: 160
   Other Courses: 118, 127, 141, 143, 161-169, 260-269
5. Comparative Social and Political Institutions
   Foundation Courses: 141, 142, 143, 144, 145
   Other Courses: 107, 111, 280-287, 135-159, 240-259
6. Research Methods
   Courses: 180, 181, 380-385

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 three of the four 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 Applied Sociology, Comparative Social and Political Institutions, Family Structures and Processes, 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

The Honors program is designed for students interested in and capable of carrying out an individualized program of independent research in close contact with one or more faculty advisors.

Admission to the program, ordinarily in the ninth quarter of residence or with special approval, during the 10th quarter, requires (1) a minimum letter grade indicator of "B" in the major, (2) a thesis project proposal to be approved by an individual faculty advisor and by the Departmental Undergraduate Studies Committee, and (3) evidence of appropriate methodological preparation for the research.

To complete the program and qualify for departmental Honors, the student must (1) complete a sociology major, (2) complete a thesis, to be reviewed and approved for Honors by the advisor and one other faculty member, and (3) participate in the departmental Honors seminar. The advisor may approve up to 15 units of credit for work on the thesis which may count toward the major, whether or not the thesis is evaluated as appropriate for Honors.

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.

SOCIOLOGY 599

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 TO GRADUATE STANDING

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 catalogue. 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 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 Law School and the Department of Sociology conduct joint programs leading to either a combined J.D. or J.M. degree with an A.M. degree in Sociology or to a combined J.D. or J.M. degree with a Ph.D. in Sociology.

Normally, the student interested in pursuing an A.M. degree in Sociology will complete one full year of his or her law program, applying for admission to the Department of Sociology during the first year of law school. If admitted, the student would be expected to complete 45 semester units (for the J.D. degree) in the Law School and meet the Sociology Department requirements. Applications for a joint program must be approved by the Research and Interdisciplinary Studies Committee of the Law School and by the Sociology Department. Faculty advisors from both the department and the school will participate in the planning and supervise the study program of students admitted to joint degree status.

The joint J.D.-Ph.D. degree program is designed for students who wish to prepare themselves for research or teaching careers in areas relating to legal and sociological concerns. Participation in this program requires application for admission to both the Law School and the Department of Sociology and acceptance by each. Upon admission, the student may elect to begin his or her study program in either the Law School or the Sociology Department. Normally, the student will spend the first full year in one program and the second full year in the other. Thereafter, the student may take courses concurrently until requirements for both degree programs have been met.

COURSES
OPEN TO ALL STUDENTS
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. (DR:5)

   5 units, Aut (Staff MWF 1:15)
   Spr (Meyer) 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 — (Same as Feminist Studies 104A.) 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, Win (Walker) MWF 9, one section by arrangement

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, Spr (Staff) given 1988-89

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 11

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, Spr (Cronkite) TTh 10:30-12

108. Peace Studies—(Same as Political Science 133.) 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, Moses, North, Ross) TTh 2:15-4:05

111. Social Issues in Health Care—Major social issues and policy problems in health care and their practical application to the present and future roles of physicians. Sociological perspectives and research findings are contrasted with other approaches; discussions stress critical evaluation of alternative viewpoints and evidence. Topics: social factors influencing illness and use of health services, patient-provider relationships, education and professionalization of physicians and other providers, incentive structures in various health institutions, the drug industry, and alternative of health care reform strategies.
5 units, Spr, given 1988-89

112. Gender and Education—(Same as Education 170; Feminist Studies 130.) 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 professors of psychology and law are examined.
4 units, Win (E. Cohen, Strober) MW 3:15-5:05

113A. Social Psychology of Gender—(Same as Feminist Studies 123.) Women who live in a flawed social structure come to view themselves and to make decisions in ways that perpetuate sexual inequality. Victims accept and justify their fate. Vicious circles surround women who must make choices as they mature, develop social ties, work, and age. Hidden traps unwittingly injure individual women, the men who are their partners, women as a social group, and the society that loses the potential female contribution. Exposing these obstacles may lead to changes in the society, reduce the likelihood of self-destructive individual decisions, and pro-
duce a clearer vision of the world faced by men and women.

3-5 units, Aut (Dornbusch) given 1988-89

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, Aut (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 both 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.
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

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. (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 (Walker) MW 1:15-2:45
lab T 1:15-2:45

COMPARATIVE SOCIOLOGY: SOCIAL INSTITUTIONS AND SOCIAL CHANGE

130. American Society in Film and Literature—Plays, films, and novels by American social realists analyze some fundamental social processes underlying the structure of American society. Emphasis to social control, including causes of conformity and deviance and mechanisms producing them; and stratification, including class, sex, and ethnic/racial inequalities. Uses film and literature to understand the central features of American society but it does not study film or literature as such. Readings: Ellison, Faulkner, Fitzgerald, James, Miller, Steinbeck, Styron, and Wharton. Films: A Thousand Clowns, Officer and a Gentleman, A Long Day's Journey into Night, One Flew Over the Cuckoo's Nest, The Little Foxes, Personal Best, 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

131. Causes of War and Peace—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, Win (de Mesquita) TTh 2:15-2:45

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

142. 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

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

144. 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

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 (Walker) MWF 10
plus section by arrangement

146. Status Attainment in Developing Countries—A comparison of social stratification systems in developing countries including theoretical developments and issues in class and general stratification, and rural/urban differences in stratification systems. How these systems and changes are interrelated with the general social and economic development of these countries.

5 units, Spr (Herting) given 1988-89

147. Politics and Society in the Predominantly English-speaking Countries: Australia, Britain, Canada, United States—(Same as Political Science 116.) Comparative analysis of social and political institutions in the major English-speaking nations, Australia, Britain, Canada, and the United States. 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, Aut (Lipset) given 1988-89

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, Aut (Conell) given 1988-89

152. Social Structure of World Society—(Same as Education 231; Values, Technology, Science, and Society 155.) A sociological analysis of human society on a world-wide basis, e.g., all the people inhabiting the earth and the institutions through which their lives are organized and treated as participants in one global social system. Competing models of the emerging world order and its dynamics are compared. Emphasis of whether once distinctive societies and cultures are converging on a common standard. Topics: 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 1988-89


5 units, Win (Wilson) MW 10-11:50

154. Urban Growth and Change—Cities and towns are continually 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, Win (Tuma) TTh 1:15-3:05

155 Religion and Politics in America—Lectures/seminars on the political consequences (elections, public policies, and court decisions) of religious revival in American history. Contemporary conflicts over school prayer, creationism vs. evolution, the electoral impact of the Moral Majority, and the meaning of America are discussed in terms of the politics of status and life style.

5 units, Spr (Hochberg) TTh 2-3
and one seminar Th 3-4 or 4-5

157. The Geographic Basis of American Political Development—The geographic and social foundations of party conflict, institutional development, voting behavior, and the formation of public policy in the United States. Various methods, sectionalism, the Annales school, world-system analysis, and sociogeography,
demonstrate the usefulness of geographic inquiry in the study of historical events and political processes.

5 units, Win (Hochberg) TTh 3:15-4:45

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, Aut (Conell) given 1988-89


5 units, Win (Hochberg) given 1988-89

FORMAL ORGANIZATIONS


5 units, Aut (Scott) MWF 9

section by arrangement

162. Organizational Cultures—(Same as Graduate School of Business 370.) Organizational cultures include institutional mythology, jargon, rituals, ceremonies, humor. Through these mechanisms, organizational members communicate their 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 participation 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 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 (March) given 1988-89

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, Aut (March)

166. Organizations and Public Policy—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

SOCIOCIAL THEORY

170. Classics of Modern Social Theory—An in-depth introduction to the works of Locke, Tocqueville, Marx, and Weber. The questions these theorists pose and the answers they offer to fundamental problems of the relationship of individuals to society, the distinctive characteristics of modern societies, and the sources of reason and freedom in social life. (DR:3)

5 units, Win (Hochberg) MWF 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, Spr (Staff) given 1988-89

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) MW 11

180B. Introduction to Sociological Research: Laboratory—Laboratory exercises consider problems of collecting observations, construct-
ing 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 in and intensive experience with basic skills useful in designing social scientific research and in collecting social scientific data. Students design a research project shedding light on some social scientific issue, collect data to answer unresolved questions pertaining to it, and perform preliminary analyses of the data collected during the quarter. Enrollment limited to 20.

5 units, Win (Tuma) given 1988-89

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, Spr (Herting) given 1988-89

INDIVIDUALIZED LEARNING EXPERIENCES, PRIMARILY FOR UNDERGRADUATE MAJORS

190. 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.

1-6 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

194. 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

195. 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

196. Honors Seminar.

2 units, Spr (Staff) W 12

FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS

207. Sociology of Mental Health—Same as 107 with special work for graduate students.

5 units, Spr (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, Aut (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, Spr (Walker) MW 2:15-3:45

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, Spr (Johnston, Berger) T 7-10 p.m.

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 (Berger) given 1988-89

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

231. Theories of International Relations—Survey of the literature on international relations focusing on theories of international conflict; primarily formal theoretical work and quantitative empirical research. Also the more traditional approaches.
5 units, Win (Bueno de Mesquita) given 1988-89

240. Seminar: Social Stratification.
5 units, Spr (Tuma) F 2:15-5:05

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 (E. Cohen) given 1988-89

245. Origin and Diffusion of Mass Education—(Same as Education 245X.) An 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, Win (Ramirez) MWF 10

247. Political Order in Changing Societies—(Same as Political Science 226.) Seminar on the conditions related to the emergence and institutionalization of democracy, and the factors making for instability and breakdown. The analytical and theoretical literature. Case studies in Europe, America, and the Third World.
5 units, Spr (Lipset, Diamond) given 1988-89

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, cooption, 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 measureable 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 both 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.

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. Among the 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.

282. Seminar: Topics in Comparative and Historical Sociology—The comparative and historical approaches to sociological analysis. Topics vary each year.


285. Seminar: Political and Economic Organization of the World System—(Same as Political Science 245.) Current theory and research on the structures 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.

286. Seminar on Institutional Analysis—Reading and research on the nature, origins, and effects of the modern institutional system. Emphasis on the state system.

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.

300A,B,C. Graduate Proseminar—Limited to first-year graduate students in Sociology.

301. Mathematics for Methodology.

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.

310. Sociology of Education—(Same as Education 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.

361. Seminar: Social Psychology of Organizations—(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 Theory—(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 470, Political Science 307.) 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, Win (Martin)

370A,B. Basic Problems in Sociological Theory—A two-quarter course on the logical analysis of theories, and basic strategies of sociological analysis. Basic concepts required for the logical analysis of theories are introduced and used for the analysis of various strategies of sociological analysis in the last six weeks of the Autumn and first six weeks of the Winter Quarter. Each strategy is illustrated by the study of one program of theoretical research starting with its origins in the classical literature and carried to one or more contemporary formulations. The strategies are selected from among functionalism, historical materialism, human ecology, the theory of action, interactionism, behaviorism, decision-theory, and phenomenology. The last four weeks refine and extend the tools of theory construction, and require a self-directed computer course in logic. Prerequisites: Consent of the instructors.

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

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 (Cronkite) TTh 10-1

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) TTh 10-12:30

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 (Tuma) 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 or error structures. Emphasis on the utility of multiple indicator approaches to social measurement.

5 units, Win (Herting) TTh 1:15-2:45


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


2 units, Aut, Win, Spr (Staff)
GRADUATE INDIVIDUAL STUDY

390. Graduate Individual Study.
(Staff) by arrangement

391. Special Colloquia.
(Staff) by arrangement

392. Graduate Research.
(Staff) by arrangement

393. Teaching Apprenticeship.
(Staff) by arrangement

394. Research Apprenticeship.
(Staff) by arrangement

(Staff) by arrangement

CENTER FOR SPACE SCIENCE AND ASTROPHYSICS

Emeriti: (Professors) William A. Bonner, John V. Breakwell, Oscar Buneman, 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. Vesecky
Consulting Professors: Owen K. Garriott, Emery Reeves

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 (Susskind)

50. Astronomy Laboratory and Observational Astronomy—(Enroll in Applied Physics 50.)
   3 units, Aut, Sum (Walker)

100. Introduction to Observational Astronomy and Astronomy Laboratory—(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 110.)
   3 units, Win (Sturrock)

111. Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 111.)
   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, McElroy, Wydevan)

190A,B,C. Independent Study in Astrophysics and Honors Thesis—(Enroll in Astronomy 190A,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 1988-89

235A,B. Space Systems Engineering—(Enroll in Engineering 235A,B.)
   3 units, Win, Spr (Banks, Lusignan)

236. Spacecraft Design—(Enroll in Aeronautics and Astronautics 236.)
   3 units, Win (Reeves)

249. Introduction to Space, Telecommunications, and Radioscience—(Enroll in Electrical Engineering 249.)
   3 units, Aut (Bracewell) given 1988-89

256. Elementary Plasma Physics—(Enroll in Electrical Engineering 256.)
   3 units, Spr (Storey)

260. Geophysical Fluid Dynamics—(Enroll in Mechanical Engineering 260.)
   3 units, Spr (Spreiter)

279A. Space Mechanics—(Enroll in Aeronautics and Astronautics 279A.)
   3 units, Win (Powell)

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)
   3 units, Spr (Breakwell)

279C. Optimal Space Trajectories—(Enroll in Aeronautics and Astronautics 279C.)
   3 units, Spr (Breakwell) alternate years, not given 1988-89

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 (Banks) alternate years, not given 1988-89

350. STAR Laboratory Seminar in Radioscience.
   1 unit, Aut, Win, Spr (Vesecky)

352. Electromagnetic Waves in the Ionosphere and Magnetosphere.
   3 units, Spr (Hellwell)

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
   3 units, Spr (Tyler) alternate years, not given 1988-89

356. Introduction to Plasma Physics—(Enroll in Electrical Engineering 356.)
   3 units, Aut, given 1988-89

   3 units, Spr (Waterman) alternate years, given 1988-89

   3 units, Spr (Sturrock) alternate years, not given 1988-89
3 units, Win (Petrosian) alternate years, not given 1988-89

3 units, Win, Spr (Sturrock) alternate years, given 1988-89

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)
3 units, Spr (Petrosian) alternate years, given 1988-89

368, 369. Gravitation—(Enroll in Physics 368, 369.)
368. 3 units, Win (Dimopoulos)
369. 3 units, Spr (Dimopoulos)

SPANISH AND PORTUGUESE

Emeriti: (Professors) Aurelio M. Espinosa, Jr., Bernard Gicovate, Ronald Hilton, Juan B. Rael, Isabel Magana Schevill; (Assistant Professor), Grace Knopp
Chairman: Michael P. Predmore
Professors: Fernando Alegria, Michael Predmore, Jorge Ruffinelli, Sylvia Wynter
Associate Professors: Mary Louise Pratt (on leave 1987-88), Tomás Ybarra-Frausto
Assistant Professor: Adrienne L. Martín
Senior Lecturers: María-Paz Haro, Karin Van den Dool
Lecturer: María Sandoval
Visiting Professor: Nelson Osorio (Autumn), Françoise Perus (Spring), María Tai Wolff (Autumn), Anthony N. Zahares (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 45 units from courses in the department numbered 100 or higher.

Requirements: Spanish 140, Introduction to Methods of Literary Analysis; 180, Undergraduate Winter Colloquium; 201 and 202, Advanced Grammar and Composition; two courses in Peninsular literature; two courses in Latin American literature. Of all the courses taken, two should be literature prior to 1750.

Recommended: Courses in Chicano literature, linguistics, and literary theory.

Literature and Society Emphasis—The aim of this path is to permit more flexibility to students by allowing them to plan a broader major than is possible in the other areas of concentration. The student can combine the study of Spanish, Portuguese, or Latin American literature with such fields as political science, history, anthropology, and economics. Students must complete a minimum of 35 units in the department from courses numbered 100 or higher, and 25 units in related fields with advisor approval.

Requirements: Spanish 140, Introduction to Methods of Literary Analysis; 180, Undergraduate Winter Colloquium; two courses in Peninsular literature; two courses in Latin American literature.

Chicano Studies Emphasis—The aim of this path is to permit more flexibility to students in Chicano Studies, allowing them to take courses in, for instance, the Departments of Linguistics and History, including optional courses in Chicano Studies. Students must design their program in conjunction with Prof. Ybarra-Frausto. Students will also be expected to acquire an adequate knowledge of the roots of Chicano literature. Candidates must complete 35 units in Chicano Studies. In addition, they must take 25 units in Latin American or Peninsular literature from courses numbered 100 or higher in the department.

Requirements: Spanish 140, Introduction to Methods of Literary Analysis; 180, Undergraduate Winter Colloquium; two courses in Chicano literature; four courses in Latin American and Peninsular literature.
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 45 units from courses in the department numbered 100 or higher. (Language emphasis path not offered 1987-88.)

Requirements: Spanish 201, 202, Advanced Grammar and Composition; Spanish 140, Introduction to Methods of Literary Analysis; Spanish 180, Undergraduate Winter Colloquium; one course in introductory linguistics (in Linguistics Department); three courses in Spanish linguistics.

Recommended: Spanish 208; 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 150. Courses numbered 151-152 (Peninsular literature) and 161-162 (Latin American literature) are introductory survey courses. These satisfy the minimum literature requirements for all the paths. It is recommended that majors enroll directly in 151-152 or 161-162. It is also expected that they will go on to take courses at the 200 level. The core courses will be offered each year.

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 should register with the Department of English.

Extended majors in Spanish and Portuguese may be arranged through the advisor with other departments by taking a minimum of 40 units in Spanish and Portuguese from courses numbered 100 and higher, plus 15 or 20 units in a related field such as history, Latin American studies, etc.

For students in the Honors Program in Humanities, up to six units of that program may be applied toward completion of the Spanish major.

STANFORD PROGRAMS ABROAD

SALAMANCA, SPAIN

Students with two years of college Spanish or the equivalent may spend two quarters in Spain as participants in the Stanford Program at the University of Salamanca. Students reside in residencias de estudiantes and attend University courses and courses given and organized by the Director in Residence. Application forms may be obtained from Overseas Studies (Room 112, Old Union).

The program offers two types of courses: Overseas Studies and courses taught at the University of Salamanca. Special courses for Stanford students include:

Overseas Studies 600, Bases sociopoliticas de la evolución cultural española (5 units)
Overseas Studies 602, Historia de España, s.XIX (4 units)
Overseas Studies 603, Historia de España, s.XX (4 units)
Spanish 201, Advanced Grammar and Composition (3 units)
Spanish 202, Advanced Grammar and Composition (3 units)
Spanish 601, Literatura Española Contemporánea (5 units)

These are required courses for all the students in the Salamanca program. Three of the courses are offered in the Autumn Quarter and three in the Winter Quarter.

Each Stanford student chooses two 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. A Program Tutor guides, supervises, and evaluates students' work for these courses. Courses taught at Salamanca include: Spanish Civilization; Spanish Literature from 1870 to the Present; History of Spain. Students may also enroll in courses given in the Facultad de Filosofía y Letras at the University of Salamanca.

Students may apply up to 20 units at Salamanca toward their majors.

For information and course list, consult Overseas Studies.

LIMA, PERU

SAO PAULO, BRAZIL

Stanford participates in two consortium-based programs in South America: one in Lima, Perú, and one in São Paulo, Brazil. Each is a full-year program beginning early in the summer and continuing through the following June. Students enroll in the Pontificia Universidad Católica del Perú in Lima or at the Universidade de São Paulo in Brazil. For credits in these and other programs abroad, consult your advisor. For information on these programs, con-
sult Overseas Studies. For information on the São Paulo program, consult Dr. Karin Van den Dool.

**INTERNATIONAL SUMMER PROGRAM**

Stanford University offers first-year intensive language study in Spanish and Portuguese during the summer. For further information, consult Paz Haro and/or Karin Van den Dool.

**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 2nd and 3rd 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**

All majors are strongly encouraged to participate in the Departmental Honors Program. In the Honors program, the student works closely with a faculty member on a research project resulting in a 20 page paper. The deadline is the end of the first week in May. Students may sign up for a total of 10 units of directed reading with the faculty member who is directing their project. These units may not count toward the Spanish major, but may count in the total needed for graduation. The project will be read and approved by three faculty members (two in addition to the director). A prize will be awarded for the best Honors project each year. Honors graduates are strongly encouraged to qualify for the Language Proficiency Notation which will appear on their graduation diploma.

**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 (this language may be Portuguese); a long research paper written in consultation with a faculty advisor.

