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

Address:
The Registrar
Stanford University
Stanford, California 94305-1684

Requests for mailing of bulletins may be made to the above address. Requests can be filled only if zip code is furnished.

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

Cover Photo: Ed Souza
AUTUMN QUARTER, 1986

Sep 29-30 (Mon-Tues) Sign class lists; last days to pay University fees
Oct 1 (Wed) Instruction begins
2 (Thurs) Conferring of degrees - Summer
Nov 27-30 (Thurs-Sun) Thanksgiving recess (no classes)
Dec 1 (Mon) Last day for filing A.B., B.S., and B.A.S. applications for January (Autumn) conferal
5 (Fri) Last day for filing candidacy applications for Educational Specialist and Engineer for April (Winter) conferal
5 (Fri) Last day for filing graduate "Notice of Intention" A.M., M.S., Engineer theses, D.M.A. final project Ph.D. dissertations, for Autumn Quarter
15-19 (Mon-Fri) End-Quarter examinations

WINTER QUARTER, 1987

Jan 5 (Mon) Sign class lists; last day to pay University fees
6 (Tues) Instruction begins
8 (Thurs) Conferring of degrees - Autumn
19 (Mon) Martin Luther King Day (holiday, no classes)
30 (Fri) Last day for filing graduate "Notice of Intention" and candidacy application for June commencement diploma
Feb 2 (Mon) Last day for filing A.B., B.S., and B.A.S. applications for April (Winter) and June (Spring) conferal
16 (Mon) Presidents' Day (holiday, no classes)
Mar 8 (Sun) Observance of Founders' Day
Mar 13 (Fri) Last day for filing candidacy applications for Educational Specialists and Engineer for June (Spring) conferal
13 (Fri) Last day for filing graduate "Notice of Intention" A.M., M.S., Engineer theses, D.M.A. final project Ph.D. dissertations, for Winter Quarter degree conferal
16-20 (Mon-Fri) End-Quarter examinations

SPRING QUARTER, 1987

30 (Mon) Sign class lists; last day to pay University fees
31 (Tues) Instruction begins
Apr 2 (Thurs) Conferring of degrees - Winter
15 (Fri) Last day for filing undergraduate scholarship applications, for matriculated undergraduates
May 25 (Mon) Memorial Day (holiday, no classes)
June 3 (Wed) Last day for filing candidacy applications for Educational Specialist and Engineer, for September (Summer) conferal
3 (Wed) Last day for filing graduate "Notice of Intention" A.M., M.S., Engineer theses, D.M.A. final project, Ph.D. dissertations for Spring (June) conferal
5-10 (Fri-Wed) End-Quarter examinations
13 (Sat) Baccalaureate Saturday and Senior Class Day
14 (Sun) Commencement

SUMMER QUARTER, 1987

22 (Mon) Sign class lists; last day to pay University fees
23 (Tues) Instruction begins
July 3 (Fri) Independence Day (holiday, no classes)
Aug 13 (Thurs) Last day for filing candidacy application for Educational Specialist and Engineer, for January (Autumn) conferal
13 (Thurs) Last day for filing graduate "Notice of Intention" A.M., M.S., and Engineer theses, D.M.A. final projects, Ph.D. dissertations for Summer Quarter degree conferal
14-15 (Fri-Sat) Eight-week term examinations
15 (Sat) Eight-week term closes
Sep 1 (Tues) Quarter closes
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Stanford University celebrated the Centennial of its Founding in November, 1885; it will celebrate the Centennial of its Opening in 1991. It 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 1985 it was 433.

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 1985 totalled 13,079, of whom 6,524 were undergraduates and 6,555 were graduate students. Blacks, Hispanics, Puerto Ricans and Native Americans numbered 1,127 undergraduates and 366 at the graduate level. Stanford awarded 4,106 degrees in 1984-85, of which 1,615 were baccalaureate and 2,491 were advanced degrees.

Among the 1,317 faculty members who make up the Academic Council there are 9 Nobel laureates, 77 members of the National Academy of Sciences, 123 members of the American Academy of Arts and Sciences, 40 members of the National Academy of Engineering, 10 members of the National Academy of Education, 10 winners of the National Medal of Science, 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:

- Allen, P. C., Stanford: From the Foothills to the Bay, 1980
- Clark, G. T., Leland Stanford, 1931
- Elliott, O. L., Stanford University: The First Twenty-five Years, 1937
- Nagel, G. W., Jane Stanford: Her Life and Letters, 1975
- Stockholm, G., Stanford Memorial Church, 1980
- Tuterow, N. E., Leland Stanford: Man of Many Careers, 1971

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 are graduated in January, April, June, and September, but all diplomas are awarded in June.

No degree will be conferred upon any person who has not spent at least three quarters in resident study at the University. No honorary degrees are given.

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

UNDERGRADUATE 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.) 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, Information.)

For students who entered Stanford prior to September 1986, an undergraduate is 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.

For students entering Stanford in September 1986 and thereafter, an undergraduate may apply a maximum of 12 units in activity courses (Physical Education Activity or Music Activity) 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 require-
ments in the Schools of Earth Sciences or Engineering, or in the Departments of Biological Sciences, Chemistry, Mathematics, Physics, or Statistics in the School of Humanities and Sciences. The B.S. degree is also conferred upon candidates in the Program in Mathematical and Computational Science, Medical Microbiology in the School of Medicine, and when appropriate the Program for Individually Design Majors. Candidates who fulfill these requirements in other schools or departments receive the degree of Bachelor of Arts.

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

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

SECOND BACHELOR'S DEGREE

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

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

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 recommendation 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 the 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 plan permits a Stanford undergraduate to be admitted to a graduate program as early as the eighth quarter (or upon completion of 105 units) and no later than the end of the 11th quarter and to study for both bachelor’s and master’s degrees simultaneously in the same or different departments.

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

Each degree is applied for separately by the deadline given in the University Time Schedules and calendars. The bachelor’s degree may not be conferred after the master’s.

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

Information and Petitions for Admission to the Coterminal Degree Program are available in the Graduate Program Office or in the department concerned.

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

UNDERGRADUATE STUDY AT STANFORD

A Liberal Education

As do distinguished universities and most undergraduate colleges, Stanford provides the means for its undergraduates to acquire a liberal education: an education which broadens the student’s knowledge and awareness in each of the major areas of human knowledge 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 importantly, what they have in common.

Depth, the intensive study of one subject or area, is provided through specialization in a major field of study. The major relates more specifically to a student's personal goals and interests than do the general requirements outlined above. Stanford's curriculum provides a wide range of standard majors through its discipline-oriented departments, a number of interdisciplinary majors in addition to departmental offerings, and the opportunity for students to design their own major programs.

Elective courses, which are not taken to satisfy requirements, play a special role in tailoring the student's program to individual needs. For most students, such courses form a large segment of the work offered for a degree. Within the limitations of requirements, students may freely choose any course which previous studies have prepared them to undertake.

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 WRITING REQUIREMENT

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

All candidates for the bachelor's degree, regardless of the date they matriculated, must complete two quarters of instruction in written composition or an equivalent. Students should fulfill this Requirement in the first year at Stanford so that its benefits may be fully realized during the rest of their formal education. The Requirement is usually met by taking two courses certified to fulfill it; a list of these courses is available at the Undergraduate Advising Center and is distributed to entering undergraduates.

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

Courses available to fulfill the Writing Requirement are designated (DR.W) in this bulletin.
THE DISTRIBUTION REQUIREMENTS

A. 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, under the authority of the Senate of the Academic Council, certifies courses which will fulfill the new Distribution Requirements in the required areas of study. Information regarding specific courses that satisfy the distribution requirements and 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.

B. CURRENT SYSTEM

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

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

One course in each of seven other subject areas which together embrace all areas of the undergraduate curriculum (see below for designated Areas numbered 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 accord-
ing 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.

C. 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.

D. PETITION
Students who have reason to believe their undergraduate program objectives are served by using some course(s) alternative to 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, First Floor).

E. 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, First Floor).

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 major at any time upon request; in some fields, though, a late change could easily result in extending the period of undergraduate study.