In addition, students may take further units of graduate courses in Spanish or Portuguese and/or approved courses in related fields such as Linguistics, Comparative Literature, Philosophy, History of Art, 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 completed toward the A.M. degree can be counted for the Ph.D.; (2) units should include the following courses or their equivalent: Spanish 201 and 202, Advanced Grammar and Composition; 301, Methods of Teaching Spanish; and 306, Introduction to Literary Theory and Criticism; (3) a reading knowledge of Portuguese and one other foreign language; (4) the qualifying, comprehensive, and 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, please see the "Advanced Degrees" section at the beginning of this bulletin. (For further information, consult the departmental Graduate Student Handbook.)

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 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.

Ph.D. candidates who will be working as teaching assistants 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 sample term paper on the first day of the Autumn Quarter of their second year. This evaluation constitutes the qualifying examination.

After the qualifying examination, students concentrate on the major field of study. After completing course requirements at the end of the third year of study, they take a written comprehensive examination on their major field. This examination is based on a comprehensive list of readings in the candidate's major field. At this time, students also hand in a long research paper to be evaluated by the faculty. For further details, consult the Graduate Student Handbook.

A University oral examination will be taken 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 his or her advisor. The advisor will request the Chairman to appoint a committee to supervise the dissertation. The committee may well advise extra preparation within or outside the department, and time should be allowed for such work. Ph.D. dissertations must be completed and approved within five years from the date of 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 and may not be submitted during the Summer Quarter.

**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 section "Humanities Special Programs" in this bulletin.

Additional courses in literature that may be of interest to graduate students in Spanish may be found in the sections "Comparative Literature" and "Modern Thought and Literature" 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)
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 (210-213)
   - Medieval and Golden Age Literatures (214-235)
   - Modern and Contemporary Literatures (236-245)
   - Latin American Literature (246-279)
   - Genres and Literary Movements (246-259)
   - National Literatures (260-275)
   - Individual Authors (276-279)
   - Chicano Literature (280-289)
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)
SPANISH PROGRAM (1-399)
- Language (1-199)
- Portuguese Literature (210-245)
- Brazilian Literature (246-279)
- Graduate Seminars (300-399)

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.)

INTRODUCTORY

1. First-Year Spanish (1st Quarter)—A proficiency-oriented introduction emphasizing speaking and oral comprehension.
   - 5 units, Aut, Win, Spr (Staff)
   - MTWThF, plus additional work in the language laboratory

2. First-Year Spanish (2nd Quarter)—As above, with additional development of reading and writing skills, and cultural readings. Prerequisite: 1 or equivalent.
   - 5 units, Aut, Win, Spr (Staff)
   - MTWThF, plus additional work in the language laboratory

3. First-Year Spanish (3rd Quarter)—As above, with additional cultural and/or literary readings. Prerequisite: 2 or equivalent.
   - 5 units, Aut, Win, Spr (Staff)
   - MTWThF, plus additional work in the language laboratory

5. Intensive Beginning Spanish—A proficiency-oriented approach focusing on listening, speaking, reading, and writing, and on cultural aspects of Spain and Spanish America. Meets three hours per day and for special activities: "Spanish Table", movies, etc. Enrollment limited to 15. No auditors permitted. Not equivalent to 1, 2, and 3.
   - 9 units, Sum (Haro) MTWThF

10. Elementary Conversation—Recommended as a complement to Second Year courses. Prerequisite: 3 or equivalent. Given Pass/No Credit only.
    - 3 units, Aut, Win, Spr (Staff) MWF

11. Second-Year Spanish (1st Quarter)—Intensive review of grammatical concepts; composition and conversation based on primarily cultural and literary readings. Prerequisite: 3 or Placement Test.
    - 4-5 units, Aut, Win, Spr (Staff) MTWThF

12. Second-Year Spanish (2nd Quarter)—Continuation of 11. Prerequisite: 11 or Placement Test.
    - 4-5 units, Aut, Win, Spr (Staff) MTWThF

13. Second-Year Spanish (3rd Quarter)—Application of grammatical concepts to composition, conversation, and oral presentation. Prerequisite: 12 or Placement Test.
    - 4-5 units, Aut, Win, Spr (Staff) MTWThF

50. Intermediate Conversation—Recommended as a complement to Second Year courses. Prerequisite: 3 or equivalent. Given Pass/No Credit only.
    - 3 units, Aut, Win, Spr (Staff) MWF

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.)

SPECIAL

1S,2S,3S. First-Year Individualized Spanish—Particularly suited to students who wish to complete more or less than five units a quarter, have an uneven background in Spanish, or have scheduling conflicts. 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. Any student who completes more than one course (5 units) of 1S/101S, 2S/102S, 3S/103S is required to attend 10/110, or pass a first year oral proficiency examination.
    - 1-15 units, Aut, Win, Spr (Staff)

15. Reading Spanish—Intensive course designed for those seeking to fulfill the University requirement of a reading knowledge of Spanish. Students must earn at least a letter grade indicator of "B."
    - 3 units, Sum (Staff)

21M. Spanish for Medical Personnel—(Graduates register for 121M; same as Family, Community, and Preventive Medicine 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, Win (Staff)

22M. Spanish for Medical Personnel—(Graduates register for 122M; same as Family, Community, and Preventive Medicine 281.) Continuation of 21M. Prerequisite: 21M or equivalent.
    - 3 units, Win (Staff)
23M. Spanish for Medical Personnel—(Graduate students register for 123M; same as Family, Community, and Preventive Medicine 282.) Continuation of 23M. Prerequisite: 22M or equivalent.
3 units, Spr (Staff)

24. Business Spanish—(Graduates register for 124.) A survey of oral and written business communication recommended for students who plan a career in business. Prerequisite: 11 or equivalent.
3 units, Aut (Staff)

99. Individual Work—Cannot be taken as a substitute for any of the regularly scheduled language courses.
1-5 units (Staff) by arrangement

101S, 102S, 103S. First-Year Individualized Spanish for Graduate Students—(See 1S, 2S, 3S.)

121M. Spanish for Medical Personnel for Graduate Students—(See 21M.)

122M. Spanish for Medical Personnel for Graduate Students—(See 22M.)

123M. Spanish for Medical Personnel for Graduate Students—(See 23M.)

124. Business Spanish for Graduate Students—(See 24.)

125. Spanish for the Professions—Prepares students for the departmental proficiency exam which must be passed in order to obtain the official transcript notation certifying foreign language proficiency. Prerequisite: 13 or equivalent.
3-5 units, Win (Staff)

FOR BILINGUAL STUDENTS

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 (Sandoval) MTWTh

The following courses are designed to meet the specific linguistic and cultural needs of the bilingual student above the second year level. Readings and topics for conversation and composition begin with a focus on the Mexican-Chicano, Puerto Rican, and Cuban heritages, and expand to include socio-cultural and historical material from Latin America and Spain. The aim of this sequence is to develop a critical perspective on issues affecting a bilingual-bicultural reality. Prerequisite: Permission of instructor. For special courses in Chicano literature and history, see courses numbered 280-289.

130B, 131B, 132B. Cultural Readings—Art, current events, folklore, history, language, and literature of Mexico and the Hispanic Southwest (130B), of Spanish America (131B), and of Spain (132B). Lectures supplemented by slides, movies, tapes, and occasional field trips. For Spanish majors and others interested in the culture of Spanish speakers.

130B. Mexican and Chicano Cultural Readings—(DR:2)
3-5 units, Spr (Sandoval)

131B. Hispanic American Cultural Readings—(DR:2)
3-5 units, Aut (Sandoval)

132B. Spanish Cultural Readings—(DR:2)
3-5 units, Win (Haro)

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 criticism and a variety of critical approaches to literature. Literary texts are discussed in light of readings in literary theory and criticism. Emphasis varies with individual instructors, but teaches students to read, write, and think about literature. Prerequisite: 13 or equivalent. (DR:2)
3-5 units, Aut (Ybarra-Frausto)
145. The Spanish Republic, the Civil War, and the Aftermath—Cultural aspects from the Second Republic to the reign of Juan Carlos I (1932- present) emphasizing writers' responses to the Spanish Civil War. Authors: Hemingway, Hernández, Lorca, Machado, Neruda, Orwell, Sender, and J. Goytisolo. Also, the International Brigades, the death of Lorca, the construction of the Valley of the Fallen, and Picasso's Guernica.

3-5 units (Predmore)

151,152. 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.

151. 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, Gáciás, Cervantes, González, Lope de Vega, Calderón. (DR:2)

3-5 units, Win (Martin)

152. 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 García 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 (Predmore)

161,162. Spanish American Literature—Basic introductions to Spanish American literature. Major works from several periods and genres and prepares the student for more specialized 200 level courses. Need not be taken in sequence. Content varies each year. Given annually. Prerequisite: 13 or equivalent.

161. 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 (Ybarra-Frausto)

162. Spanish American Literature II—Continuing 161, focuses on literary periodicals to examine an emerging cultural debate. (DR:2*)

3-5 units, Spr (Ruffinelli)

180. Undergraduate Winter Colloquium: An Introduction to the Elements of Lyric Poetry—Representative poems from modern Hispanic poetry (Bécquer, Dario, Unamuno, Lorca, Neruda) illuminating figurative language, image, symbol, metaphor, irony, meter, meaning, idea. Poems in Spanish: basic text required in English.

3-5 units, Win (Predmore)

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. Open to all students.

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 1987-88

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.)

5 units, Aut (Islas)

FOR ADVANCED UNDERGRADUATES AND GRADUATES

ADVANCED LANGUAGE AND LINGUISTICS

201. Advanced Grammar—Problems of grammar at an advanced level.

3 units, Aut (Martin)


3 units, Win (Sandoval)

204. Creative Writing Workshop—Writing in Spanish or English. Admission by consent of instructor.

3-5 units, Aut (Alegria)


3-5 units, Aut (Martin)

PENINSULAR LITERATURE

210. Lyric Poetry in the Renaissance and the Baroque—Major Spanish poets of the 16th and 17th centuries focusing on the popular tradition
and the emergence and development of new poetic genres. The poetry of love, metaphysics and humor: García Lasso, Boscán, Cervantes, Fray Luis de León, Lope de Vega, Góngora, Quevedo, and Sor Juana.

211. The Spanish Golden Age—The literature and thought which flowered in 16th and 17th century Spain and Spanish America in the wake of the 1492 event and the rise of the first world empire.

3-5 units (Wynter)

212. Literary Theory and The Golden Age comedia—A new approach to the comedia and its related critical literature by arguing that both discourses find their referential constant not in the social context, but rather in the abduction systems from which all three "texts," i.e. the literary, critical, and social, are generated. Knowledge of Spanish and the Golden Age comedia helpful. The texts have been translated into English or translated extracts are provided.

3-5 units (Wynter)


3-5 units

214. La Celestina—Fernando de Roja's masterpiece and the major criticism of this text. Other topics: the situation of the conversos in 15th century Spain and the development of the figure of the go-between or alcahueta.

3-5 units (Gicovate)


3-5 units, Win (Zahareas)

216. El cuento fantastico hispanoamericano—"The fantastic" in the 20th century short story of Latin America emphasizing the polemical theme of "magical realism."

3-5 units, Spr (Ruffinelli)

217. The Literature of Deviance: From the Picaresque to the Criminal Autobiography.

3-5 units, Win (Zahareas)

LATIN AMERICAN LITERATURE

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)

242. La Poesia Vanguardista Hispanoamericana—Main trends and tendencies in the evolution of Vanguard poetry and poetic theory in Latin America.

3-5 units (Ruffinelli)

247. El cuento fantástico hispanoamericano—"The fantastic" in the 20th century short story of Latin America emphasizing the polemical theme of "magical realism."

3-5 units, Spr (Ruffinelli)

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 (Wynter)

249. El modernismo hispanoamericano—The renewal of the language and literature of Spanish America in the social and political context of the beginning of the 20th century.

3-5 units, Spr (Perus)

250. Latin American Theater: Theory and Practice—(Graduate students enroll in 350.) The development of Latin American theater from pre-Colombian times to the present. Emphasis on recent trends in socially committed theater. Reading and interpretation of dramatic texts.

3-5 units, Spr (Ybarra-Frausto)

251. Taller de Teatro: Theater Workshop—Current theater esthetics in the dramatic production of Latin America and of Spanish-speaking groups within the U.S. emphasizing popular theater and vanguard experiments. A group class in which the participants experience the many aspects of mounting a production.

3-5 units (Ybarra-Frausto)

253. El Cuento Contemporáneo—A variety of younger short story writers from Mexico, Central, and South America.

3-5 units (Ruffinelli)

254. Spanish American Writings of the 20's and 30's: Vanguardismo, Regionalismo, Feminismo—A study of these developments in culture in connection with processes of urbanization, modernization, and North American expansionism.

3-5 units (Pratt) given 1988-89

257. La crítica literaria hispanoamericano—Latin American currents in literary criticism of the 20th century. Focusing on major Latin American critics and their work.

3-5 units, Aut (Ruffinelli)

258. La actual narrativa hispanoamericana—The culture of the periphery and the legacy of the Enlightenment in America.

3-5 units, Aut (Osorio)

259. The Modern Spanish American Novel—Readings and analysis of the works of Roberto Arlt, J.J. Arreola, Juan Carlos Onetti, Mario Benedetti, and Gustavo Sainz.

3-5 units (Ruffinelli)

260. The Culture of Fear in Latin America—(Same as Portuguese 366.) Latin American cultural production under the restrictive conditions imposed by the authoritarian military regimes of the 1970's and '80's, especially Brazil and the southern cone. Poetry, novel, lyrics, and films focus on the uses of testimony, allegory, parody, and humor, and such topics as the representation and displacement of violence; recodings of the gender system, symbolizations of the state; how specific characteristics of power structures determine cultures of resistance; the role of the U.S. and the West in producing the discourse and technology of terror. Prerequisite: Reading knowledge of Spanish and Portuguese.

5 units

CHICANO STUDIES

280. Introduction to Chicano Literature—Selected works by major Chicano writers of the 20th century, including poetry, fiction, and drama. Introduction to questions of genre and textual interpretation emphasizing the sociohistorical and cultural context of Chicano literature.

3-5 units (Ybarra-Frausto)

281. History of the Chicanos in the U.S.: 19th Century Roots and 20th Century Developments. 3-5 units

283. Chicano Poetry—Main trends and tendencies in the evolution of Chicano poetry and some of its singular characteristics: bi-linguality, social context, and relationship to Anglo-American and Latin American poetics.

3-5 units

284. Chicano Narrative—Aspects of narrative theory related to principal Chicano authors in the short story and the novel. Historical development of Chicano fiction from the 19th century to the present.

3-5 units

285. Chicano Theatre—The contemporary Chicano theater movement emphasizing the idea of popular theater. Focusing on Teatro Campesino and Teatro de la Esperanza.

3-5 units (Ybarra-Frausto)

286. 19th Century Chicano Literature—The various genres of Chicano literature from the 19th Century, oral and written. Emphasis on the impact of Mexican and Anglo-American literary expressions on the development of Chicano literature.

3-5 units

287. Chicano Literature in a Comparative Context—Situates and analyzes Chicano literature within the context of diverse world literatures.

3-5 units

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.

3-5 units (Pratt) given 1988-89

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 (300-399)
Open to undergraduates by permission 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) MWF

306. Introduction to Literary Theory and Criticism—Initial readings in the major currents of 20th century literary theory and criticism. Roughly chronological beginning with the Russian Formalists, and moving on to Bakhtin, Auerbach, reader response, feminist criticism, marxist approaches, semiotics. All readings in English.
4-5 units (Pratt)

307. Readings in Latin American Criticism—Selections from the principal figures in Latin American literary and cultural studies. Organized around topics such as modernismo, the dictator novel, indigenismo, mass culture, the politics of the vanguard.
4-5 units (Pratt)

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.
4-5 units (Pratt)

326. Don Quijote I: The Historical Function of Madness—(See 226.) For graduate students.
3-5 units, Win (Zahareas)

327. Don Quijote II—(See 227.) Continuation of 326.
3-5 units, not given 1987-88

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, Kruasism, pure poetry, and symbolic system.
3-5 units (Predmore)

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)

346. Juan Rulfo: Texto y Contexto—Close reading and analysis of the narrative works of Juan Rulfo in a social context.
3-5 units (Ruffinelli)

349. Literatura latinoamericana del exilio—A critical study of testimonial literature: García Márquez, Galeano, Argueta.
3-5 units, Win (Alegría)

350. Latin American Theater: Theory and Practice—(Same as 250.) For graduate students.
3-5 units, Spr (Ybarra-Frausto)

3-5 units (Alegría)

353. Onda y Escritura en Mexico—Main line; in the development of literary production in Mexico since 1968. Examination of the aesthetic and textual practices of writers identified with “La Onda” (Jose Agustín, Gustavo Saenz, García Saldaña Parmenides) etc. Analysis of key works by the younger generation of writers (Luis Zapata, Armand Ramirez, Cristina Pacheco) in this social historical context.
3-5 units (Ybarra-Frausto)

3-5 units

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 (Alegría)
358. Latin American Writings in the 19th Century II—The 19th century Spanish American exiles in England and France. Readings from poetry and fiction of Argentina, Mexico, Cuba, Columbia, and Chile.
3-5 units (Alegria)

364. La Novela del Dictador—In the context of contemporary Latin American history, Augusto Roa Bastos, Alejo Carpentier, and Gabriel García Márquez focused on the theme of the dictator. Emphasizes a close reading and discussion of this theme in Latin American literature in the 20th century.
3-5 units (Alegria)

365. Autobiografia hispanoamericana del siglo XX: Darío, González Martinez, Pablo Neruda and Matilde Neruda—Memory as a creative instrument in four autobiographies that describe decisive movements in the literary and social history of Latin America.
3-5 units, Win (Alegria)

379. El viaje a la selva en la novela hispanoamericana de los siglos XIX y XX—Examines four Latin American novels: María, La corvínge, Mamita y unai, and Los pasos perdidos.
3-5 units, Win (Alegria)

390. Salvador Allende: The Makings of a Biography—A critical reading of sources, documents, letters, interviews, books, etc., related to the life and death of President Allende.
3-5 units, Aut (Alegria)

395. Metodología de la investigación y de la crítica—Workshop for dissertation level students emphasizing methodological problems in writing of the dissertation.
3-5 units, Aut (Osorio, Ruffinelli)

398. Vanguardia literaria y cambio social en América latina—The literature of the avant-garde in Latin America and its implications with the economical, political, and social changes in the decade of the 20's.
3-5 units, Spr (Perus)

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

2. First-Year Portuguese (2nd Quarter)—As above, with additional development of reading and writing skill. 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)—As above, 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—Proficiency-oriented preparation in listening, comprehension, speaking, reading and writing, and presentation of various cultural aspects. Meets daily for three hours; language laboratory practice required. Special activities such as a "Portuguese table," movies, etc. throughout the quarter. Enrollment limited to 15. No auditors permitted.
9 units, Sum (Van den Dool) MTWThF plus language laboratory

10. Elementary Conversation—(Graduates register for 110.) 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: 3 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

50. Intermediate Conversation—Recommended as a complement to 11 and 12. Prerequisite: 3 or equivalent. Given Pass/No Credit only.
3 units, Aut, Win (Staff) MWF
99. Individual Work—Cannot be taken as a substitute for any of the regularly scheduled language courses.

1-5 units (Van den Dool) by arrangement

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

109. Portuguese for Speakers of Spanish—
Accelerated one-quarter course for beginners with advanced knowledge of Spanish. Designed to give reading competence in Portuguese for research and courses in Luso-Brazilian studies. Includes some practice in speaking (if taken for 5 units) and comprehension.

3 units, Aut, Spr (Van den Dool) MWF

110. Elementary Conversation for Graduate Students—(See 10.)

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 elect for 5 units and write weekly compositions.

3-5 units, Win (Van den Dool) MWF

199. Individual Work—Enrollment only by permission. Prerequisite: 13 or equivalent.

1-5 units (Staff) by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE (200-299)

240. Portuguese Literature—Main currents of the literature of Portugal. Major authors and socio-esthetic ideas from the 12th century to the present.

3-5 units

246. Brazilian Writing in the 1970's and 1980's—A study of the first signs of postmodernism in Brazilian poetry, focusing on its aesthetic and political dilemmas. The fall of High Modernism, the committed poetry of the 60's, the emergence of the new minimalism in the young poetry and the outburst of the women's vanguard in the 70's. Theoretical readings include Jameson, Habermas, P. Burger, Huyssens, and Hall Foster.