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

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

The student pursuing a single degree, either the Bachelor of Arts (A.B.) degree or Bachelor of Science (B.S.) degree, 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 not departmental requirements but rather school requirements (e.g., for two majors within the School of Engineering).
3. At the time the student becomes a degree candidate (i.e., files to graduate) the major...
departments or programs must be cognizant of the courses the student proposes to satisfy the declared majors and of the limitation of number 2 above and 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 Major" section of this bulletin.

Undergraduate Academic Advising

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

Freshmen are assigned to general academic advisors according to their residence and the primary academic interest which they have indicated. Each residence where freshmen live offers them the services of a group of advisors representing the major academic disciplines. While freshmen are assigned to one specific advisor, they have easy access to all members of the advising group. Each freshman advisor works with advisees each quarter to plan academic programs; the advisor must sign study list
cards for each quarter of the student’s freshman year.

Sophomores who are undecided about their major usually continue to work with the advisor with whom they were associated as freshmen, and that advisor continues to sign the student’s study list. By the time junior status is achieved, undergraduates must declare a major, at which time they are assigned to an advisor from the faculty of the major department or program. Sophomores, juniors, and seniors should continue to consult their advisors for planning of programs every quarter.

The Undergraduate Advising Center, located in Sweet Hall, is an integral part of the advising program. The Undergraduate Advising Center is the place where advisors and students will be given an answer—or assistance in finding one—to all questions relating to academic matters. Included in the services and resources available are on-call advisors; announcements of fellowships, assistantships, scholarships, and special study programs available at other schools; a complete collection of graduate and undergraduate catalogs from other institutions in the United States; information on undergraduate degrees at Stanford; guides to graduate and professional schools; and many other printed references.

The Undergraduate Advising Center also coordinates a pre-preprofessional advising program to provide guidance for students interested in further study in business, law, medicine, or allied health fields.

Location: Sweet Hall
Hours: Monday through Friday, 8:00–5:00
Phone: 723-2426.
Pre-professional phone: 723-1151.

The Center for Teaching and Learning (CTL) provides counseling on a wide range of efficient learning techniques, study skills and effective reading strategies. It helps students obtain tutoring in courses where they need individual assistance and trains undergraduates to become effective tutors. The CTL has credit courses in learning skills, reading, and tutoring. Further information and course listings are in the Undergraduate Programs section of Courses and Degrees.

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. Full time enrollment is 11 units per quarter during the academic year and 15 units in the Summer Quarter. Credit toward the residency requirement for a degree is based on full tuition paid each quarter, or the equivalent in partial registrations.

Graduate students who complete academic requirements before their residency requirements may make a tuition deficiency payment to the University rather than continue registering. The outstanding tuition requirement is calculated as a percentage of full tuition still lacking and at the tuition rate for the concurrent academic year.

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 full-time 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 use Advanced Graduate Registration status for nine unit registration.

2. Terminal Graduate Registration (TGR)—
Doctoral students who have been admitted to candidacy, completed all required coursework, and accrued 10.5 quarters of residency 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 returning 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 AGR or TGR status may register for one quarter on a unit basis to cover the deficiency. This status may be used only once during a degree program.

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

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, or 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 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. The Petition for In Absentia Registration with appropriate departmental signatures, is submitted to the Registrar's Office. Students with fellowships should make arrangements 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. 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.

Applications for Admission to Candidacy for Ed.S. and Engineer degrees must be submitted by the last day of class of the quarter preceding the degree quarter. Doctoral candidates are expected to apply for candidacy by the end of their second year in the doctoral program. Students must be registered in the quarter in which they apply for candidacy.
Candidacy is valid for five years from the date of Graduate Division approval unless a student is terminated for unsatisfactory progress. The Graduate Division places a hold on the registration of students whose candidacy has expired. 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 additional degrees 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.

Applicants seeking degrees 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 OR 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-time quarters of work 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.

Following Faculty Senate action of May 15, 1986, candidacy for the A.M. and M.S. degrees is discontinued, effective Autumn Quarter 1986. This policy supercedes other references to master’s candidacy that appear in the departmental sections of this publication. In the first quarter of enrollment in a master’s program, students must submit a Program Proposal for the 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 (or larger departmental requirement) 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 quarters of full-time graduate work at the University and have fulfilled other requirements prescribed by the School of Education and one of the academic departments participating jointly in the program. The program is reserved for experienced teachers or for individuals who have previously completed a program of teacher preparation.

MASTER OF FINE ARTS

Upon recommendation to the Senate of the Academic Council by the faculty of the Art Department and the Committee on Graduate Studies, the degree of Master of Fine Arts (M.F.A.) is conferred on candidates who have satisfactorily completed at least three quarters of full-time graduate work at the University and have fulfilled other requirements prescribed by the Art Department as described in the Art section of this bulletin above.

MASTER OF BUSINESS ADMINISTRATION

Upon recommendation to the Senate of the Academic Council by the faculty of the Graduate School of Business and the Committee on Graduate Studies, the degree of Master of Business Administration (M.B.A.) is conferred on candidates who have satisfied the requirements laid down by the faculty of the Graduate School of Business and the University. (Full particulars...
concerning these requirements will be found in the Graduate School of Business Bulletin.)

EDUCATIONAL SPECIALIST

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the Committee on Graduate Studies, the degree of Educational Specialist (Ed.S.) is conferred on candidates who have completed a minimum of three quarters of residence 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-time quarters of approved work as a graduate (of which a minimum of three quarters and 36 quarter units must be in residence at Stanford), 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.

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

MASTER OF LEGAL STUDIES

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

The degree of Master of Legal Studies is conferred upon applicants 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 residence 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-time graduate study (or two years following a master's degree) is required of each candidate. A final project appropriate to the area of concentration is also required.

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 received the degree of Bachelor of Arts, or its equivalent, from this University or from some other institution of recognized collegiate rank, and who have satisfactorily completed courses in law aggregating the number of units required under the current Faculty Regulations of the School of
Law after devoting not less than three academic years thereto, and who otherwise have satisfied the requirements of the University and of the School of Law.

**MASTER OF THE SCIENCE OF LAW**

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Law and the Committee on Graduate Studies, the degree of Master of the Science of Law (J.S.M.) is conferred upon candidates who have completed one academic year (26 term units) with distinction in accordance with the rules of the University and the School of Law.

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

**DOCTOR OF THE SCIENCE OF LAW**

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

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

**DOCTOR OF MEDICINE**

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

**DOCTOR OF PHILOSOPHY**

**GENERAL REGULATIONS**

Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the Committee on Graduate Studies, the degree of Doctor of Philosophy (Ph.D.) is conferred on candidates who have demonstrated substantial scholarship, high attainment in a particular field of knowledge, and ability to do independent investigation and present the results of such research.

Candidates for the Ph.D. degree must satisfactorily complete a program of study and residency requirement that includes a minimum of three years (nine full tuition quarters) of graduate courses and research. 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 program may include a master's or Engineer degree. However, the minimum requirement for a doctoral degree taken after another Stanford advanced degree requiring two or more years of study (M.B.A., M.D., Ph.D., Ed.D.) 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 program requirements following review by the department and the Graduate Program Office. Students who wish to receive credit for graduate work done at another institution during the course of their Stanford program must receive prior approval.

**CANDIDACY**

Admission to candidacy for the doctoral degree is an acknowledgement of the student's potential to complete successfully the requirements for the Ph.D. Students are expected to complete departmental qualifying procedures and apply for candidacy by the end of the second year of doctoral study. The Application for Candidacy specifies a departmentally approved three year program of study to fulfill degree requirements. If the program includes a minor, approval by 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 approval. Doctoral students are expected to complete their degree requirements in a timely manner. Therefore, candidacy is valid for five years unless terminated by the department for unsatisfactory progress. Extensions of candidacy must be approved by the department and the Graduate Division.

**TEACHING REQUIREMENTS**

A number of departments require their students to teach for one to three quarters during their doctoral program. Detailed information is
FOREIGN LANGUAGE REQUIREMENT

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

UNIVERSITY ORAL EXAMINATION

A University oral examination is a requirement of the Ph.D. program. The purpose of the examination is to test the candidate's command 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 dissertation proposal, or a defense of the dissertation.