3-5 units

267. Brazilian Literature I: Modern Brazilian Fiction—Major works of Brazilian fiction from Machado de Assis to the contemporary scene (1885-1985). Emphasis on literary experiment and innovation, the relation of literature to its socio-historic moment, and issues in narrative theory. Readings in Portuguese and English.

3-5 units, Aut (Wolff)

268. Brazilian Literature II—Survey of literary trends and authors of Brazilian literature.

3-5 units

271. Brazilian Cinema—Brazil cinema from the 60's to the 80's. The new film of the political opening period.

3-5 units

299. Individual Work—May be repeated for credit. Open to graduates or undergraduates who are majoring in Spanish.

1-12 units (Staff) by arrangement

GRADUATE SEMINARS (300-399)

341. Seminar on Fernando Pessoa.

3-5 units

366. The Culture of Fear in Latin America—
(Same as Spanish 266.) Latin American cultural production under the restrictive conditions imposed by the authoritarian military regime of the 1970's and 80's, especially Brazil and the southern cone. Poetry, novel, lyrics, and film focus on the uses of testimony, allegory, parody, and humor and such topics as the representation and displacement of violence; readings of the gender system, symbolizations of the state, how specific characteristics of power structure determine cultures of resistance; the role of the U.S. and the West in producing the discourse and technology of terror. Prerequisite: Reading knowledge of Spanish and Portuguese.

5 units

378. Seminar on Brazilian Modernism.

3-5 units

399. Individual Work—Exclusively for graduate students in Portuguese engaged in special work.

1-2 units, by arrangement
Emeritus: Rosedith Sitgreaves
Chairman: Herbert Solomon
Professor of Biostatistics: Byron W. Brown
Associate Professor: Iain M. Johnstone
Assistant Professors: Anindita Adhikari, Thomas DiCiccio, James A. Fill, Art B. Owen, Joseph P. Romano, Anne G. Sheehy
Courtesy Professor: 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), Family, Community, and Preventive Medicine (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 graphics 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 statistics 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 opera-
tions 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 statistics courses required for the M.S. degree (116, 200, 217, 218, and three additional courses) which are offered for letter grades must be taken for letter grades.

MASTER OF SCIENCE:
DATA ANALYSIS AND
STATISTICAL COMPUTING

The goal of this program is to teach data analytic procedures and their applications to real world problems. Special emphasis is placed on the use of computers and on the design of efficient algorithms for statistical computations. The program is thus more practically oriented than the Ph.D. program and mathematically less demanding. The degree is a terminal degree. Students planning to obtain the Ph.D. degree are advised to apply directly to the Ph.D. program.

Upon entrance to the program, students are expected to have proficiency on the level of Statistics 116, 200, and Computer Science 106A. Students lacking in one or both of these areas should enroll in and complete these courses prior to entering the program. These background courses are offered during the Summer Quarter as well as during the academic year. Experience in practical applications of statistics and/or a background in mathematical sciences is advantageous.

The course requirement is 42 units of work from offerings in the Statistics Department or from authorized courses in other departments. At least half the units taken for this degree must be from offerings in the Statistics Department. Each student will normally fulfill the following requirements for the degree:

2. Mathematics 113 or 103, and Computer Science 110.
3. Additional units to complete the requirements are normally taken from the group of courses Statistics 205, 206, 207, 217, 218, Computer Science 135 or 237A, B, C, 248A, B, Operations Research 240.
4. Each student is required to work on a practical project (incorporated in 3 units of Statistics 266). This can be the development of a reasonably sophisticated computer program or the application of statistical procedures to a current data analytic problem.

A 2.75 letter grade indicator will be required for all statistics courses required for the M.S. degree in Data Analysis and Statistical Computing. All courses which are offered for letter grades must be taken for letter grades.

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 as part of their program to obtain experience 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

**60. 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 packages are used. Students cannot receive credit for both Statistics 60 and Psychology 60. (DR:6)

5 units, Aut (Moses) MTWThF 1:15

Win (Solomon) MTWThF 1:15

Spr (Switzer) 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 (Moses) MWF 1:15

**70. Biostatistics**—(Enroll in Family, Community, and Preventive Medicine 202.) Statistical reasoning and basic methods. Applications to biology and medicine. Prerequisite: High school algebra.

3 units, 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 (Lai) MTWF 10
Spr (Sheehy) MTWF 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)

4 units, Win (Lieberman)

160. Introduction to Statistical Methods I — (See 60.) For graduate students.
5 units, Aut (Moses) MTWThF 1:15
Win (Solomon) MTWThF 1:15
Spr (Switzer) MTWThF 1:15
Sum (Staff) MTWThF 1:15

161. Introduction to Statistical Methods II — (See 61. For graduate students.)
5 units, Win (Moses) 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 (Lat) MTWF 11
Win (Owen) MTWF 11

CONTINUATION

Courses in this category have been designed for particular use in applications. Generally, they have introductory statistics or probability as prerequisites.

5 units, Win (Romano) MTWThF 2:15

201B. Data Analysis II — Classification and discriminant analysis. Dimensionality reduction. Principal components, factor analysis, multi-dimensional 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 (DiCiccio) MW 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 (Adhikari) MWF 3:15
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, Win (Johnstone) MWF 3:15

205. Introduction to Nonparametric Statistics—Nonparametric analogs of the one- and two-sample t tests and analysis of variance: the sign test, median test, Wilcoxon's tests, and the Kruskal-Wallis and Friedman tests, tests of independence. Nonparametric confidence interval estimates. Prerequisites: 200. (Concurrent registration in 200 is permitted.)
3 units, Spr (Johns) MWF 11

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, alternate years, given 1988-89

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, alternate years, given 1988-89

209. Quantitative Methods and Their Application to Public Policy—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, Aut (Fill) MWF 2:15
Win (DiCiccio) 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 (Fill) MWF 2:15
Spr (Cover) MWF 10

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

3 units, Win (Staff) MWF 1:15

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 (Staff)
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 (Siegmund) MWF 1:15
230B. 3 units, Win (Siegmund) MWF 1:15
230C. 3 units, Spr (Adhikari) MWF 1:15

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 (Efron) MWF 2:15

236A,B,C. Theoretical Statistics—Decision theory; minimax and Bayes solutions, the concepts of admissibility and invariance. Bounds for the variance of estimators, maximum likelihood estimation, exponential families, tests of hypotheses, confidence intervals. Neyman-Pearson theory, large sample theory, sequential analysis, multiple decision problems. Prerequisite: 200.

236A. 3 units, Aut (Stien) MWF 9
236B. 3 units, Win (Stien) MWF 9
236C. 3 units, Spr (Stien) MWF 9

240. Linear Programming—(Enroll in Operations Research 240.) Treats 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)
stationary and first passage distributions for Markov chains and processes. Martingales; introduction to potential theory. Examples from queueing, risk theory, branching processes, nonparametric statistics, and sequential analysis. Prerequisite or corequisite: 230A.

317. 3 units, Aut (Fill) MWF 11
318. 3 units, Win (Fill) MWF 11

3 units, Win (Anderson) MWF 11

326A. Sequential Analysis—The Wald sequential probability ratio test, operation characteristics and applications. General theory of optimal stopping with applications to sequential statistical decision problems.
3 units, alternate years, given 1988-89

328A. Nonparametric Statistical Inference—Statistical inference without strong model assumptions; hypothesis testing and estimation using permutations and ranks; nonparametric model-fitting, tolerance limits, discriminant analysis, and analysis of variance.
3 units, Aut (Johns) MWF 11

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, Win (DiCiccio) MWF 1:15

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, Spr (Romano) MWF 1:15

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 1988-89

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

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 1988-89

3 units, Win (Lai) 11-12:15

3 units, Spr (Hillier)

3 units, Win (Glynn)

3 units, given 1988-89

376. Information Theory—(Same as Electrical Engineering 376A.) Information Theory and

3 units, Aut (Cover) TTh 2:45-4:00

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 Manell (History)
Professor: N. Gregson Davis (Classics, on leave)
Lecturers: George Cattermole, Suzanne Greenberg, Leigh Sealy (Drama), Amy Sims
Coordinator: Suzanne Greenberg (History)

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 for the freshmen year; 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**

Interested freshmen should apply for SLE during the summer preceding the academic year in which they will enroll.

SLE is designed as a three-quarter sequence, and all students applying should be willing to make a commitment for the entire program, although a student can withdraw from the program at any time.

**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 nine-unit course. Autumn Quarter concentrates on the Greeks from Homer through Aristotle; Winter Quarter focuses on the Renaissance through the Scientific Revolution; and Spring Quarter treats the modern Western world. Completion of the SLE Program satisfies the Western Culture Requirement (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 3:15-5:15 and TWTh 7-9 p.m.
92. 9 units, Win (Staff) TWTh 3:15-5:15 and TWTh 7-9 p.m.
93. 9 units, Spr (Staff) TWTh 3:15-5:15 and TWTh 7-9 p.m.

**PROGRAM IN SYMBOLIC SYSTEMS**

Chairman: Jon Barwise (Philosophy)
Program Committee: John Etchemendy (Philosophy), Martin Kay (Linguistics), Helen Nissenbaum (Program Coordinator, on leave), P. Stanley Peters (Linguistics), Stuart T. Reges (Computer Science), Paul Rosenbloom (Computer Science and Psychology), Thomas Wasow (Linguistics and Philosophy), Terry Winograd (Computer Science, on leave)
Affiliated Faculty: Joan Bresnan (Linguistics), Herbert H. Clark (Psychology), John McCarthy (Computer Science), Nils J. Nilsson (Computer Science), John Perry (Philosophy), Ivan A. Sag (Linguistics), Solomon Feferman (Mathematics)
Affiliated Consulting Faculty: Phil Cohen (Linguistics), Pat Hayes (Computer Science), David Israel (Philosophy), Ron Kaplan (Linguistics), Lauri Karttunen (Linguistics), Ray Perrault (Philosophy), Stan Rosenschein (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 intelligently in the world. The notions of symbol, repre-
sentation, 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 like English?

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

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 both a core of 11 or 12 required courses (see core courses listed below) and a concentration consisting of four or five additional courses.

Students may select from the list below, or design their own concentrations in consultation with their advisors.

Artificial intelligence
Cognition
Computation
Logic
Natural Language
Philosophical Foundations

Semantics
Speech

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

The core consists of 11 or 12 courses. Students are required to take 106B or 106X, 108A,B, and 224 (in Computer Science); 80 and 160A (in Philosophy); and 107 (in Psychology). In addition, students must take either 154 (in Computer Science) or 160B (in Philosophy); 180 or 186 (in Philosophy); and either 120 and 130 or 220A,B and 230 (in Linguistics).

80. Mind, Matter, and Meaning—(Enroll in Philosophy 80.) A writing focus course.
  5 units, Aut (Bratman)
  Spr (Beardsley)

106B,X. Introduction to Software Engineering—(Enroll in Computer Science 106B or 106X.)
  106B. 5 units, Aut, Win (Staff)
  Spr (Reges)
  106X. 5 units, Aut (Gorin)
  Win (Staff)
  Spr (Gorin)

106B. Introduction to Software Engineering—(Enroll in Computer Science 106B or 106X.)
  106B. 5 units, Aut, Win (Staff)
  Spr (Reges)

  108A. 5 units, Spr (Staff)
  Aut, Win (Rogers)
  108B. 5 units, Aut, Win, Spr (Wilson)

120. Introduction to Syntax—(Enroll in Linguistics 120.)
  4 units, Win (Zwicky)

130. Introduction to Semantics and Pragmatics—(Enroll in Linguistics 130.)
  4 units, Spr (Staff)

154. Introduction to Automata and Complexity Theory—(Enroll in Computer Science 154.)
  4 units, Win (Ullman)
  Spr (Rogers)

160A. First Order Logic—(Same as Philosophy 160A.)
  4 units, Aut (Devlin) MWF 9
  Win (Etchemendy) 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 (Etchemendy)

186. Philosophy of Mind—(Enroll in Philosophy 186.)  
4 units, Spr (Perry)

220A, B. Syntactic Theory—(Enroll in Linguistics 220A, B.)  
4 units, Aut, Win (Mohanon, Wasow)

224. Introduction to Artificial Intelligence—  
(Enroll in Computer Science 224.)  
3 units, Win (Rosenbloom)  
Spr (Jones)

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 on the notions of symbol, representation, information, and action from the perspectives of artificial intelligence, linguistics, logic, philosophy, and psychology at the heart of the study of computer systems, robots, and people; agents that use language to represent the world around them so as to communicate and act intelligently. Videotaped. Check Time Schedule for organizational meeting.

1 unit, any quarter

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 (Zalta) TTh 3:15-4:30

101. Introduction to Information and Intelligence—(Same as 1.) For graduate students.

150. Computational Linguistics—An introduction to the basic tools and techniques of computational linguistics. Students write a number of programs in LISP to solve linguistic problems, mainly in lexicography, phonology, morphology, and syntax. Recommended: Some experience in linguistics or computer programming.  
4 units, Spr (Staff) TTh 8:45-10

190. Senior Honors Tutorial.  
1-5 units, any quarter (Staff) by arrangement

PROGRAM ON URBAN STUDIES

Director: Leonard Ortolano (Professor of Civil Engineering, on leave 1986-87)  
Acting Director: Lyna Wiggins (Assistant Professor of Civil Engineering)  
Chairman: Paul Turner  
The Committee on Urban Studies: Albert Camarillo (Associate Professor of History), Nancy Tuma (Professor of Sociology), Paul Turner (Associate Professor of Art), Sylvia Yanagisako (Associate Professor of Anthropology)  
Lecturers for Adjunct Courses: Gerald Gast, Susan Goltsman, Daniel Iacofano, Randall Rossi, 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 critically 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—linking a planning or policy analysis masters, for example, with a business or law degree.

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 for approval prior to the end of the student's junior year.

**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 prerequisite 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.
120. Utopia and Reality in Modern Urban Planning.
130. Urban Politics or
141. Race, Ethnicity, and Gender in American Urban Society: History and Public Policy.
143. Undergraduate Colloquium: Race and Ethnicity in American Cities—History and Public Policy.
150. Urban Sociology or
151. Urban Growth and Change.
160. Urban Problems in Anthropological Perspective or
161. Women in Cities: A Cross-Cultural Perspective
170. Introduction to Urban Design or
171. Urban Design Studio.
180. Introduction to Urban Planning or
181. Environmental Planning.

**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)**

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economics I. Elementary Economics</td>
<td>5</td>
</tr>
<tr>
<td>Economics 51. Economic Analysis I</td>
<td>5</td>
</tr>
</tbody>
</table>

**MAJOR REQUIREMENTS (25-27 units)**

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Earth Science 130.</td>
<td></td>
</tr>
<tr>
<td>Environmental Earth Sciences</td>
<td>6</td>
</tr>
<tr>
<td>Civil Engineering 234. Land Use</td>
<td>3</td>
</tr>
<tr>
<td>Planning and Control</td>
<td></td>
</tr>
<tr>
<td>Computer Sciences 105A. Introduction</td>
<td>4</td>
</tr>
<tr>
<td>to Computers</td>
<td></td>
</tr>
<tr>
<td>Applied Microeconomics—select one of the following: Economics 148, 150, 155; Civil Engineering 221.</td>
<td></td>
</tr>
<tr>
<td>Statistics—select one of the following: Statistics 60, 110; Sociology 182; Psychology 60 or 153.</td>
<td></td>
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</tbody>
</table>

**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 I and Economics 51).

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Applied Earth Sciences 131.</td>
<td></td>
</tr>
<tr>
<td>Environmental Earth Sciences II</td>
<td>5</td>
</tr>
<tr>
<td>Applied Earth Sciences 132.</td>
<td></td>
</tr>
<tr>
<td>Environmental Earth Sciences III</td>
<td>5</td>
</tr>
<tr>
<td>Sociology 181. Research Design</td>
<td>5</td>
</tr>
<tr>
<td>and Data Collection</td>
<td></td>
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<tr>
<td>Civil Engineering 135. Transportation</td>
<td>3</td>
</tr>
<tr>
<td>Policy</td>
<td></td>
</tr>
</tbody>
</table>

**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>
</tbody>
</table>

At least two courses on the history of architecture (or architecture and art) offered by the Department of Art (100 level or above).

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>
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<tbody>
<tr>
<td>Civil Engineering 150. 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:

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Mechanics. Statics</td>
<td>3</td>
</tr>
<tr>
<td>Math 19. Calculus and Analytic Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Math 20. Calculus and Analytic Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Math 21. Calculus and Analytic Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Physics 21. Mechanics and Heat</td>
<td>4</td>
</tr>
</tbody>
</table>

Students seeking exposure to orthographic projection, sectioning, and other aspects of technical drawing should take Mechanical Engineering 103D, Engineering Drawing.

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 policy formulation.

4 units, Aut (Stout) MW 3-4

115. Seminar: Utopia and Reality in Modern Urban Planning—(Enroll in Art 280.) The origins of the contemporary urban situation emphasizing the culture of 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 3-5


5 units, Spr (Riordan) MTWThF

130. Urban Polictics—(Graduate students enroll in Urban Studies 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) alternate years, given 1988-89

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, Spr (Sipel) T 3-5 plus periodic Th 3-4

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, Iacofano) alternate years, given 1988-89

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, Win (Camarillo) MTWThF 10 alternate years, given 1988-89

143. Undergraduate Colloquium: Race and Ethnicity in American Cities—History and Public Policy—(Enroll in History 262A.)

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

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. Course 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, Aut (Connell) MWF 1:15 alternate years, given 1988-89

151. Urban Growth and Change—(Enroll in Sociology 154.) Cities and towns continually change in size, density, composition, and internal organization. The causes and consequences of changes. The processes of change in a city as a whole; the other on 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, Win (Tuma) TTh 1:15-3:05

160. Urban Problems in Anthropological Perspective—(Enroll in Anthropology 146.) A series of issues derived from current urban problems examined from the cross-cultural perspective of anthropology. Topics: the social consequences of crowding, rural-urban migration, pre-industrial urbanism, changing family and kinship patterns, urban ethnic communities and inter-ethnic relations, urban poverty and stratification, and crime.

5 units, Win (Yanagisako) alternate years, given 1988-89

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, Spr (Yanagisako) MWF 11

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 re-
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.

4 units, Win (Rickford)

171. Urban Design Studio—(Undergraduates enroll in Art 168B; graduates enroll in Urban Studies 271.) 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: 170. Enrollment limited to 14.

5 units, Win (Gast) T 10-12 and 7-9 p.m. plus two required Sat. workshops

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, Aut (Goltsman, Iacofano) Th 2:15-5:05

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 (Wiggins) MWF 10

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 alternate years, given 1988-89

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 (Rossi) TTh 9-10:30


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

184. Facility Siting—(Enroll in Civil Engineering 239.) Site selection procedures for facilities which are difficult and controversial to locate because of their social and environmental externalities: landfills, hazardous waste sites, conventional power plants, and alternative energy systems. Siting techniques including constraint mapping, optimization procedures, and decision analysis. New planning strategies, including environmental dispute resolution. Pre-requisite: Civil Engineering 234 or consent of instructor.

3 units, Spr (Wiggins) MWF 10

185. Microcomputers in Urban and Environmental Planning—(Enroll in Civil Engineering 225.) Current applications of microcomputer
technology in the design professions and other businesses and agencies concerned with the built environment and urban services. Software programs study word processing, spreadsheets, Land Management Systems (LMS), and statistical mapping as they pertain to architecture, construction, urban design, environmental planning, and city planning. Organizational changes which may occur in response to technological innovations and future directions in the field. Prerequisite: Computer Science 105 or consent of instructor.

4 units, Spr (French)

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 (Campbell) M 2:15-4:05

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) W 12-2

alternate years, given 1988-89

230. Urban Politics—(See 130.) For graduate students.

231. Managing Local Government—(See 131.) For graduate students.

270. Introduction to Urban Design—(See 170.) For graduate students.

271. Urban Design Studio—(See 171.) For graduate students.

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. The eight courses that constitute the Western Culture Program are sponsored by different departments and programs; however, 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 their 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 1987-88. The courses are organized to accommodate all entering freshmen and transfer students, and every effort will be made to assign students to the specific courses that they elect. However, 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 section, “Program in Structured Liberal Education,” in this bulletin.

GREAT WORKS OF WESTERN CULTURE

Track Chairman: David R. Riggs (Professor of English)

Students meet for four hours per week in classes of 16 or fewer to discuss great works of
of philosophy, religion, imaginative literature, history, and science. These discussions are led by members of the faculty from departments and programs throughout the University. Once a week a lecture by an outstanding scholar helps interpret these works, placing them in their historical context and acquainting the students with the related history of the visual arts and music.

1. From the Beginnings to the End of the Ancient World—The great writings of the Hebrew, Greek, Roman, and early Christian eras (from Genesis to St. Augustine). (DR:1; three-quarter sequence)
   5 units, Aut (Staff)

2. From the Middle Ages to the Enlightenment—Great works of imaginative literature and religious, philosophical, and scientific writings of the Medieval, Renaissance, Reformation, and Enlightenment periods of European history. (DR:1; three-quarter sequence)
   5 units, Win (Staff)

3. From the Enlightenment to the Present—Major political treatises, works of imaginative literature, historical documents, and scientific works, from the late 18th through the 20th century. (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 inter-relationships between the literary and philosophical masterpieces of Western culture on the one hand and political, social, and economic developments in Europe since the Middle Ages on the other. The focus 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. 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)
   5 units, Aut, Win, Spr, MTW 9 plus section

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, philosophical, 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 (McCall, Staff) lecture MTW 11
   Win (Ryan, Staff) lecture MTW 11
   Spr (Harvey, Staff) lecture MTW 11
   plus 2-hour discussion seminar

IDEAS IN WESTERN CULTURE

Track Chairman: John Perry (Professor of Philosophy)

(Enroll in Philosophy 5A, 5B, 5C.) This sequence, developed by the Philosophy Department, offers each week three large-group lectures by faculty and two-hour discussion sections taught by younger scholars to groups of fewer than 20 students. The course studies such ideas as justice, freedom, democracy, monotheism, God as a perfect being, and reason as a universal possession of mankind, not only by studying their historical development but also by asking their relationship to less exalted ideas and to historical realities: anti-semitism, the debasement of women, slavery, and the conquest of the so-called “Third World.” By critically and constructively criticizing the ideas that have shaped Western Culture, we encourage students to scrutinize the ideas that have shaped their lives. (DR:1; three-quarter sequence)
   5 units, Aut, Win, Spr, MWF 10 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 by faculty in the Program in Values, Technology, Science, and Society, studies the development of Western culture by exploring the changing interconnections among the three major realms of culture: the intellectual (ideas and worldviews), the material (technological devices and systems), and the societal (organizations and institutions). This is designed to be of equal appeal to all entering students, whether their present academic interests center on the humanities, the social sciences, natural sciences, medicine, or engineering. The course will not require the use of mathematics. Three one-hour lectures per week and a weekly two-hour semi-
CONFLICT AND CHANGE IN WESTERN CULTURES
Track Chairman: John J. Winkler (Associate Professor of Classics)

10, 11, 12. Western Culture—Taught collaboratively by faculty from the humanities and the social sciences, this track situates works of literature, philosophy, and social thought in a rich social context. It sees culture as shaped by conflicts between elites and subordinate groups, men and women, rulers and ruled, as well as by conflicts between civilizations, peoples, and nations. This sequence attends to cultural dialogue among different groups. Thus we study those elite voices which ultimately became dominant in the civilization of the West, but also attend to those subordinated traditions which have provided alternative visions of the world. (DR:1; three-quarter sequence)

5 units, Aut, Win, Spr plus section

LITERATURE AND THE ARTS IN WESTERN CULTURE
Track Chairs: Charles Fifer (Professor of English), Nancy Packer (Professor of English)
(Enroll in English 7, 8, 9.)—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 receive five units of credit per quarter toward fulfillment of the Western Culture requirement. (DR:1; three-quarter sequence)

5 units, Aut, Win, Spr, lecture TTh 12:30-2 plus 2-hour discussion

Students who have satisfied the Writing Requirement by Advanced Placement also have priority; they receive five 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 (Wack, Staff) MTW 10 lectures plus sections

8 units, Win (Riggs, Staff) MTW 10 lectures plus sections

5 units, Spr (Friedlander, Staff) MTW 10 lectures plus section

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, tel. 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 Stanford. Proposals may not be submitted until a student has actually registered at Stanford and is present on the campus.

THE GUIDELINES

To defend the Program for Individually Designed Majors as being fully equivalent to a Stanford Bachelor of Arts or Bachelor of Science degree in an established department or program, the Senate of the Academic Council has established 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 of these 60 may be taken on a Pass/No Credit basis.
3. A maximum of five 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 students' 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 on which the proposal is approved by the Committee.

These specific requirements are in addition to the general guidelines discussed in "The Major" in the "Degrees" section of this bulletin. Since each proposal is considered individually, the student and the faculty advisory group may request exception to the specific requirements. Such a request must be included in the statement which justifies the major.

Several extradepartmental programs have administrative offices that provide advising services to students interested in individually designed majors of an interdisciplinary nature.
Examples of such programs are Feminist Studies, History of Science, and Medieval Studies within Humanities Special Programs. These programs do not grant undergraduate degrees, but encourage interested students to propose majors to the Dean's Advisory Committee for Individually Designed Majors. Students should see the relevant sections of this bulletin for information on these programs.

INNOVATIVE ACADEMIC COURSES (IAC)

Innovative Academic Courses offer a variety of special studies not covered in the University's departmental curricula. 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. Innovative Academic courses include three types of offerings: Freshman-Sophomore Seminars, Workshops in Political and Social Issues (SWOPSI), and Undergraduate Special courses.

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, at the Undergraduate Advising Center, 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 registration 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 PROPOSAL

A proposal for an Undergraduate Special or SWOPSI course may be initiated by a student, staff member, faculty member, or other member of the community. The proposed instructor, the person doing the actual teaching or presentation of course materials, should file a proposal with the committee using forms obtained from the Program Office, Sweet Hall, indicating:

1. A statement of course objectives.
2. The planned approach and an outline of general requirements and/or prerequisites.
3. Specific requirements, definition of special projects, method of evaluation and intended grading system.
4. A reading list identifying required and suggested readings.
5. A week-by-week syllabus which is as detailed as possible and which links readings, lectures, discussions, and projects.
6. The name of the instructor(s) and any others who will assist in teaching the course, and 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 Accreditation Committee of IAC 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 their 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 the research and scholarship that rarely find their way into introductory courses.

Approximately 15 seminars will be offered in 1987-88; each seminar will have 8 to 12 students.

ADMISSION PROCEDURES

Enrollment is limited to freshmen and sophomores. Seminar offerings are announced each autumn 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.

STANFORD WORKSHOPS ON POLITICAL AND SOCIAL ISSUES (SWOPSI)

Stanford Workshops on Political and Social Issues (SWOPSI) is an extradepartmental pro-
gram initiated by students in 1969 to harness the research capabilities of Stanford 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 10 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, or 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 classes are innovative educational experiences. Goals of the program are to introduce alternative topics and methods into the standard University curriculum and to link student academic experience to social and political activism. Workshops take an interdisciplinary approach to problem solving, give students a substantial voice in the conduct of workshops, and encourage cooperative group work.

Workshops are open to both undergraduates and graduates, as well as 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. 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, student organizations designed to assist students interested in public service in the Bay Area, Sacramento, Washington, D.C., and in the international development field. It administers the Summer Public Service and John Gardner Fellowship programs, designed to provide financial support to students undertaking public service work. Students are working 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 (CTL)**

**Director:** Michele Marincovich

The services of the Center for Teaching and Learning can be divided into two broad categories—those for undergraduate and, to some extent, graduate students in the areas of study skills, reading rate improvement, and tutoring in academic subjects, and those for teaching
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; 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 TA's 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 teaching 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 and ask to be placed on the mailing list.

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., 106 instead of 6) 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 1D.) Focuses on reading and writing. Students meet four times weekly in class and once in tutorial.
   5 units, Sum (Staff)

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 resources.

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 contact 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 qualifications, 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 three 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, administered by URO and available exclusively to Stanford undergraduates, offers three categories of grants, all on a competitive basis and in limited numbers: URO Major Grants for Extended Research, Robert M. Golden Major Grants for Humanities Scholarship and Artistic Creation, and Small Grants for Research Expenses.

Golden and URO Major Grants differ from Small Grants in the scope of the project proposed rather than the level of reimbursement requested. URO Major and Small Grants are restricted to supplies and expenses associated with research. Golden Grants may include a stipend to replace summer earnings.

URO Major and Golden Grants (up to $2,500) are awarded once a year, to as many as 35 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. The application deadline for 1987-88 is April 1. Small Grants (up to $500) are awarded each quarter. The deadlines for 1987-88 are October 30, February 5, and April 2. The URO Office has information on applications and criteria.

Students interested in research, and faculty with projects to list should contact the program at 122 Sweet Hall or (415) 723-3828.

STANFORD PROGRAM IN WASHINGTON, D.C.

Director: David Danelski

Beginning in the Spring of 1988, the University will offer 13 week "stretch quarters" (early September to December or late March to July) in residence at a 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 Washington'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 will be the internship. A typical internship might be served with a Congressional leader, a nonprofit sector policy analyst...
(i.e., at the Brooks Institution) or a high level administrative agency official (i.e., Director of the Arms Control and Disarmament Agency). Internships will also be available for students interested in pursuing the arts (i.e., at the Smithsonian Institution) and sciences (at the National Institute of Health or NASA).

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, 4 units. Students also have the option of writing a major paper for credit (3-5 units).

The academic program will be supervised by a Stanford faculty member appointed to serve as the Washington, D.C. Program Director. 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

Public Policy Making in Washington—(Enroll in Political Science 190W). Seminar analyzing national public policymaking, institutions, and processes. Focus is on political, economic, and ethical aspects of public policymaking in the nation's capital.

5 units, Spr (Danielski) TTh 7-8 p.m.
Dean: Paul A. Brest
Associate Deans: Robert Weisberg, Thomas McBride, John Gilliland
Assistant Dean: Margo D. Smith
Emeriti: J. Myron Jacobstein, John H. Merryman, Howard Williams
Associate Professors: Ellen Borgersen, Janet M. Cooper, Henry T. Greely, Barton H. Thompson
Assistant Professor: Barbara H. Fried
Lecturers: Frances Foster-Simons, Christopher Cameron Murray, Thomas J. Nolan, Lisa M. Pearson, H. David Rosenbloom, Stephen Scharf, Dean A. Schlobohm, A. Logan Slagle, Cynthia L. Zollinger
Visiting Professors: Douglas G. Baird, Daniel A. Farber, Bill Ono Hing, L. Thorne McCarty, Gunther Teubner, Eric W. Wright, Stephen C. Yeazell

The School of Law was established as a department of the University in 1893. Its purpose is to provide a thorough legal education for students who are fitted by their maturity and their previous academic training to pursue professional study under university methods of instruction. The curriculum leading to the first professional degree in law (J.D.) constitutes an adequate preparation for the practice of law in any English-speaking jurisdiction. Graduate work leading to the degrees of Master of the Science of Law and Doctor of the Science of Law is also offered. (For full School of Law Curriculum, see the School of Law Bulletin.) The School of Law is on a two-term academic calendar. Autumn Term classes begin on September 10, 1987. Spring Term classes begin on January 25, 1988. Spring Term ends on June 1, 1988.

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 professionals from various disciplines cooperate to improve the process by which child custody decisions are made. Seminar is limited to 20 graduate and law students. Admission is by consent of the instructor.

2 term units or 3 quarter units, Aut (Wald, Maccoby) W 4:15-6

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, Aut (Rosenhan) not given 1987-88

316. Law in Radically Different Cultures—(Same as American Studies 176L, Anthropology 157, Political Science 182L; graduates enroll in Anthropology 257.) 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. 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 Quarter and 3 quarter units in Spring Quarter. The first class meeting is on January 25.)

3 term units or 5 quarter units, Spr (Barton, Foster-Simons)

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) T 2:15-5

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, Spr (Rosenhan) not given 1987-88

337. Public Policy Towards Abused and Neglected Children—The standards that are, and should be, used in defining child abuse and neglect and evaluating means of state intervention to protect such children. The role of various professionals, doctors, lawyers, mental health experts, police, and social workers in dealing with the problems of child abuse and neglect. The 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 Law School semester system. Permission of the instructor required.

2 units, Win, Spr (Wald) W 4:15-6:45

345. Psychology and Law Proseminar—(Same as Psychology 225.) 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. 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) not given 1987-88

NONPROFESSIONAL

The following nonprofessional courses, open to juniors and seniors, as well as to graduate students in other departments, may be counted toward the A.B. degree but may not be counted toward professional degrees in law.

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 non-law 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. Limited enrollment, mandatory preregistration. Junior standing or above. Not open to undergraduate communication majors.

5 units, Spr (Franklin) not given 1987-88

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, Aut (Rabin) not given 1987-88
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 has 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 medical school has completed the basic courses in physics, chemistry, and biology, the choice of an undergraduate major may reflect other interests, including the arts and humanities. Course work in mathematics and the behavioral sciences is highly recommended because of its importance in understanding medicine. Extracurricular activities and breadth of interests and experiences play an important role in the selection of students from among those applicants having superior academic records. The general requirements for admission are in the Stanford School of Medicine bulletin. For application materials write: Chairman, Committee on Admission, Stanford University School of Medicine, Stanford, California 94305.

**BIOCHEMISTRY**

*Chairman:* David S. Hogness  
*Associate Professor:* Douglas L. Brutlag  
*Assistant Professors:* Robert S. Fuller, Suzanne R. Pfeffer

**OFFERINGS**

The Department of Biochemistry is part of the Graduate Division of the University and a department of the Medical School. Departmental offices and laboratories are located in the Stanford Medical Center. Courses offered by the department may be taken by undergraduate, graduate, and medical school students. Postdoctoral fellows, as well as house staff members, are also welcome to attend. A basic series in biochemistry (200, 201) is taught by the entire staff as well as by a number of guest lecturers from the campus and from other institutions. Students who elect to enroll in either of the above courses should have a good background in general and organic chemistry, 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
The Department of Biochemistry conducts a seminar program in the departmental library at noon Tuesdays and on Thursdays, which includes special seminars by guest investigators from other institutions.

Opportunities exist for directed reading and research in biochemistry and molecular biology, utilizing a small but excellent departmental library as well as the most advanced research facilities, including those for light and electron microscopy, chromatography and electrophoresis, enzyme purification and analysis, analytical and preparative ultracentrifugation, and amino acid and radioisotope analysis. Computer and text editing facilities are available. Laboratories are equipped for research with bacteria and bacteriophage, animal cells and their viruses, yeast and Drosophila.

**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 of study is designed to prepare men and women for productive careers in biochemistry; its emphasis is training in research, and each student works closely with members of the staff. In addition to the requirement for a Ph.D. dissertation based upon original research, students are required to enroll in six advanced courses in biochemistry and related areas, and at least three of these courses must be taken in the Department of Biochemistry. Selection of these courses is tailored to fit the background and interests of each student. A second requirement involves the submission of three research proposals, which are presented by the student to a small advisory committee of departmental faculty members, who are also responsible for monitoring the progress of the curricular and research programs for each student. All Ph.D. students are expected to participate actively in the departmental noon seminar program and are also given the opportunity to attend, as well as to present papers, at the regional and national meetings in biochemistry and molecular biology. Teaching experience is an integral part of the Ph.D. curriculum and is required for the degree.

General University regulations concerning the Ph.D. degree are summarized in the "Degrees" section in this bulletin. The department offers neither master's nor undergraduate degrees.

Men and women interested in pursuing a career in biochemical research and teaching are invited to apply directly to the Department of Biochemistry for admission to the Ph.D. program. Those applying should have at least a baccalaureate degree, and should have completed work in cell and developmental biology, basic biochemistry and molecular biology, and genetics. Also required are at least one year of university physics, differential and integral calculus, 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 4. Applications are available from the department beginning August 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 application for a National Science Foundation 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 of Biochemistry will be considered without regard to race, color, creed, religion, sex, age, national origin, or marital status.

Postdoctoral research training is available to graduates who hold a Ph.D. or an M.D. degree. Qualified individuals may write to individual faculty members for further information.

At present the primary research interests of the department are: proteins and nucleic acids, including their enzymatic synthesis, chemical structure, physical chemistry and function; the biochemical structure, physical chemistry and function; the biochemical and animal virus infection biology of bacterial and animal virus infection and the function of chromosomes; control and regulation of gene expression; the biochemistry and control of developmental processes; and the structure, function, and biosynthesis of cellular membranes and organelles.

**COURSES**

**200. Biochemical Structure, Metabolism, and Energetics**—The structure and function of biochemical molecules, enzyme kinetics and mechanisms, bioenergetics, pathways of intermediary metabolism and their control, and membrane structure and function. Alternative lectures dealing with special topics also presented. Prerequisites: Organic chemistry, cell biology (equivalent to Biology 41).

5 units, Aut (Baldwin, Fuller, Kaiser, Kornberg, Lehman, Pfeffer, Rothman) MTWThF 11
201. 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, Win (Berg, Brutlag, Davis, Hogness, Kornberg) MTWThF 11

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—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 stage, 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) given 1988-89

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

222. Research Techniques in Biochemistry and Molecular Biology—Lectures, demonstration, and laboratory practice, including growth of bacteria and viruses, and analysis of macromolecules using ultracentrifugation, restriction enzyme analysis, electrophoresis, autoradiography, and electron microscopy. Enrollment limited to students in the Biochemistry Ph.D. program and to those in the Stanford Medical Scientist Training Program.

5 units, Aut (Davis) by arrangement

294. DNA Replication and Recombination—Enzymes and molecular mechanisms. How some physiological aspects of these DNA transactions are explained at the molecular level. Prerequisites: 200 and 201.

3 units, Win (Kornberg, Lehman) 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

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CELL BIOLOGY

Chairman: Roger D. Kornberg
Professors: Roger D. Kornberg, James A. Spudich, Lubert Stryer
Assistant Professors: Robert O. Fox, Peter Parham
Lecturer: Patricia Cross

OFFERINGS

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 Pro-
gram 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 each 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 architectural 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.

3 units, Aut (Staff) given 1988-89

**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.

3 units, Aut (Unwin, Cross, Staff)

**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, Aut (Staff) given 1988-89

**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)

**226. Molecular Immunology**—Current understanding of the molecules involved in immune phenomena and their mechanisms of action. Themes: immunoglobulins, antigen receptors of B and T lymphocytes, histocompatibility antigens, complement components and their cellular receptors, lymphokines, leukotrienes, mediators of allergy, cell surface receptors for immunoglobulins, differentiation antigens, and cell surface markers. Methods for cell cloning, DNA cloning, monoclonal antibody preparation, and cell sorting. Background information concerning each topic is provided. Recommended: Previous knowledge of immunology. Prerequisite: Knowledge of basic biochemistry and cell biology.

3 units, Spr (Parham) given 1988-89

**227. Membrane Channels**—Ion transport through membrane channels is critical in sensory transduction, synaptic transmission, and nerve impulse conduction. Theme: the molecu-
lar basis of ion transport by membrane channels and its regulation. Light-activated channels of photoreceptor cells, the voltage-regulated sodium channel of axonal membranes, and the acetylcholine receptor. Experimental approaches used to study membrane channels are: gene cloning and site-specific mutagenesis, isolation and reconstitution of functional channels, patch-clamping and other electrophysiological methods, and electron microscopic studies of channel architecture. Prerequisite: Knowledge of basic biochemistry and cell biology.

3 units, Aut (Stryer) given 1988-89

228. Protein Structure and Engineering—The analysis of protein structure at high resolution by X-ray crystallography allows detailed molecular interpretation of many biological processes. The results of protein crystallography after a survey of the methods and their limitations. Themes: patterns of chain folding and association, the physical basis of protein structure and stability, analysis of protein families at the level of primary and tertiary structure, the evolution of protein structure and the proposed role of exon elements in that process, and the prediction of secondary and tertiary structure from amino acid sequence information. Progress in the engineering of protein structure, and the modification of enzyme function and specificity by site-directed mutagenesis. Protein: DNA interactions, antigen: antibody complexes and simple enzyme systems. Prerequisite: Knowledge of basic biochemistry and cell biology.

3 units, Aut (Staff) given 1989-90

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, Aut (Kornberg)

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)
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 and 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, biochemical genetics, population 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, Medical Microbiology, and Cell Biology.

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 examples from humans where appropriate. Lectures and reading in all aspects of genetics, including molecular-, chromosomal-, cellular-, developmental-, population and medical genetics with emphasis on the latter. Prerequisites: Knowledge of biochemistry and basic genetics.

201. 3 units, Win (Calos, Cavalli-Sforza, Cohen, Ganesan, Herzenberg) MWF 9
202. 3 units, Spr (Calos, Cavalli-Sforza, Cohen, Ganesan, Herzenberg) TTh 10

for genetic counseling purposes. Human evolution. Interactions of cultural, social, biological evolution. Eugenics, eugenics, and human welfare. Prerequisites: Algebra, elementary statistics, basic genetics.

3 units, Aut (Cavalli-Sforza) TTh 4:15-5:45 alternate years, given 1988-89

249. Advanced Genetics—Principles and modern methods of chromosome analysis. Structural changes in 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 graduate students, medical students and advanced undergraduates with good knowledge of biochemistry, biology, and basic genetics.

3 units, Aut (Ganesan) alternate years, not given 1987-88

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 SERVICES RESEARCH

Director: John P. Bunker
Professors: John P. Bunker, Victor R. Fuchs
Clinical Associate Professors: Sheldon S. King, Roland S. Merchant, Sr.
By Courtesy: Alain C. Enthoven, W. Richard Scott

MASTER OF SCIENCE PROGRAM IN THE DEPARTMENT OF FAMILY, COMMUNITY, AND PREVENTIVE MEDICINE

The division offers courses for medical and other graduate students in masters and doctoral programs, programs of study, and research training leading to a Master of Science degree in Health Services Research, and doctoral and postdoctoral research opportunities and training.

The master's degree program in Health Services Research (M.S. in HSR) 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 at the Graduate Program Office, and a separate departmental application, available from the Division of Health Services Research 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 HSR degree. The remaining 9 units may be double-counted to meet other degree requirements.

For additional information, address inquiries to the Program Administrator, Division of
COURSES

The following are selected courses offered through the Division of Health Services Research. Information on additional courses can be obtained by contacting the Program Administrator.

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 United States; 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 for 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.) Description of problems and institutions, review of analytical studies, and discussion of policy issues. Topics: mortality and morbidity, physicians and other personnel, hospitals, the drug industry, national health insurance and health maintenance organizations. Open to graduate students, undergraduate economic majors (seniors and juniors), or by permission of instructor. Recommended: Preparation in micro theory and some statistics. Prerequisites: 51 plus some background in math or statistics.

5 units, Win (Fuchs) TTh 10-11:50

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 United States, how various existing and proposed financing and organizational arrangements affect the allocation of resources, fee-for-service practice and health maintenance organizations, hospital investment decisions and regional planning, health care costs, and national health insurance. Not open to undergraduates.

4 units, Aut (Enthoven) MF 8-10

394. 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

SCIENCES PROGRAM

Committee: Edward H. Shortliffe, Chairman and Program Director (Associate Professor of Medicine and by courtesy of Computer Science); Bruce G. Buchanan, (Professor of Computer Science, Research); Richard L. Popp, (Professor of Medicine); Allen K. Ream, (Associate Professor of Anesthesia); Harold C. Sox, Jr., (Professor of Medicine, Clinical); 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), Allen K. Ream (Associate Professor)

Biochemistry: Douglas L. Brutlag (Associate Professor)

Computer Science: Thomas O. Binford (Professor), Robert L. Blum (Research Associate), James Brinkley, (Research Associate), Bruce G. Buchanan (Professor), William J. Clancey
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; students wishing to obtain a Ph.D. are therefore encouraged to apply directly for Ph.D. training.

The core curriculum is common to all degrees offered by the program, but is adapted or augmented depending upon the interests and prior experience of the student. Deviations from the core curriculum outlined below must be justified in writing and approved by the student’s MIS advisor and the chairman of the MIS Committee. It should be noted, however, that the Medical Information Sciences Program is intended to provide flexibility and to complement other opportunities in applied medical research that exist at Stanford (e.g., the Program on Engineering in Biology and Medicine, and the Graduate Division Special Programs). 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 simultaneously enrolled in other degree programs within the University.

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 111 (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 (9-13 units): The student is expected to acquire a knowledge of the use of computers, computer organization, and programming. It is assumed that students will have had prior computing experience at
least equivalent to Computer Science (CS) 105. All students are required to take a minimum of 9 units of courses in the Computer Science Department. If similar courses have not been taken previously, these units must include (1) one of CS 108A, 108C, 111, or 168 plus (2) CS 261. Both CS 108A and 108C may be taken for credit towards the degree, but neither may be taken for credit if CS 111 or CS 168 has been taken. With the exception of CS 135, all other courses applied to the degree requirement must be numbered 200 or higher.

3. Decision Making (14-16 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 Statistics 201A and 201B (Data Analysis); Statistics 116 (Theory of Probability) or Engineering-Economic Systems (EES) 221 (Probabilistic Analysis); EES 231 (Decision Analysis). Statistics 228 is highly recommended.

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), MIS 211A (Computer-Assisted Medical Decision Making), and MIS 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 FCPM 200 (Health and Society). A second course may be selected from among Family, Community, and Preventive Medicine (FCPM) 220/Human Biology 40 (Public Decision Making Regarding Human Health), or any other advanced course in Health Policy/Social Issues proposed by the student and approved by the MIS Committee.

Note that the core curriculum generally entails a minimum of 44 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. Three of the following: CS 135, 223A, B, 245, 323, Psychology 256.
3. Electives: Additional courses as desired by candidate to bring total to 54 or more units.

MASTER OF SCIENCE
(SPECIAL PROGRAM)

This special program is designed as post-doctoral training for individuals with established research credentials who may wish to acquire 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 com-
plete 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 six additional units of advanced coursework, (e.g., CS courses numbered 135 or higher, Statistics 228, or advanced courses in Decision Analysis). 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 attain a letter grade indicator (LGI) as outlined for 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 two units of teaching assistant service in MIS courses, one 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 3 times for credit.)

1 unit, Aut, Win, Spr, Th 1:15

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 1:15

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—One quarter course for students who are not enrolled in the MD program or do not have an MD degree. One afternoon 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 will 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 stu-
dent’s class schedule. Available only to students in an 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 both research and applied environments. Topics: office systems, hospital information systems, medical databases, laboratory systems, image analysis, EKG analysis, history taking, library systems, multi-phasic health testing, medical computer-aided instruction.

3 units, Aut (Pagan, Shortliffe) TTh 12:15

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 12:15

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 (Shortliffe, Cooper, Buchanan) TTh 12:15

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 AI research evolves as new ideas and concepts are discovered. Prerequisites: At least one course in artificial intelligence and familiarity with LISP.

2 units, Spr (Buchanan, Shortliffe) T 3:30-5

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. Individual analyses are generalized by outlining a computer-clinical decision tool for cases similar to the one analyzed. Also, advanced topics in decision analysis of particular relevance to medical decisions, including influence diagram formulation, probability encoding, risk attitude assessment, value model development, and computer-based decision system design. Prerequisite: Engineering-Economic Systems 31 or 231, or equivalent. No formal medical background is required.

4 units, Spr (Holtzman) MF 3:15-4:30

299. Directed Reading and Research—For students wishing to receive credit for research time.

any quarter, by arrangement

MEDICAL MICROBIOLOGY

Emeriti: (Professors) Sidney Raffel, Carlton E. Schwerdt; (Adjunct Professors) Monroe D. Eaton, Esther M. Lederberg (Research)

Chairman: Hugh O. McDevitt

Professors: Stanley Falkow, Hugh O. McDevitt, Leon T. Rosenberg, Bruce A. D. Stocker

Associate Professors: Mark M. Davis, Harry B. Greenberg, Abdul Matin, Robert J. Roantree, Gary K. Schoolnik

Assistant Professors: John C. Boothroyd, Edward S. Mocarski, Peter O’Hanley, Lucy S. Tompkins

Associate Professor (Research): Thomas E. Hamm

Professor (Teaching): John P. Steward

The Department of Medical Microbiology 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: Medical Microbiology 101, 102, 103, 203, 204, and 206; Biochemistry 200.

Students in this program can arrange to take units in research (see 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. 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 of which laboratories will be worked in during the two required rotations (each lasting 1-2 quarters) will be made. 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; Chemistry; Computer Science; Genetics; Pathology; Structural Biology; and Family, Community, and Preventive Medicine.

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


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

198A. Microbiology.
198B. Immunology.
198C. Virology.
198D. Bacterial Genetics.
198E. Parasitology.
198F. Bacterial Physiology.

199. Undergraduate Research—Individual study or research in microbiology by arrangement with a faculty member. Possible fields of study: general bacteriology, bacterial physiology and ecology, bacterial genetics, microbial pathogenicity, immunology, virology, viral oncology, and molecular parasitology. (Appropriate backgrounds for these various areas are required, to be discussed with the faculty member concerned.)

1-15 units, any quarter (Staff) by arrangement

200. Immunology—(Same as Pathology 220.) Immunology as related to medicine is emphasized. Principally for medical, graduate, and advanced undergraduate students. Prerequisite: 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

201. Advanced Immunology—(Same as Pathology 220A.) Reading/discussion on major ongoing areas of immunology, primarily for graduate students and postdoctoral fellows. Topics: genetics and structure function relationships of antibody/T cell receptors, MHC Class I and Class II molecules; accessory molecules such as T3, LFA1, T4 and T8; the phenomena of tolerance, suppression and autoimmunity, and the response to viral and protozoan challenges. Recommended: Introductory course in immunology. No final exam.

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

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 (optional minilab may be available) on inheritance in bacteria. Prerequisites: 101 and Biological Sciences 31, or equivalents. Consent of instructor for minilab.

3-4 units, Win (Stacker) MWF 9 lab MWF 2:15 or by arrangement

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, Win (Falkow) W 3:15-5:05 alternate years, not given 1988-89

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., Family, Community and Preventive Medicine 204. Prerequisite: Biochemistry 201 or consent of instructor.

2 units, Win (Boothroyd) T 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

399. Graduate Research—Students who have satisfactorily completed necessary foundation courses may elect research work in: general bacteriology, bacterial physiology and ecology, bacterial genetics, microbial pathogenicity, immunology, parasitology, and virology.

18 units maximum, 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, 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. The requirements of the Ph.D. program will be fitted to the individual interests and time schedules of the student. Postdoctoral training is available to graduates holding Ph.D. or M.D. degrees and further information should be sought directly from the faculty member concerned.

Research interests of the department include: mechanisms of visual transduction and information transmission in vertebrate retina; 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. Presents a coherent framework as 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, Shatz, Shooter, Skene) M 1:15-5:15, W 1:15-5:15, F 1:15-5:15 (2nd year students); M 1:15-4:15, W 1:15-2:15, Th 2:15-5:15, F 1:15-5:15 (1st year students)

213. Principles of Development and Functional Organization of the Central Nervous System—Advanced seminar/reading examining the way the vertebrate brain develops, processes information, and the role of experience in establishing and maintaining neuronal connections. Examples illustrate principles of development and organization, taken from the visual, auditory, and somatosensory systems. Emphasis on the study of original papers and on student presentations. Prerequisite: 200 or the permission of the instructors.

3 units, Win (Knudson, Shatz)

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. Topics are covered by reading and discussing 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, Spr (Alrich, 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

399. Individual Research—Prerequisite: Consent of instructor.

any quarter (Staff) by arrangement


(Staff)

PATHOLOGY

Emeriti: (Professors): Bruno Gerstl, David Glick, Lelland J. Rather, (Clinical Professor) Donald L. Alcott

Chairman: Klaus G. Bensch


Associate Professors: Margaret E. Billingham, Gerald R. Crabtree, Edgar G. Engleman, F. Carl Grumet, Richard K. Sibley, Roger A. Warnke

Assistant Professors: Eugene C. Butcher, Michael L. Cleary, Steven K. H. Foung, Robert V. Rouse, Jeffrey L. Sklar, Lawrence M. Weiss

Professor (Research): Lawrence F. Eng

Associate Professor (Research): Teresa S. F. Wang

Professors (Clinical): Lysia K. Forno (Neuropathology), 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 Associate Professors: Robert W. R. Archibald, Stephen S. Chen, John T. Differding, Seth L. Haber, A. Paul Miller, Mahendra Ranchod

Physician Specialists and Clinical Assistant Professors: P. Joanne Cornbleet, Barbara M. Egbert

Clinical Assistant Professors: Robert M. Cardelli, Meredith Halks-Miller, Maie K. Herrick, Paul L. Herrmann, Steven C. Quay, Jon C. Ross, Charles T. Uyeda, Peter Windhorst

Physician Specialist and Clinical Instructor: Charles M. Lombard, Robert Shiurba

Senior Research Associate: Nahid Moheghpour

Research Associates: Peggy Bradshaw, Naomi Galili, Debra Hiraki, Roger Schultz, Barry S. Stein, Ellen F. Wallace

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 abnormal molecular, cellular, and organ structure and function that manifest themselves in clinical disease. Accordingly, the research interests of the department encompass a broad range that extends from fundamental molecular biology to clinical-pathological correlations. A primary emphasis of the departmental research program is in experimental oncology.

At the present time, the major areas of investigation in the department include DNA replication and repair in prokaryotes and in cultured eukaryotic cells, genomic derepression in human neoplasms, 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 ar-
COURSES

205. Clinical-Pathological Correlations—Correlation of clinical histories with surgical and autopsy material, including microscopy. Maximum 12, minimum 5 students.

2 units, Win (Kosek, Fajardo, Forno, Chen, Rouse, Egbert) MF 3:15-5:05

207. Principles of Electron Microscopy—
Seminar 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 the 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 Medical Microbiology 200.) 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 (equivalent to 200-201) and histology.

3 units, (tutorials offered for additional unit), Spr (Weissman, Rosenberg, McDevitt) MWF 10

220A. Problem Solving in Immunology—
(Same as Medical Microbiology 200A.) Provides direct experience in understanding immunology using problems. Each week 3-5 problems are corrected and discussed. Prerequisite: Simultaneous enrollment in Medical Microbiology 200 (Pathology 220).

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 upon 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. H. Sussman. 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. Directed Reading — Prerequisite: Consent of faculty member
   1-18 units, any quarter (Staff)
   by arrangement

399. Research—The faculty of the Pathology Department are involved in active research programs, at the Stanford Medical Center and at the Palo Alto V.A. 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

Emeritus: (Professor) Robert H. Dreisbach
Chairman: Tag E. Mansour
Professors: Avram Goldstein, Dora B. Goldstein, Sumner M. Kalman, Tag E. Mansour
Associate Professors: Terrence Blaschke (Jointly with Medicine), Helen M. Blau, Howard Schulman, James P. Whitlock, Jr.
Assistant Professors: Stuart E. Leff, Richard A. Roth
Professors (by courtesy): Kenneth Melmon, Ferid Murad
Assistant Professors (by courtesy): Phyllis Gardiner, Brian Hoffman, Stephen Peroutka
Consulting Professors: Gordon Ringold, Alejandro Zaffaroni

GRADUATE PROGRAMS

The department presents two basic courses in contemporary pharmacology (201 and 202) and advanced courses open to qualified medical and graduate students.

A program of study and research training is offered leading to the Ph.D. degree. Postdoctoral research training is available to graduates having the Ph.D. or M.D. degree. Research opportunities also exist for medical students, graduate students, and a limited number of undergraduate students.

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, molecular biology of differentiation and development particularly as it relates to chemical teratogenesis, molecular mechanism of steroid hormone action, biochemical basis for control of synaptic functions, drug metabolism and toxicology, and biochemical mechanisms associated with drug addiction and tolerance.

Students desiring to become candidates for advanced degrees should consult the general University regulations regarding such degrees, as summarized in the "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 course, 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; chemotherapeutic agents; antibiotics; antiparasitic drugs; and the anticancer 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

206. Toxic Effects of Environmental Pollutants—Discussions of heavy metals, chlorinated hydrocarbons and other organic pesticides, components of smog, asbestos, contaminants of food and water, and the casual use of medicinal products and strategies for combatting pollution.

2 units, Win (Kalman) by arrangement

216. Opiates, Opioid Peptides, and Opioid Receptors—A series of lectures emphasizing recent research developments and relating events at the molecular level to physiological and pharmacological phenomena.

2 units, Spr (A. Goldstein) by arrangement

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, Aut (D. Goldstein) T 3:15-5:05

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

280. Tutorial Program—Guided readings in the literature of any area of pharmacology. A critical review paper may be required. Primarily for graduate students in pharmacology.

any quarter (Staff) by arrangement

299. Directed Reading.

any quarter (Staff) by arrangement

399. Research.

any quarter (Staff) by arrangement

PHYSIOLOGY

Emeriti: (Professors) Frederick A. Fuhrman, Ronald Grant
Chairman: Roy H. Maffly
Professors: Julian M. Davidson, Eugene D. Robin (jointly with Medicine)
Courtesy Professor: Jeffrey J. Wine
Courtesy Associate Professor: Allen D. Cooper
Courtesy Assistant Professors: William T. Clusin, Andrew R. Hoffman, Timothy Meyer
Courtesy Professor (Research): David M. Maurice
Courtesy Professor (Clinical): Mark G. Perlooth
Consulting Associate Professor: Noel Thompson
Senior Research Associate: Erla R. Smith

GRADUATE PROGRAMS

The Department of 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 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 physiology, 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 Medical School.

In general, graduate students must expect to find the majority of their financial support outside of 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 demonstrations on normal and disordered function in the cardiovascular system. 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 exam given. Prerequisite: An understanding of general biochemistry.

6 units (201, 4 units; 202, 2 units), Win
(Endocrinology: Hoffman; Gastrointestinal: Cooper) MW 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
(Respiratory: Robin; Renal: Maffly, Meyer) MT 8-9:50

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 1987-88

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

215. Tutorial in Clinical Physiology—Guided study, with readings and discussions in introductory and advanced physiological topics, to supplement 200, 201, 202.
1-2 units, any quarter (Robin, Staff) by arrangement

218. Surgical Physiology—Demonstrates surgical techniques and procedures involved in large animal surgery.
1-2 units, Aut, Spr (Robin, Collins) by arrangement

219. Advances in Physiological Research—A seminar presenting current research topics in physiology. Speakers are Stanford faculty, physiology graduate students, 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 hours and units arranged by the student. The fields of research include endocrinology, neuroendocrinology, central nervous system function, reproductive physiology, chemistry and mechanism of action of toxins in marine biology, cybernetics (systems analysis and instrumental techniques).
any quarter (Staff) by arrangement

THERAPEUTIC RADIOLOGY

Chairman: Malcolm A. Bagshaw
Associate Professors: Richard T. Hoppe, Daniel S. Kapp
Assistant Professors: Eamonn P. Dunphy, Steven L. Hancock
Associate Professor of Therapeutic Radiology (Research): David G. Hirst
Professor of Therapeutic Radiology (Teaching): Peter Fessenden

PROGRAMS OF STUDY

Although the Department of Therapeutic Radiology does not offer degrees, its faculty teaches a variety of courses open to medical students, graduate students and undergraduates. The department also accepts students in other curricula as advisees for study and research. Graduate students in the Biophysics Program, for example, may choose Radiation Biology or Radiological Sciences as a major and pursue their dissertations in this field; similarly, students in the Cancer Biology Ph.D. Program may major in Radiation Biology. Undergraduate students may also arrange individual research projects under the supervision of Therapeutic Radiology faculty.

Therapeutic Radiology is a discipline that is focused around the use of radiation as a therapeutic and research tool. The fundamental and applied research within the department reflects this spectrum: in therapeutic radiology and clinical oncology; in radiation biology and tumor biology.

At the present time, the major areas of basic research investigation in the department include: DNA repair in bacterial and mammalian cells after ultraviolet and ionizing irradiation; the role of error-prone DNA repair in spontaneous and radiation mutagenesis; effects of heat, drugs, and radiation on the killing and repair of mammalian cells both in vitro and in vivo; studies of cell kinetics and reoxygenation in animal tumors after irradiation, chemotherapy, heat, and combinations of these modalities; studies of the effect of radiation on the microvasculature and blood flow in normal and malignant tissues; radiosensitization of tumors in vivo with a variety of drugs; studies of the late effects of radiation on a variety of normal tissues in young and adult animals; an in-depth investigation of the role of viruses in the etiology of animal and human tumors; clinical and basic research relating to the effects on neoplasms 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 psychological 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.

3 units, Spr (Brown, Staff) alternate years, not given 1988-89

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. Also, carcinogenesis and mutagenesis 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 1988-89

299. Directed Reading.
any quarter (Staff) by arrangement

399. Research.
any quarter (Staff) by arrangement
DEAN OF GRADUATE STUDIES

Vice Provost and Dean of Graduate Studies: Elizabeth C. Traugott
Associate Deans of Graduate Studies: Cecilia P. Burciaga, Karlene N. Dickey

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, 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 Interdisciplinary Training Programs and Committees which include: Committee on Biophysics, Cancer Biology Program, Graduate Division Special Program, Neurosciences Program, and the Scientific Computing and Computational Mathematics Program. The Dean also has responsibility for the Bechtel International Center.

Three independent 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: Robert D. Simoni Chairman (Professor of Biological Sciences); Steven Boxer (Professor of Chemistry); David A. Clayton (Professor of Pathology); Philip C. Hanawalt (Professor of Biological Sciences); Oleg Jardetzky (Professor of Pharmacology); Harden M. McConnell (Professor of Chemistry)

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) Chemistry 131, 171, 173, and 175.
   d) Additional courses as required for the individually tailored program.
4. Proficiency in one or more foreign languages and/or a computer language may be required at the discretion of the major professor.
5. The completion of eight sections of teaching apprenticeship during the first nine quarters, 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

given 1988-89

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

**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 4 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 thesis research or proposed thesis 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 which will include one member of the Committee on Cancer Biology.

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 alternate years, not given 1988-89
242. 3 units, Win (Staff) TTh 4:15-5:35 alternate years, not given 1988-89
243. 3 units, Spr (Staff) TTh 4:15-5:35 alternate years, not given 1988-89

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 thesis-related research work.

GRADUATE DIVISION SPECIAL PROGRAM

The Graduate Division Special Program is designed for students seeking a Ph.D. degree, who are unusually well-qualified and, whose study plans do not fall within the province of any one department. 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.

A student may apply to the Graduate Special Program after completing a minimum of two quarters but before the end of the third year of graduate study at Stanford. Students must have been admitted to a Stanford Ph.D. program in a department or school, and must have completed all department requirements, including any qualifying examinations, which normally fall within the time of the enrollment. (Students who have failed a qualifying examination must pass a re-examination before an application to the Graduate Special Program will be considered.) Students who are beyond the second year of graduate study at the time of application to graduate special status must have been admitted to candidacy in the department in which they are currently enrolled.

The applicant is responsible for selecting 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. Approval of prospective members who are not on the Academic Council must be obtained in advance from the Graduate Program office. In accordance with the nature of the program, members of the committee should represent at least two departments of the University.

Students admitted to the Graduate Special Program must have the agreement of either the original admitting department or the department of the student's committee chair to act as the student's responsible department. The responsible department provides administrative
support and services normally available to its regular doctoral students. The responsible department will not be obliged to monitor the academic progress of the student, find or provide financial support for the student, or find a new committee if the student's Graduate Special Committee disbands.

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_

**NEUROSCIENCES PROGRAM**

Chairman: U. Jackson McMahan (Professor of Neurobiology)  
Committee: Richard W. Aldrich (Assistant Professor of Neurobiology), Jack D. Barchas (Professor of Psychiatry and Behavioral Sciences), Helen Blay (Associate Professor of Pharmacology), Stephen Peroutka (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), Student Members: Sascha du Lac, Chuck Sole

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)  
Neurobiology: Richard Aldrich (Assistant Professor), Denis A. Baylor (Professor), Eric I. Knudsen (Assistant Professor), U. J. McMahan II (Professor), Carla J. Shatz (Associate Professor), Eric M. Shooter (Professor and Chairman), J.H. Pate Skene (Assistant Professor)  
Neurology: Dennis Choi (Assistant Professor), Arnold Kriegstein (Assistant Professor), Stephen Peroutka (Assistant Professor), David A. Prince (Professor and Chairman), Bruce Ransom (Assistant Professor), Marion E. Smith (Professor, Research), Lawrence Steinman (Associate Professor), Michael Weinrich (Assistant Professor)

Pathology: Lawrence F. Eng (Professor, Research)  
Pharmacology: Helen Blau (Associate Professor), Dora Goldstein (Professor), Howard Schulman (Associate Professor)  
Physiology: Julian M. Davidson (Professor)  
Psychiatry and Behavioral Science: Jack D. Barchas (Nancy Friend Pritzker Professor), Roland D. Ciaramello (Professor), William C. Dement (Professor), Seymour Levine (Professor), John Madden (Assistant Professor), Kazuhiko Tatemoto (Associate Professor, Research), Dona Wong (Assistant Professor)  
Psychology: Jeffrey J. Wine (Professor)  
Surgery: David M. Maurice (Professor, Research), 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 15 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, Fairchild D 201A, Stanford University 94305) must be submitted to the Neurosciences office by January 1st.

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). The remaining courses are then chosen to reflect the student's
interests in one or more of the biochemical, neurophysiological, neuroanatomical or bio-behavioral aspects of the subject.

It is anticipated that the required course work will be completed by the end of the second year. Successful passing of a comprehensive oral preliminary examination given by the student's advisory committee is required for admission to Ph.D. candidacy. This examination is usually taken in the second year of study and must be completed by the end of the second year. Students are strongly encouraged to begin research on entry or, at the latest, during the Winter Quarter of the first year. The student will be required to present a Ph.D. 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 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, cardio-vascular physiology, respiration, salt and water balance, exercise and gastrointestinal physiology. Lectures and dissertations.

4-5 units, Win (Heller, Lawry)

**Biological Sciences 153. Introduction to the Nervous System: Cell Signaling and Behavior** — (Same as Psychology 107.) A survey of neural mechanisms and interactions underlying behavior. Prerequisites: 32 and 43, or Psychology 1, or Human Biology 4A.

4 units, Aut (Wine)

**Biological Sciences 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, Win (Scheller)

**Biological Sciences 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 107 or equivalent, and elementary biology.

4 units, Win (Fernald)

**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)

**Biological Sciences 307. Seminar in Developmental and Molecular Neurobiology.**

Aut, Win, Spr (Scheller)

**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. Enrollment limited to eight Human Biology Seniors. Prerequisites: Permission of the instructor plus either 167 or Biochemistry 200 and Neurobiology 200.

3 units, Spr (Ciaranello)

**Mechanical Engineering 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; application to sports and rehabilitation such as posture, walking, jumping, and cycling.

3 units, Spr (Zajac) not given 1987-88

**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, Shatz, Shooter, Skene)

Neurobiology 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, Spr (Shooter, Skene) not given 1987-88

Neurobiology 213. Principles of Development and Functional Organization of the Vertebrate Central Nervous System—Advanced seminar examining the role of experience in establishing and maintaining neuronal connections. Examples illustrate principles of development and organization from the visual, auditory, and somatosensory systems. Emphasis on the study of original papers and on student presentations. Prerequisite: 200 or permission of the instructors.

3 units, Win (Knudson, Shatz)

Neurobiology 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 original research papers. Emphasis on concepts, quantitative analysis of 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, Spr (Aldrich, Baylor)

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 physiology of mammalian central nervous system. Limited to 8 students. Prerequisite: Consent of instructors.

4 units, Spr (Kocsis, Connors) by arrangement

Neurology 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 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, Aut (D. Goldstein)

Pharmacology 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 course of recent research developments.

2 units, Win (Blau) not given 1987-88

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, Spr (Davidson) not given 1987-88

Physiology 212. Human Sexuality in Medicine—A multi-disciplinary survey of physiological and psycho-social 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)

Psychiatry 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, Aut, Win, Spr, Sum (Madden) by arrangement

Psychology 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)

Psychology 147. Animal Behavior: Neurobiological Aspects—(Same as Biological Sciences 164.) Etological studies of behavior emphasizing understanding of the psychological substrates. Prerequisites: 107, 108, or 109, or Biological Sciences 22 or Human Biology 3A.

4 units, Win (R. Frenald)

Psychology 228. Ion Transport—Ion channels, carriers, and ion pumps and their regulation by intracellular messengers in variety of cell types. Laboratory demonstrations and brief hands-on introduction to some techniques (patch clamping).

2 units, Spr (Wine)


1-3 units, Spr (Wine)

SCIENTIFIC COMPUTING AND COMPUTATIONAL MATHEMATICS PROGRAM

Core Faculty: Gene Golub (Computer Science), Joseph B. Keller (Mathematics), Joseph Oliger (Computer Science)

Associate Faculty: Joel Ferziger (Mechanical Engineering), George M. Homsy (Chemical Engineering), Thomas J. Hughes (Mechanical Engineering), Thomas Kailath (Electrical Engineering)

The Scientific Computing and Computational Mathematics Program (SC/CM) is an interdisciplinary graduate program leading to the M.S. and Ph.D. degrees. It is designed for students who are interested in studying and developing computational tools in those aspects of applied mathematics which are central to modeling in the physical and engineering sciences. Graduates of this program are expected to be able to deal with a scientific problem from its formulation, moving through its mathematical analysis to algorithm development and implementation. The symbiosis of applied mathematics and numerical computing is of fundamental importance but there is also emphasis on areas such as symbolic computation and computer architecture.

The program is intended to prepare students for research in the rapidly expanding field of supercomputers.

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 masters 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 six units must be at the 200 level. Suggested courses are the following: Math 135; 173; 224; 230A,B,C; 254A,B; 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: CS108A,B, 212, 248, 260, 261. 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 210A,B; Electrical Engineering 363, 364, 365, 378A,B.

5. Seminar (1 unit)—Each student is required to attend regularly the Scientific Computing/Computational Mathematics seminar for one quarter. The seminar is held weekly during the academic year.
DOCTOR OF PHILOSOPHY

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section "Degrees" in this bulletin. The following are 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.

HUMANITIES CENTER 677

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, 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. In addition, a Stanford faculty member is designated as a Special Fellow for Research and Development. One of the Stanford Faculty Fellows serves as an advisor to undergraduates and as a coordinator of undergraduate activities at the center. Another Stanford Faculty Fellow serves as an advisor to graduate Fellows and as a liaison between the center and other Stanford graduate students. For information, please call (415) 723-3052.

In 1987-88, the center will host the annual meeting of the Humanities Institute (October 8-10.

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. A list of courses to be given by Fellows in 1987-88 follows:

**COURSES**

- **Anthropology 22. World Outside the West in the Age of European Imperialism**—(Same as History 22, Political Science 22.)
  - 5 units, Spr (Varese)

- **English 189A. Medicine and Culture in America**—(Same as American Studies 215.)
  - 5 units, Aut (Burbick)

- **History 21. World Outside the West: Change and Tradition Before the Age of European Imperialism**—(Same as Anthropology 21.)
  - 5 units, Win (Roberts) MTWThF 10

- **History 350. Graduate Colloquium on Meta-histories, Models, and Politics in Constructing American History.**
  - 5 units, Win (Berkhofer) Th 2:15-4:05

- **History of Science 142. Galileo and the Church: Political Inquisition or Critical Dialogue?**
  - 4 units, Win (Feldhay) TTh 2:15-3:30

- **Philosophy 236. Seminar on Some Problems in Kant’s Theoretical Philosophy.**
  - 3 units, Spr (Forster) Th 3:15-5:05

- **Portuguese 267. Brazilian Literature I: Modern Brazilian Fiction.**
  - 3-5 units, Aut (Wolff) MW 11-12:15

- **Slavic 230A. Russian Formalism and Structuralism.**
  - 4 units, Spr (Brown)

**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 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 section “Feminist Studies” 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 Bay Area residents working independently without other educational opportunities 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 for International Studies, Hansen Laboratory of Physics (including Ginzton Lab and the High Energy Physics Lab), Stanford Photon Research Lab, Institute for Mathematical Studies in the Social Sciences (including the Center for the Study of Language and Information), International Strategic Institute at Stanford and the Stanford Synchrotron Radiation Laboratory.

The Stanford Linear Accelerator Center, under the direction of Burton Richter is independently operated under a contract with the Department of Energy. The Stanford Synchrotron Radiation Laboratory, under the direction of Arthur Bienenstock, is a national research facility supported by the Department of Energy and National Institute of Health.

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 Assistant)

As its primary mission, the Center for Economic Policy Research (CEPR) fosters a more 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 area 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 and Natural Resources 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 Roger Noll of Economics (chair), 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, award degrees, appoint faculty affiliates not otherwise belonging to the Academic Council of Stanford University, nor appoint research associates to permanent positions of any kind.
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 gyrolrelativity 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.

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. Forum staff members have helped other departments to develop programs with China in the fields of communication, education, and public health.

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, 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 the forum on Asian-Pacific security relations.

The training program of the center includes 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, principally in the social sciences. In addition, the center has included as resident fellows several mid-career scientists and journalists.

The Center for Research in International Studies (CRIS) was established in 1967 as a means of coordinating Stanford's numerous activities in the fields of international, comparative, and regional studies. CRIS provides the University with a means of planning, financing, stimulating, and coordinating a variety of activities and programs that relate to teaching and research in the international field. It is specifically concerned with the nature and quality of Stanford's curriculum in the sphere of international, comparative, and foreign area studies and has played a leading role in the development of the undergraduate curriculum in International Relations and the A.M. program in International Policy Studies. It is continuously and closely involved in the planning, support, and coordination of Stanford's foreign area and language programs and a
variety of major research programs as well. CRIS also raises and administers funds from governmental, foundation, and private sources to support the University's activities in the international field and uses these funds in part to finance related faculty research, student fellowships, library development, graduate student exchanges, and appointment of new faculty members and international visiting professors.

The operations of CRIS are University-wide and extend to research and teaching activities in the Schools of Humanities and Sciences, Law, Business, and Education. Relations with the various departments in the social sciences and humanities are especially close, as are those with the Hoover Institution on War, Revolution, and Peace which is very heavily involved in international studies and research.

CRIS administers a program to develop internationally oriented curriculum materials for use by public school teachers and to provide inservice training for pre-collegiate educators who teach in this field. These activities are undertaken by projects on China, Japan, Africa, Latin America, and International Security which are organized within the Stanford Program on International and Cross-cultural Education (SPICE).

CRIS also administers on behalf of two consortia of major universities the Inter-University Center for Japanese Language Studies in Tokyo and the Inter-University Program for Chinese Language Studies in Taipei. Between them, these provide the United States' most outstanding facilities for advanced professional training in the Japanese and Chinese languages.

CRIS is administered by a Director and Associate Director who work with a small administrative and secretarial staff. The offices are located in the Lou Henry Hoover Building (Telephone: 415 723-4581).

CRIS neither offers courses nor confers degrees. These academic functions are performed by the schools, departments, and programs with which CRIS is associated.

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.

Note: For course information, see listings under the "School of Humanities and Sciences" 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. Appli-
cants 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:
Center for Research in International Studies Room 200, Lou Henry Hoover Building Stanford University Stanford, California 94305

INTER-UNIVERSITY CENTER FOR JAPANESE LANGUAGE STUDIES IN TOKYO

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 Tokyo provides maximum opportunities for students to gain fluency in both the written and spoken language in a Japanese-speaking and Japanese cultural environment. Language study is carried on in small classes or in individual tutorial sessions by Japanese instructors. Advanced and post-doctoral students may be given opportunities for specialized work in the language, as well as other individual study, dependent upon programs 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:
Center for Research in International Studies Room 200, Lou Henry Hoover Building Stanford University Stanford, California 94305

CENTER FOR MATERIALS RESEARCH (CMR)

Director: T. H. Geballe
Associate Director: R. P. Girouard
Director, Crystal Science Division: R. S. Feigelson
Affiliated Faculty: Currently 81 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 13 seed programs and three multi-investigator, multidiscipline thrust programs. CMR's professional staff also conducts research programs in crystal synthesis and vapor phase synthesis.
INSTITUTE FOR MATHEMATICAL STUDIES IN THE SOCIAL SCIENCES

Director: Patrick Suppes
Assistant Director: Joyce Firstenberger

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.

STANFORD LINEAR ACCELERATOR CENTER

Director: Burton Richter
Deputy Director: Sidney D. Drell
Executive Officer of the Faculty: David W. G. S. Leith
Associate Directors: Kaye D. Lathrop (Technical Division), Charles Y. Prescott (Research Division), John Rees (SLC Project), Eugene B. Rickansrud (Business Services Division)
Emeriti (Professors): Joseph Ballam, Jean V. Lebacqz, Robert F. Mozley, Richard B. Neal
Associate Professors: Jonathan Dorfan, John Jaros
Assistant Professors: David L. Burke, Thomas M. Himel, Rafe H. Schindler, Morris Swartz, Walter Toki

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 450 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. The interaction rate or luminosity of PEP is obviously of critical importance, and a program to increase the luminosity in one of the interaction regions is now in progress.

A new colliding beam facility began construction at SLAC in October 1983 and will begin operating in 1987. 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 $Z^0$, the neutral mediator of the weak interaction, can be produced. 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 1987, 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 a lecture series on various aspects of high energy physics, and conducts seminars on topics of current interest. The SLAC Summer Institute on Particle Physics is an annual meeting which combines pedagogic lectures with a critical review of recent progress in high energy physics.

The experimental research program at SLAC deals with almost all areas of elementary particle physics at high energies. To name but a few, experiments are in progress on high energy elastic and inelastic electron scattering, the study of high energy photon and hadron interactions, studies of decay properties of weakly interacting particles, and the study of electron-positron annihilation to form hadrons, leptons, and photons. The work in theoretical physics deals with all phases of elementary particle theory.

Stanford graduate students may, with the approval of their departments, carry out research for the Ph.D. degree with members of the SLAC faculty. Graduate students from other universities also participate in the research programs of visiting groups.

Research assistantships are available for qualified students by arrangement with individual faculty members. There are also opportunities for summer employment in the research groups at the center. Interested students should apply to Professor David Leith, Graduate Student Advisor.

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**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, S. 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,
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 Twentieth 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. John Raisian coordinates the program.

The National Security Affairs Program was significantly expanded three 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.
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, 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 are 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. Hitchecock (Chief Catalog Librarian); Anna Hoen (Reference Librarian, Lane Medical Library); 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); Ruth Pressman (Assistant Director, Lane Medical Library); Ruth Scibert (Curator of the Stanford Collection); Marion Smith (Director, Jackson Library of Business); Grace Stillson (Assistant Chief, Catalog Department); Margaret Windsor (Assistant Chief Librarian)

University Libraries
Director: David C. Weber
Director for Administrative Services: Bruce A. Jones
Director for Technical Services: Cynthia J. Gozzi
Deputy Director: Paul H. Mosher
Collection Development Officer: Michael T. Ryan
Library Development Officer: Brigitte Carnochan

Department Chiefs: Anthony M. Angiletta (General Reference); Carol Fleishauer (Acquisition); Tamara Frost (Catalog); Eleanor Goodchild (Science); Susan J. Schoell (Personnel); Joan K. Krasner (Access Services); Susan Perry (Meyer); Jerry C. Persons (Systems Office); Michael T. Ryan (Special Collections and University Archives); Roberto Trujillo (Foreign Languages and Area Collections); Anthony N. Angiletta (Government Documents, Acting)

Branch Librarians: Alan Baldridge (Hopkins Marine Station); Joseph G. Wible (Swain Chemistry and Chemical Engineering, Acting); Barbara Celone (Cubberley Education); Henry Lowood (Physics); Rebecca Lasher, (Mathematical and Computer Sciences); Charles C. Milford (Food Research Institute); Karen Nagy, (Music); Alexander Ross (Art and Architecture); Joseph G. Wible (Falconer Biology)

Curators—Collection Development Program: James M. Breedlove (Latin American Collections); Peter R. Frank (Germanic Collections); James Knox (U.S. and British History Collections); William McPherson (English and American Literature Collections); Roxanne L. Nilan (University Archives); Mary Jane Parrine (Romance Language and Humanities Collections); Alexander Ross (Art and Architecture Collections); Michael T. Ryan (Special Collections); Roberto Trujillo (Mexican American Collection); Barbara Van Deventer (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); Chalres J. Tanenbaum (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
Head Public Services Librarian: Karen A. Wilson
Head Reference Services Librarian: Hannah V. Sloeum
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, Aut (Ross) alternate years, not given 1988-89

Chicano Studies 186. Chicano Bibliography: Information Sources and Search Strategies—An introduction to fundamental library research in the study of the historical and contemporary condition of the Mexican American population in the United States. Includes the study and use of standard library resources and subject specialized information sources. Class design is to develop competencies in bibliographic research on the Mexican American experience.

3 units, Aut (Trujillo)

English 313. Research Seminar: Methods and Materials for the Study of Modern Literature—Some prevalent methods of inquiry into 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.

5 units, Spr (McPheron)

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)

German 300A. Introduction to German Studies—Provides bibliographical research background to acquire the necessary skills to find, to know and to handle the essential bibliographies, reference works, etc. in the field of German Studies—culture, literature, history, political science, etc. The aim is to enable students to find all facts and information needed for study and research by themselves and in the shortest possible time.

3 units, Aut (Frank) not given 1987-88

Latin American Studies 260. Colloquium on Latin American Bibliography—Directed to the
needs of beginning graduate students. Purpose is: to acquaint the student with the principal resources for Latin American studies in the humanities and social sciences and to teach the mechanics of utilizing the bibliographic data available for the study of Latin America.

3 units, Aut (Breedlove)

Medical Information Sciences 208. Computer-assisted Literature Searching—See course description listed under Medical Information Sciences.


3 units, Win (Nagy)

Slavic 184. Introduction to Slavic Bibliography—Historical and evaluative analysis of Slavic bibliographic and research tools with emphasis on Russian and Soviet materials. Application of bibliographic search methodology. Final bibliographic project required. Reading knowledge of Russian required, another Slavic language helpful.

3 units, Win (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.

IR focuses its energies through four divisions: Academic Information Resources, the Stanford Data Center, Library Information Systems, and Networking and Communication Systems.

ACADEMIC INFORMATION RESOURCES (AIR)

Academic Information Resources, directed by Ralph E. Gorin, supports the students, faculty, and staff of the University in their computer-related endeavors by providing a 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. Through these activities, AIR contributes to the computing development of the academic community. Further descriptions of some of the services that AIR provides follow. For more details about any of the services provided by AIR, contact Instruction and Research Information Services (IRIS), a division of 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 (referred to as Watson) running the VM/CMS Interactive Timesharing System, and a VAX8800 (referred to a Portia) running 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 include several text editors and programming languages such as Pascal, FORTRAN, Basic, Lisp, and statistical packages such as SPSS®, APL, 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 rack located on the Second Floor of Sweet Hall contains instructions on how to obtain an account. An AIR student consultant is usually available at this location and at the Tresidder Union location.

In addition to 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), 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). AIR also develops software tools that allow Stanford faculty, with minimum intervention by computer programmers, to create innovative instructional applications on computers and are actively developing and providing interactive classrooms for the introduction of these applications.

COURSES

LOTS 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. Classes are held in Sweet Hall except the PC Intro sessions which are held at Tresidder Union.

Instruction and Research Information Services (IRIS), a division of AIR, also offers alternatives for learning about computers and
their use: formal 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 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.

TOPS-20 Intro-Class—An introduction to the TOPS-20 Operating System. Topics: opening an account on the Tragedies (DEC-20’s), an overview of basic commands, directories and files, and on-line help.

0 units, Aut, Win, Spr, Sum

TOPS-20 Editors (EMACS and Edit)—An introduction to the screen-oriented editor (EMACS) and the line-oriented editor (Edit) on the Tragedies.

0 units, Aut, Win, Spr, Sum

UNIX® Intro-Class—An introductory session outlining opening accounts, logging in, logging out, features of the UNIX file system, useful utilities available, creating and editing files, and running programs on Portia.

0 units, Aut, Win, Spr, Sum

VM/CMS Intro-Classes—Introductory classes covering opening an account, logging on and logging out, basic file editing and facility, and other VM commands.

0 units, Aut, Win, Spr, Sum

PC Intro Classes—One-hour hands-on sessions covering the basics of the word processing program WordStar and the spreadsheet program Lotus 1-2-3.

0 units, Aut, Win, Spr, Sum

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 section, “Libraries” in this bulletin.
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-X®, 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 center also produces a wide range of graphic products via services in board design, comprehensive computer graphics, photography, typesetting, writing, and printing. 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) 723-4391. The Class Schedule is also available on-line (DOC#SCHEDULE PUBLIC). A related educational program is offered by IRIS, a division of Academic Information Resources (AIR). Call (415) 723-1055 for information.

COURSES

INTRODUCTORY SEMINARS

40. Introduction to DOS—Topics: the purpose and role of DOS (Disk Operating System), fundamental DOS concepts and commands, and advanced functions particular to hard disk machines (subdirectories, search paths, batch files). Also, an optional hands-on session after the initial lecture.

0 units, Aut, Win, Spr, Sum

48. Introduction to the IBM Personal Computers—For those with little or no experience with microcomputers. Part I: basic computer concepts (memory, storage, program, and file); similarities and differences among the various members of the IBM PC family; choose the right hardware; balancing cost and capability; the operating system; and applications software. Part II is an optional hands-on session for which you register after attending Part I.

0 units, Aut, Win, Spr, Sum

81. Introduction to Macintosh—An overview of Macintosh skills for those with little or no computer experience. Topics: MacWrite, types and configurations of Macintosh equipment, and file management. Demonstrations on how to communicate with the Data Center mainframe.

0 units, Aut, Win, Spr, Sum

TEXT EDITING AND FORMATTING

1. Introduction to WYLBUR—An introduction to WYLBUR, the text editor (word processor) on the Data Center mainframe. Emphasis is on Page WYLBUR, an extension to WYLBUR that allows you to edit a screen of text by positioning the cursor where you want to insert, delete, or change the text.

0 units, Aut, Win, Spr, Sum

2. Introduction to WordPerfect—Introduction to the wordprocessing microcomputer software package, WordPerfect, for the novice involved in the preparation of frequently modified documents and reports, and lengthy reports, papers, and manuscripts. Trains in the fundamentals of word processing and the special features of WordPerfect software.

0 units, Aut, Win, Spr, Sum

3. Accelerated Introduction to WYLBUR—The same material as (1) in half the time. An introduction to WYLBUR, the text editor and job entry system on the Data Center mainframe computer. Emphasis on Page WYLBUR, a full-screen text editor.

0 units, Aut, Win, Spr, Sum

8. Introduction to MacWrite and MacPaint—Introduction to the basic capabilities of MacWrite and MacPaint on the Macintosh. Learn to: create and modify simple text documents; create graphic images; print files; and integrate MacWrite and MacPaint files via the Clipboard.

0 units, Aut, Win, Spr, Sum

53. Introduction to MultiMate—Introduction to 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

69. Advanced MultiMate—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, Aut, Win, Spr, Sum

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 Version 4.2

0 units, Aut, Win, Spr, Sum

DATA BASE MANAGEMENT

5. Intermediate DataBase—For those with a basic understanding of DataBase (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, the Stanford Public Information Retrieval System on the Data Center mainframe, is a unified approach to storing, retrieving, and processing information which enables you to develop a small data base; 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. SPIRES, the Stanford Public Information Retrieval System in the Data Center mainframe, is a unified approach to storing, retrieving, and processing information. Search for information, add new data, modify your 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—For programmers with experience in SPIRES or other languages. How to create a comprehensive SPIRES data base application. A complete, high-level overview of application development concepts and facilities of SPIRES in order to integrate the components of SPIRES.

0 units, Aut, Spr

46. Reporting in SPIRES—How to create reports using data stored in SPIRES data bases in the Data Center mainframe. Covers 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, Spr

55. Introduction to DataEase—How to use the basic functions and features of DataEase, 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

61. Developing Applications in Prism®—How to develop and install your own application in the Data Center mainframe in Prism, a tool for SPIRES end-users and application developers that provides easier methods for searching, entering, reporting, and exporting data in SPIRES files. The concepts and facilities of the Prism environment and the development techniques required to put up a full Prism application. Applications design for the Prism environment; understanding the Prism meta-data files; use of the SPIRES Screen Definer utility to create formats for Prism applications; user exits, special topics; installation of a full Prism application.

0 units, Win, Sum

77. Introduction to Prism—How to use Prism, a tool that provides SPIRES users with a consistent and easy-to-use framework for manipulating data in SPIRES files, to retrieve, print, and enter information into existing files, and to understand similar techniques for working in various Prism applications. Covers Prism basics: how it is structured, how to search for information, how to enter new data in a Prism file, and how to generate printed reports. Also, demonstration of some applications currently available in Prism, i.e., the online Faculty/Staff Directory.

0 units, Aut, Win, Spr, Sum

JOB CONTROL LANGUAGES

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 (Statistical Package for the Social Sciences, Extended Version) and SAS (Statistical Analysis System). How to submit jobs and examine output critically. Introduction to batch processing on the 3084. 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

88. 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

STATISTICAL APPLICATIONS PACKAGES

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 code to transform and create variables, and run elementary statistical procedures on the mainframe computer. Some advanced data step applications. SAS is a package of programs used for data analysis. Sophisticated data and file manipulation tools are part of the software. How to prepare data for analysis. Oriented to those with programming knowledge.

0 units, Aut, Win, Spr, Sum

97. Advanced DATA Step Applications in SAS®—How to write custom reports using SAS system files as input. Programming techniques for transformation and creation of variables and how to use the macro facility, SAS’s code generation language. Techniques for the intermediate to advanced user. Examination of report writing, data manipulation, and variable handling procedures. Introduction to the macro language. First session: specific DATA Step needs. Second session: user topics.

0 units, Aut, Win, Spr, Sum

98. Advanced Statistical Procedures in SAS®—How to choose 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, Sum

GRAPHICS

47. SAS/GRAPH®—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, Spr

57. Introduction to Lotus 1-2-3—Introduces the fundamentals of using Lotus 1-2-3 on the IBM PC/XT for those with little or no exposure to electronic spreadsheet programs. Emphasis is on developing basic spreadsheet skills, entering and formatting data, creating and editing formulas, and building simple financial models for conducting "what-if" analyses and/or gaining experience in producing graphs and printing simple reports.

0 units, Aut, Win, Sum

75. Publication Design and Layout Using the Macintosh—How to design and lay out a simple publication, newsletter or a 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, Aut, Win, Spr, Sum

83. Introduction to Presentation Graphics on the Macintosh—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, Aut, Win, Spr, Sum

APPLICATIONS

80. Advanced Lotus 1-2-3—Sophisticated spreadsheet models take full advantage of the powerful 1-2-3 program. Follow-up to Introduction to Lotus 1-2-3, taken after you have worked
with 1-2-3 for several months, or have equivalent experience. Focuses on using Lotus in a University administrative environment; emphasis is on data management techniques (sorts and queries, data tables and data base statistical functions); logical operators (simple and nested IF functions); date arithmetic, file operations, and printing and graphing of spreadsheet data. Also, a lesson on Lotus macro programming.

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.

45. Introduction to Samson on 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.

93. Introduction to Samson on 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.
Technology and science are activities of pivotal importance in modern life, intimately bound up with industrial society's evolving character, problems, and potentials. If technological and scientific 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. While issues of professional ethics and social responsibility confront practicing engineers and scientists, lawyers, public officials, and business people are increasingly called upon to make decisions for which a basic understanding of modern technology or science, and of ethical, social, and environmental impacts, is essential. Ordinary citizens, moreover, are being asked with increasing frequency to pass judgment on controversial matters of public policy relating to technology and science. These circumstances require a new form of liberal education adequate to the technical character of contemporary society.

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 technology and science with human values and worldviews, social organizations and institutions, and broader cultural and environmental contexts. VTSS courses study technology and science 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, in a variety of ways:

1. To satisfy University Distribution Requirements.
2. To satisfy the Technology and Society requirement of the School of Engineering.
3. As parts of student-designed concentrations required for majors in Humanities Special Programs.
4. To satisfy the requirements of the VTSS Honors Program complementing any standard major (see below).
5. As part of majors in VTSS (see below).
6. As general education courses.

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 broad, technology- and science-related aspects of life in modern society and culture.

WALTER G. VINCENTI PRIZE

An annual prize is awarded to the best essay in VTSS 1, 2, 3. This prize honors Professor Walter G. Vincenti, historian of technology, a 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 technology and science from philosophical, ethical, historical, social, economic, and aesthetic perspectives. Students pursuing the A.B. degree will, in addition, study a field of technology and science in sufficient depth to obtain a grasp of basic concepts and methods and will complete a concentration on a technology- or science-related theme, area, or problem. Those seeking the B.S. degree will complete the equivalent of one full year of courses in technology and science, partly chosen with reference to the student's special interest in the technology and science in society field. The requirements for the bachelor's degrees in VTSS are as follows:

BACHELOR OF ARTS

1. VTSS Core (7 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)
   f. Social Science Perspectives (one of VTSS 150, 153, 155, 159, 161, or 162)
   g. Core Seminar (VTSS 200)

2. Technical Literacy (5 courses)
   a. Computer literacy, normally demonstrated by:
      1) completing Computer Science 105A or 106 or equivalent with a letter grade indicator of "B" or better; and
      2) giving evidence of ability to use the computer in scholarly work.
   b. Science or Engineering literacy, as demonstrated by:
      1) completing a four-course "technical depth sequence" (minimum of 12 units) in one field of engineering or science (samples on file in the VTSS office), or
      2) completing the program's technical literacy sequence (VTSS 51, 52, 53) and one other technical course selected in consultation with the Program Chairman or Associate Chairman.

3. Thematic Concentration (at least 6 courses above the introductory level, minimum of 24 units). A concentration shall be organized around a technology or science-related theme, problem, or area (sample thematic concentrations on file in the VTSS Office).

BACHELOR OF SCIENCE

The student pursuing the B.S. degree shall complete the VTSS core and a coherent package of a minimum of 50 units of technical courses designed to ensure not only an understanding of but an ability to work with concepts and methods of engineering and science. While part of this component may be designed to reflect the student's interest in societal problems, all courses in it must be in science, engineering, or mathematics. Introductory courses in mathematics or physics (e.g., Mathematics 19 or Physics 19) will not normally be countable as part of the technical depth component.

A maximum of three courses may be taken on a Pass/No Credit basis. VTSS majors wishing to do an Honors thesis should consult with the Chairman or Associate Chairman.

HONORS PROGRAM

As distinguished from VTSS majors, the VTSS Honors Program is intended to complement study in any conventional major. The aim of the Honors program is to enhance the student's understanding of the relations among technology and science, social institutions, and human and cultural values, with special although not exclusive reference to modern and modernizing societies.

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 technology and science have influenced ideas and developments examined in their respective major fields.

ADMISSION

The program is open to students majoring in any field. Interested students should indicate their intention to pursue the Honors program no later than Autumn Quarter of their junior year, but they are urged to consult with the Chairman or Associate Chairman of the Program in their freshman or sophomore years.

REQUIREMENTS

1. Introductory Course: VTSS 101
2. Philosophical and Ethical Perspectives: VTSS 110
3. Historical Perspectives: VTSS 107 or 121
4. Social Science Perspectives: One of VTSS 150, 153, 155, 159, 161, or 162.
5. Core Seminar: VTSS 200
6. Honors Project: A 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 and 5 units Winter Quarter, senior year). The topic must be approved by the Associate Chairman in consultation with other program faculty. The project will be evaluated by the student's tutor and a second reader.

The Honors project must be completed with a letter grade indicator (LGI) of at least "B." The student must also achieve a LGI of at least 3.3 in the courses taken to satisfy Requirements 1-4 above. If these requirements are met, the designation "Honors Program in Values, Technology, Science and Society" will be affixed to the student's permanent academic record and appear in the graduation program.

COURSES

WESTERN CULTURE SEQUENCE

1, 2, 3. Western Culture and Technology—The development of Western culture from the ancient world to the 20th century through the interconnections among the three major realms of culture: intellectual, material, and social. Does not require the use of mathematics.

1. The Ancient World—From the earliest civilizations in the Near East to the fall of the Roman Empire. (DR:1; three-quarter sequence)
   5 units, Aut (Good, Katz, Staff) MTW 10; two-hour section by arrangement

2. Middle Ages, Renaissance, and Enlightenment—Society, religion, and technology from the Middle Ages to the 18th century. (DR:1; three-quarter sequence)
   5 units, Win (Seaver, Staff) MTW 10 two-hour section by arrangement

3. The Modern World—Industrialization and its impact on social and economic structures. Artistic, political, and ideological perspectives on 19th and 20th century science and technology. (DR:1; three-quarter sequence)
   5 units, Spr (J. Corn, Staff) MTW 10 two-hour section by arrangement

TECHNICAL LITERACY SEQUENCE

51, 52, 53. 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) given 1988-89

CORE

101. Technology and Science in 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 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, funding, women in science and technology); 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)

3-5 units, Win (McGinn) MW 2:15-3:30 two-hour section by arrangement

107. Technology and Modern Industrial Society—(Same as Economics 113.) The interrela-
tionships between technology and the nature and form of industrial societies over the past 200 years. Technological change as a socio-economic process illuminating the history of industrial societies. Factors influencing the rate and direction of technological change and diffusion. Implications for economic structure and the growth of large-scale organizations. The impact of these changes on modern industrial man as producer and consumer. (DR: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 nature of ethics and morality; the nature 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: biomedical ethics (abortion, euthanasia, in vitro fertilization, pre-determination of sex of offspring, and genetic testing); environmental ethics (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, Aut (McGinn) MW 2:15-3:30
plus two-hour section by arrangement

115. Technology and Aesthetics—The role of emotion in technological and scientific problem-solving and in the responses of users and observers to the results of such inquiries. Analysis of concepts such as beauty, ugliness, elegance, quality, appropriateness, and function as they apply to the activities and specific works of technology and science. Attention to improving the ability to analyze and appraise the "fit" of the products and practices of technology and science with human beings. Case studies of personal computers, buildings, machines, offices, and scientific models and theories.

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

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 United States, 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 10
plus section W 2:15-4:05 or Th 2:15-4:05

200. Core Seminar—Weekly seminar for VTSS majors and Honors program students. Analysis of influential, advanced-level works in the VTSS field. Prerequisite: 4 VTSS Core courses or consent of instructor.

2 units, Spr (Staff) by arrangement

Note—See "Undergraduate Programs" section above for courses which satisfy the Social Science Perspectives requirement.

OTHER OFFERINGS

106. The Nature of Technology in Modern Society—(Same as Engineering 221.) Development of unified consideration of technology, science, society, 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 (Kline) given 1988-89


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

132. The Scientific Revolution—(Same as Philosophy 145, History 139, History of Science
133. History and Philosophy of 20th Century Physics—(Same as Philosophy 168, History 139A, History of Science 168.) 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.

4 units, Win (Galison) TTh 11-12:15

139. Ancient Travel in Fact and Fiction—(Same as Classics 131.) Reading a culture through its modes and perceptions of travel. The technologies of transport and communication in the Graeco-Roman world. Motivations for and purposes of travel: distribution of commodities, warfare and colonization, awareness of and interest in foreign cultures, imperialism. The attitudes revealed in the structures of travel and in travel literature. The interrelation of realities and fantasies in regard to travel. The journey as metaphor. Readings from ancient authors in translation. Lectures and slide presentations provide social, political, and technological information.

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

140. Science, Technology, and Soviet Society—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 responsibilities of careers in science. The images of science and technology in Marxist philosophy, Soviet ideology, and popular culture.

3 units, Spr (Becker) W 2:15-4:05

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, 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

142. Information Systems and Society—Information systems and their social impact. The elements of information systems: coding/decoding (alphabets, music, maps, body language), storage/recall (memory, cave walls, magnetic tape, xerography), and transmission/reception (pigeons, smoke signals, satellites). The social impact of sound, pictorial, and written information systems from the development of writing, through the invention of the printing press, to satellite broadcast, personal computation, and rock video. Speculation about changes after the next generation due to the coming graphics revolution, VCR, CDI, PIXAR.

4 units, Spr (House)

143. Technology and the Body—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 by social historians and cultural anthropologists: Thomas Laquer, Rayna Rapp, Sherry Ortner, and Michel Foucault. Open to advanced undergraduates and graduates.

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

144. 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
147. Medicine and Technology—The ethical issues resulting from technical developments in medical diagnosis and treatment. The methods of control in application of such technologies without impeding progress in new development. Example case studies for discussion.

3 units, Spr (Chase)


4 units, Spr (Clayton) MWF 1:15-2:05

149. Technology and National Security—(Same as Physics 145) The technology of strategic nuclear armaments and their implications for the present and future security of the United States 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)

150. Legal and Political Perspectives on Technology and Biology—(Same as Human Biology 125.) How legislatures, courts, and regulatory agencies deal with contemporary issues involving technology and biology. Issues: computers and privacy; risk-benefit analysis and politics; equal pay and job safety in the workplace; and government and corporate accountability in a time of rapid technological and scientific change. Introduction to the workings of law, politics, and regulation. Emphasis on student research and developing skills of written and oral presentation to educate and persuade. Limited to 30 students.

4 units, Spr (McBride) TTh 3:15-4:45

151. Technology in American Society—(Same as History 270.) Undergraduate colloquium on five related areas: the impact of industrialization on work and living patterns, the roles of professionals in directing technology, the problems in bio-medicine of applying and developing technology, the development and uses of technology in weaponry and foreign policy, and the problem of whether there should be limits on the development and uses of technology. The analysis requires consideration of the society and political economy in which particular technologies have developed. Limited enrollment. Permission of instructor.

5 units (Bernstein) given 1988-89

152. The Atomic Bomb in History—(Same as History 755, History of Science 75.) Analysis of the use of the A-bombs, the roles of scientists, problems of postwar international control of atomic energy, the quest for the H-bomb, the rise of nuclear strategy, and the issues of "atomic spies." Limited enrollment. Prerequisite: Consent of instructor.

5 units, Win (Bernstein) M 3:15-5:30

153. Applied Anthropology—(Same as Anthropology 137.) Application of anthropological knowledge and skills to practical problems: developing and evaluating medical care delivery systems and educational programs at home and abroad; assisting in the transmission of technological innovations and predicting their impact; serving as planners, administrators, and advisors for development programs at the national and community level. The substance of such programs; the utility of anthropological theory and techniques in solving contemporary problems; and the ethics of professional practice.

5 units, Spr (Barnett) given 1988-89

155. Social Structure of World Society—(Same as Sociology 152, Education 231.) Sociological analysis of human society on a worldwide basis, i.e., all the people inhabiting the earth and the institutions through which their lives are organized treated as participants in one global social system. Competing models of the emerging world order and its dynamics are reviewed and compared. Topics: 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 1988-89

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 preven-
tion and management, and the means of translating such measures from theory to practice. Limited enrollment. Prerequisite: 154A.

5 units, Spr (Abrams) Th 2:15-4:05

157. The Machine in American Culture—(Same as American Studies 221.) 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 (J. Corn) given 1988-89

158. Material Culture—(Enroll in American Studies 217, History 251S.) An introduction to the study of culture through three-dimensional objects. The artifacts of the built environment in the United States over the last 100 years.

5 units, Spr (J. Corn)

159. Sociocultural Implications of High Technology—(Same as Anthropology 138/238.) Seminar on the development, diffusion, and utilization of technology as a cultural process. Emphasis on high technology of the type developed in and around Stanford, biogenetics, microelectronics, and the new information technology. Local technologists and venture capitalists give weekly in-class presentations. Examines unintended human damage such technological innovations have sometimes produced; ways in which such innovations can drive or enable profound changes in other parts of a sociocultural system (its symbolic, value, and belief patterns, and its social and economic organization); and implications thereof 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. Open to all graduate students and undergraduates contemplating Honors theses. (DR:5)

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

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. Discrepancies 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

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 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. Lecture-seminar format.

5 units, Win (Siegel) MWF 11

162. Communication, Technology, and Society—(Same as Communications 169/269.) The intellectual tools for analyzing the question: Does technology drive societal change or does society drive technological change? How what people can do (their technology) is related to psychological, social, economic, cultural, and political systems. Topics: technologies emerging in the U.S. since 1850, emphasizing the post-industrial society and computer technology.

4 units, Spr (Nass)

163. Specialized Workshop: Science Writing—(Same as Communications 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 both lay and professional audiences. Discussions of relationships between scientists and the media.

4 units, Spr (Levenstein) given 1988-89

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 (Good)
166. **Innovation**—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 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 of product life cycle. Government role in innovation.

3 units (Kline) given 1988-89

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 technology, “appropriate” technology, factors affecting choice of technology, technological capability, and the relationship between technology and culture. Limited enrollment. Open to all.

4 units, Aut (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. The evolving nature of and attitudes toward work in the preindustrial world; the impact of early industrialization on work and leisure; early industrial management and the emergence of unions; and historically influential philosophies of work and work-society relations (Marxism and Taylorism). Major focus 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 in contemporary America, contrasted with the situation in Italy, West Germany, 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, Win (Adler) MWF 3:15-4:30

175A,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) given 1988-89

178. **Phenomenological Foundations of Cognition, Language, and Computation**—(Same as Computer Science 378.) Critical analysis of theoretical foundations of cognitive approach to language, thought, and computation. Readings contrast the rationalistic assumptions of current linguistics and artificial intelligence with alternatives drawn from phenomenology, theoretical biology and socially-oriented speech act theory. Emphasizes relevance of theoretical orientation to the design, implementation and impact of computer systems, especially those dealing with language.

3 units (Winograd) given 1988-89

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 undergraduates and graduates in any field.

3 units (Adams) given 1988-89

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 (Ortolano) given 1988-89

185. Facility Siting—(Same as Civil Engineering 239.) Site selection procedures for facilities which are difficult and controversial to locate because of their social and environmental externalities including landfills, hazardous waste sites, conventional power plants, and alternative energy systems. Siting techniques including constraint mapping, optimization procedures and decision analysis. New planning strategies, including environmental dispute resolution. Available to undergraduates with consent of instructor.

3 units, Spr (Wiggins) MWF 10

190A,B,C. Honors Project—Project for VTSS Honors students.

190A. Submission of Proposal—Preliminary planning and study. Project proposal to be submitted by middle of Spring Quarter of junior year.

2 units, Spr (Staff) by arrangement

190B. Continued Study and Writing—Regular meetings with tutor. Prerequisite: 190A.

5 units, Aut (Staff) by arrangement

190C. Final Work on Project—Regular meetings with tutor; participation in honors project seminar. Project due in final form in first week of Spring Quarter. Prerequisite: 190B.

5 units, Win (Staff) by arrangement


3-5 units, Aut, Win, Spr (Staff) by arrangement

199. Individual Work.

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

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, 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. Santiago Rodriguez, 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 regulations should contact Mr. Rodriguez 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 Aid 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, Quarterly Time Schedule) are available through the Catalog Mailing Services. Individual departments, Hopkins Marine Station, School of Law, School of Medicine, Graduate School of Business, School of Education, and the School of Engineering may be contacted directly for more specific information.

The quarterly Time Schedule may be picked up 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, and Chicanos and Puerto Ricans. The Office of Undergraduate Admissions and the Office of Graduate Studies 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:

Access Stanford, a guide for the physically limited, available at the Office of the Dean of Student Affairs.


Campus Report, the weekly faculty/staff newspaper (includes events calendar and employment opportunities), available at News and Publications Service.

Conference Planning at Stanford, available at the Conference Office.


Faculty/Staff Directory, on sale at Stanford Bookstore.

Guide to University Resources 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 by request to the Daily office.

Stanford Preview, an introduction to the undergraduate experience at Stanford, sent to inquirers by 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.
## APPENDIX

### COURSES CERTIFIED FOR 1987-88 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 1987-88. 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 1987-88 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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>English 7, 8, 9</td>
<td>Literature and the Arts in Western Culture (entire sequence must be completed)</td>
</tr>
<tr>
<td>History 1, 2, 3</td>
<td>Europe from the Middle Ages to the Present (entire sequence must be completed)</td>
</tr>
<tr>
<td>Humanities 61, 62, 63</td>
<td>Western Thought and Literature (entire sequence must be completed)</td>
</tr>
<tr>
<td>Philosophy 5A, B, C</td>
<td>Ideas in Western Culture (entire sequence must be completed)</td>
</tr>
<tr>
<td>SLE 91, 92, 93</td>
<td>Program in Structured Liberal Education (entire sequence must be completed and thereby also satisfies Areas 2 and 3)</td>
</tr>
</tbody>
</table>

### AREA 2: LITERATURE AND FINE ARTS

**A) Courses typically taken either by non-majors or by people without special preparation.**

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
Art 65 (same as Medieval Studies 65, History 65); Medieval Culture and Society
*Asian Languages 91; Traditional East Asian Civilization: China
*Asian Languages 110; Japanese-Western Literature and Cultural Interaction
*Asian Languages 114; Haiku
*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 136; Classics of Japanese Literature in Translation I
*Asian Languages 137; Classics of Japanese Literature in Translation II
*Asian Languages 138; Modern Japanese Literature in Translation
*Asian Languages 176; Chinese Myths, Legends, and Folktales
*Asian Languages 177/277; Classic Japan
*Asian Languages 179/279; Classical Japanese Drama
*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

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 10, 11, 12; Conflict and Change in Western Culture (entire sequence must be completed)
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-1950's
Drama 155N; American Drama: 1960 to Present
Drama 156; American Women Playwrights
Drama 157N; Contemporary Black Playwrights

English 5; Introduction to Literature

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 40/140; Drama
English 50/150; Poetry and Poetics
English 60/160A; The English Bible as Literature

English 64B/164B; Arthurian Literature

*English 68/168; American Indian Mythology

English 73 (same as Drama 59); Shakespeare

English 79/179A; Hemingway and Fitzgerald

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 71A; Modern German Novel

German Studies 83A; Faust in the Western Tradition

German Studies 150; Introduction to German Literature

German Studies 153; Contemporary German Drama

German Studies 154; Modern Short Prose

History 174 (same as English 128, American Studies 100); Reflections on the American Condition

Humanities 90; Introduction to the Humanities

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; Introduction to the Language and Structure of Western Music

Religious Studies 121A, 121B; Hebrew Bible (both courses must be completed)

Slavic 145; Survey of Russian Literature in English Translation I

Slavic 146; Survey of Russian Literature in English Translation II

Slavic 147; Survey of Russian Literature in English Translation III

Slavic 151; Dostoevsky

Slavic 153; Leo Tolstoy

SLE 91, 92, 93; Structured Liberal Education (entire sequence must be completed and thereby also satisfies Areas I 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 105A; Art and Architecture in Medieval Britain

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: 1670-1860

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 119; Modern British Literature

English 120; American Historical Novel

English 132; 19th Century English Novel

English 133; 20th Century English Novel

English 137; Development of the Short Story

English 146; Drama Since 1945

English 161A; Afro-American Novel

English 163F; Women Writers: The Literary Tradition

English 167A; Literature of Fantasy

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 Mannerism Through the Modern
Spanish 11B, 12B, 13B; Second-Year Spanish for Bilingual Students (entire sequence must be completed)
Spanish 130B; Mexican and Chicano Cultural Readings
Spanish 131B; Hispanic American Cultural Readings
Spanish 132B; Spanish Cultural Readings
Spanish 140; Introduction to the Methods of Literary Analysis
Spanish 151; Spanish Literature I: Major Works of the Middle Ages and Renaissance
Spanish 152; Spanish Literature II: Major Works in Spain 1800-Present
*Spanish 161; Spanish-American Literature I
*Spanish 162; Spanish-American Literature II

AREA 3: PHILOSOPHICAL, SOCIAL, AND RELIGIOUS THOUGHT

Biological Sciences 114; Scientific Philosophy and Bioethics
Classics 3; Democracy and Imperialism
Classics 8; Classical Politics
Classics 18; Greek Mythology
Economics 120; The Marxian and Radical Tradition
French 290; Civilization I: 17e and 18e siecle
German Studies 33A/133; Democracy, Protest, and Political Culture in German-Speaking Europe
*History 21,22 (same as Anthropology 21,22, Political Science 21,22); The World Outside the West (both courses must be completed to satisfy Area 3; taken independently, each course satisfies area 5 and Non-Western Culture.)
History 136A; European Thought in the 19th Century
History 136B; European Thought in the 20th Century
History 174 (same as English 128, American Studies 100); Reflections on the American Condition
*History 187A; The Middle East 370-1718
History of Science 147; Science in the Enlightenment
Humanities 90; Introduction to the Humanities

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 Philosophy
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, 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

*Religious Studies 1D; Religions of the East
*Religious Studies 14; 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 131; Founders in Myth and History
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 4 (same as Linguistics 4); Language and Culture
Anthropology 5 (same as Human Biology 113, Linguistics 5); 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 101 (same as Linguistics 71B); Linguistics and Literature
English 102; History of the English Language
English 104 (same as Linguistics 78); Language and Literary Theory
German 19A/119 (same as Linguistics 75); Introduction to the Germanic Languages
German 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 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); 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 and Society

*Anthropology 187 (same as Human Biology 183); Hunter Gatherers in Archaeological Perspective
Anthropology 188 (same as Human Biology 188); The Evolution of Prehistoric Civilizations
Anthropology 238 (same as VTSS 159); Sociocultural Implications of High Technology
*Asian Languages 92/192; Traditional East Asian Civilization: Japan
*Asian Languages 152 (same as History 195); Nomad Empires of Inner Asia
*Asian Languages 153 (same as History 193, History of Science 163); Science, Technology, and Material Culture in Traditional China
*Asian Languages 156 (same as History 192A); China from Earliest Times to the 9th Century
Classes 14; Classical Athletics
Classes 20; Introduction to Classic Archaeology
Classes 101 (same as History 101H); History of Greece
Classes 102 (same as History 102H); Greek and Roman History from Alexander to Caesar
Classes 103 (same as History 103H); History of the Roman Empire
Classes 107 (same as History 112A); Art, Religion, and Society in Late Antiquity: 284-717AD
Classes 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
Education 200; History of Education
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 Political Science 22, Anthropology 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 24A; Russian Civilization: Shaping of Culture and Society 9th-17th Centuries
History 64 (same as Anthropology 110, Chicano Studies 110, Spanish 135); Introduction to Chicano Life and Culture
Mathematics 42; Calculus and Analytical Geometry
Mathematics 43; Calculus and Analytical Geometry
Mathematics 43H; Honors Calculus and Analytic Geometry
Mathematics 44H; Honors Calculus and Analytic Geometry
Mathematics 103; Matrix Theory and Its Applications
Mathematics 113; Linear Algebra and Matrix Theory
Operations Research 50/150; Models and Applications of Operations Research in Society
Philosophy 57/157; Introduction to Logic
Philosophy 138A and 138B (same as Classics 138A, 138B, History 138A, 138B, History of Science 138A, 138B); Cosmology (both courses must be completed to satisfy Area 6; taken independently, each course satisfies Area 3)
Psychology 60; Statistical Methods
Statistics 40; Chance and Strategy
Statistics 60; Introduction to Statistical Methods I
Statistics 110; Statistical Methods in Engineering and the Physical Sciences
Statistics 116; Theory of Probability
VTSS 51, 52, 53; Nature of Technology, Mathematics, and Science (entire sequence must be completed and thereby also satisfies Areas 6 and 8)

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; Biology for Humanists
Biology 50A, B; Biology and the Oceans
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
Psychology 103A; Visual Sensing by Humans and Computers
VTSS 51, 52, 53; Nature of Technology, Mathematics, and Science (entire sequence must be completed and thereby also satisfies Areas 6 and 8)

AREA 8: TECHNOLOGY AND APPLIED SCIENCE
Applied Earth Sciences 1; Introduction to Earth Resources
Applied Earth Sciences 130; Environmental Earth Sciences 1
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 (students must also have completed CS 106, as taught before 9/1/85)
Computer Science 105A; Introduction to Computers
Computer Science 106A; Introduction to Software Engineering
Computer Science 108A; Fundamentals of Computer Science
Electrical Engineering 106; Planetary Exploration
Engineering 10; Applied Mechanics - Statics (formerly English 3)
Engineering 12; Intermediate Dynamics
Engineering 30; Engineering Thermodynamics
Engineering 35; Automotive Technology
Engineering 40; Basic Electronics
Engineering 50 (same as Material Science 50); Introductory Science of Materials
Engineering-Economic Systems 31; Introduction to Decision Analysis
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
Physics 145 (same as VTSS 149); Technology and 
National Security
VTSS 51, 52, 53; Nature of Technology, Math-
ematics, and Science (entire sequence 
must be completed and thereby also satis-
fies Areas 6 and 7)
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 Requirement. 
This limitation does not apply to courses 
offered by faculty who are Academic Coun-
cil members.

BERLIN
A) Courses taught by Academic Council mem-
bers:
Area 2:
Overseas Studies Germany 101; Berlin 1949-
1961: A Culture in Division
Overseas Studies Germany 102; Brecht's Berliner 
Ensemble: Seminar
Area 5:
Overseas Studies Germany 1; Political Econ-
omies of Advanced Industrial Democ-
racies: Japan, US, Western Europe
B) Courses taught by Non-Academic Council 
members
Area 2:
Art 120X; New Ways of Seeing
Art 123X; Art in the Weimar and Nazi Periods
Overseas Studies Germany 4; The Industrial 
Revolution's Impact on Art, Architecture, 
and Society Theory
Overseas Studies Germany 124X; German Art 
Since 1945
Area 5:
History 230B; Berlin: Its History, Politics, and 
Culture
Overseas Studies Germany 125; Introduction to 
German History: Politics and Culture from 
the Middle Ages to the Reunification of 
Germany
Political Science 140X; The German Federal 
Republic in the International System

FLORENCE
A) Courses taught by Academic Council mem-
bers:
Area 2:
Overseas Studies Florence 101; Forster and 
Lawrence in Italy

Overseas Studies Florence 102; Modern Italian 
Novel
Overseas Studies Florence 103; The Arts as Pub-
lic Policy in Italy from the Renaissance
Area 5:
History 135A; (same as Political Science 121X); 
US and Western Europe after World War II
B) 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 5:
Political Science 110X; Contemporary Italian His-
tory and Politics

OXFORD
A) Courses taught by Academic Council mem-
bers:
Area 2:
English 131B; The 18th Century English Novel
Overseas Studies Britain 102; High Life and Low 
Life—Relations between Polite and Pop-
ular Forms in 18th Century Literature
Area 3:
Philosophy 20; Introduction to Moral Theory
Area 5:
Overseas Studies Britain 103; Constitutional Pro-
tection of Human Rights in the United 
States and United Kingdom
B) Courses taught by Non-Academic Council 
members
Area 2:
Art 176X. History of English Architecture
Area 5:
History 143A; British History, 1780-1870
History 143W; British History, 1870-1970

TOURS
A) Courses taught by Academic Council mem-
bers:
Area 3:
Overseas Studies Tours 010; Tocqueville on 
France and the United States
B) Courses taught by non-Academic Council 
members
Area 2:
French 100; 17th Century French Literature
French 101; 19th Century French Literature
French 102; 20th Century French Literature
Area 5:
Economics 122X; The Economy of Modern 
France
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Economics 128X; Contemporary Problems of Economic Growth
History 130V; Survey of French History 1715 to Present
Political Science 111X; Contemporary French Politics
Political Science 120X; French Foreign Policy
Political Science 140X; France in the Third World

UPPER-LEVEL COURSES SATISFYING THE NON-WESTERN CULTURE DISTRIBUTION REQUIREMENT, 1987-88

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
128E. Japanese Ceramics

ASIAN LANGUAGES
197. Images of Women in Modern Japanese Literature
260. Chinese Poetry I
261. Chinese Poetry II
273. Chinese Drama
294. Major Haiku Poets
332. Seminar: The Bamboo Annals
371. Seminar in Chinese Narrative
396. Seminar 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
194. Early and Medieval Japan to 1336
246. Undergraduate Colloquium: The New History of Africa
249A. Undergraduate Colloquium: Africa Since 1945
250. Undergraduate Colloquium: Modern Mexico
251. Undergraduate Colloquium: Contemporary Andean History
254A. Undergraduate Colloquium: National Identity in Latin America, 1890-1940
256. Undergraduate Colloquium: Middle Eastern Women Through Film
299. Undergraduate Colloquium: The Institutions of Medieval Japan

PHILOSOPHY
331. Seminar in Confucian Ethics (same as Asian Languages 331, Religious Studies 238)

POLITICAL SCIENCE
139. Seminar: Chinese Foreign Policy
182L. Law in Radically Different Cultures (same as American Studies 176, Anthropology 157, Law 316, Sociology 138)
215. Japanese Political Economy
221S. Education and Radical Change: African Experiences (same as Education 395)
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 Ch'an and Zen
236. Buddhist Meditation Texts
239. The Golden Rule
258. Life in the Light of Death: Cross-Cultural Perspectives

SPANISH AND PORTUGUESE
SPANISH
247. El cuento fantastico hispanoamericano
248. The Caribbean Americas: An Introduction to Their Literature, Thought, and Culture (same as African and Afro-American Studies 248, English 162G)
249. El modernismo hispanoamericano
257. La critica litteraria hispanoamericana
258. La actual hispanoamericana

PORTUGUESE
130. Brazilian Cultural Readings and Composition
267. Brazilian Literature: Modern Brazilian Fiction
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