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 department or any department represented by a committee member. The oral examination committee 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 Council, if approved in advance by the Graduate Division.

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 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 non-
matriculated status in the Graduate Division of the University. Nonmatriculated status is granted to students of demonstrated ability who are not seeking an advanced degree from Stanford University, but who would benefit from course work at Stanford for a variety of reasons. Some schools and departments do not 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; from 100 to 199 inclusive, for third- and fourth-year undergraduates; from 200 to 499 inclusive, 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 "Appendix." Graduate students should ignore the assorted (DR:) markings since such requirements do not apply to them.

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

SUMMER SESSION

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

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

Dean: Robert K. Jaedicke

Associate Deans: Charles A. Holloway, Paul R. Johnson, Carol F. Marchick, James M. Patell, Eugene J. Webb

Assistant Deans: Jeffrey H. Moore, Gary G. Williams


Senior Lecturer: Steven C. Brandt

Lecturers: John R. Berthold, George A. Blackstone, David L. Bradford, Christopher Canellos, Kirk O. Hanson, Robert Hessen, F. Pitcher Johnson, Bruce R. Judd, John McMahan, Jeffrey H. Moore, Richard T. Pascale, Dennis M. Rohan, David B. Zenoff


Visiting Professors: Peter G. Clark, Mark Granovetter

The Graduate School of Business, since its founding in 1925, has provided graduate education for careers in management, research, and teaching.

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

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

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

For detailed information on programs, curricula and faculty write to the Graduate School of Business, Stanford University, Stanford, California 94305 for the current bulletin.
The School of Earth Sciences includes the departments of Applied Earth Sciences, Geology, Geophysics, and Petroleum Engineering. The aims of the school are: (1) to prepare students for careers in the fields of geology, paleontology, geochmistry, 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**

For admission to the School of Earth Sciences there are no special examinations or prerequisite course requirements. Any undergraduate student admitted to the University may declare a major in one of the Earth Science departments by contacting the appropriate department office. The student will be 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 information is available from the departments. Applications should be filed by January 15 for awards which become effective in Autumn Quarter for the following year.

APPLIED EARTH SCIENCES

Emeriti: Evan Just, Konrad B. Krauskopf (Affiliated Faculty). Frederick C. Kruger, Charles F. Park, Jr.
Chairman: André G. Journel
Associate Chairman: George A. Parks
Professors: Marco T. Einaudi*, John W. Harbaugh, Ronald J. P. Lyon, George A. Parks**, David D. Pollard*, Irwin Remson*
Associate Professors: Stephan A. Graham*, André G. Journel
Senior Lecturer: George Mader

OFFERINGS

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

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

Programs leading to the B.S., M.S., Engineer, and Ph.D. degrees are available with the "special field" designation of the program on the diploma.

A general degree in Applied Earth Sciences is available for students with specialized objectives consistent with the scope of the department. At the graduate level, the department welcomes applicants from any scientific or engineering discipline who are interested in using their training in Applied Earth Sciences.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

Three pre-professional environmental programs are offered: Environmental Earth Sciences, Environmental Earth Sciences Management and Land Resources Planning. The 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.

The department is developing plans for a new undergraduate program in earth resources, including minerals, petroleum and water. This program will deal with resources in terms of their geological characteristics and origin, exploration methods and strategies, development and extractive technology, and economic, political, and societal issues. Students interested in such a program of study commencing in 1986-87 should contact the department chairman.

COMMON ENVIRONMENTAL CORE

Course No. Subject Qtr. & Units
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
A.E.S. 192. Computing in Geology A 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
Geol. 193. Introduction to Probability and Statistics in Geology W 3
Math 19-20. Analytic Geometry and Calculus or Math. 41 6
Environmental Core Subtotal .................. 47

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
A.E.S. 190. Introduction to Earth Structures S 4
Common Environmental Core 47
One course from the following:

- Geol. 2, Geol. 119, Geol. 150
- or A.E.S. 135
- Chem. 135. Physical Chemical Principles W, S
- Civ. Engr. 170. Environmental Science and Technology or
- Civ. Engr. 171. Environmental Planning
- Civ. Engr. 270. Movement, Fate and Effects of Contaminants in Natural Waters
- Math. 21, 22, 23. Analytic Geometry and Calculus or Math. 42, 43
- Mech. Engr. 137. Air Pollution
- Phys. 21, 22, 23, 24. Elementary Physics A, W

(students intending to enter graduate programs in science and engineering should substitute 2 courses from Phys. 51 series)

Urban Studies 131. Managing Local Government
Urban Studies 170. Introduction to Urban Design

Total 92

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.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 136.</td>
<td>Environmental Earth Sciences Management</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 145.</td>
<td>Mineral Economics</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 199.</td>
<td>Decision Analysis in Petroleum Exploration</td>
<td>W 3</td>
</tr>
<tr>
<td>Econ. 1.</td>
<td>Elementary Economics A, W, S</td>
<td>5</td>
</tr>
<tr>
<td>Engr. 60.</td>
<td>Engineering Economics A, W, S</td>
<td>3</td>
</tr>
<tr>
<td>Ind. Engr. 133.</td>
<td>Industrial Accounting A, S</td>
<td>3</td>
</tr>
<tr>
<td>Math. 21, 22, 23.</td>
<td>Analytic Geometry and Calculus or Math. 42, 43</td>
<td>9</td>
</tr>
</tbody>
</table>

Total 97

HONORS PROGRAM IN APPLIED EARTH SCIENCES

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 grade point averages 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 award of Honors shall be made jointly by the Honors Subcommittee and the student’s advisor.
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 resources, energy 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 B average 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 and M.S. theses are described in the section “Advanced Degrees” of this bulletin. The student should be guided by the following additional department requirements:

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

2. The student must complete one core curriculum. The student then completes the 45-unit degree requirement with additional courses or research.

Special core curricula may be formulated by the student in consultation with his or her research advisor. Special core curricula must be approved by the faculty of the department.

3. Either a written report or a thesis is required for all programs.

The curricula recommended for the Master’s degree are as follows:

APPLIED GEOMATHEMATICS IN PETROLEUM EXPLORATION AND RESOURCE ANALYSIS

This program focuses on the use of mathematics and other tools in exploration for petroleum and in analysis of petroleum resource potential on a regional basis.

Course No. Subject Qtr. & Units
A.E.S. 192. Computing in Geology W 3
A.E.S. 251. Oil Field Exploration and Development S 3
A.E.S. 252. Sedimentary Basins A 3
A.E.S. 253. Petroleum Geology and Exploration S 3
A.E.S. 298. Decision Analysis in Petroleum Exploration S 3
Geol. 193. Intro. to Probability and Statistics in Geology W 3
Geophys. 180. Geologic Interpretation of Reflection Seismograms W 3
Pet.Eng. 150A. Well Log Analysis I A 3
Pet.Eng. 150B. Well Log Analysis II W 3
Total .................................................. 27

In addition to these core courses, students must receive at least 8 units of credit in courses from the following: A.E.S. 292, Geology 251, 253, 254, 278; Petroleum Engineering 151A, 151B, 250; Geophysics 150, 290, 294; Statistics 110, 116, 119, 120.

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. 135. Soil Science alt. A 4
A.E.S. 255. Introduction to Solute Transport alt. A 2
A.E.S. 258. Role of Fluids in Geologic Processes W 2
Civ.Engr. 260. Engineering Hydrology A 4
Civ.Engr. 361. Soil Moisture and Groundwater S 4
Civ. Engr. 270. Movement, Fate and Effects of Contaminants in Natural Waters A 3
Geol. 193. Intro. to Probability and Statistics W 3
Geol. 230. Hydrogeology W 5
Total .................................................. 34

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 Environmental Geochemistry).

LOW TEMPERATURE AQUEOUS GEOCHEMISTRY

Courses and research opportunities in theoretical and experimental low temperature
aqueous chemistry are available in the Departments of Applied Earth Sciences, Civil Engineering, and Geology. Students in any of the A.E.S. core programs, such as Applied Hydrogeology or Ore Deposits and Exploration can take advantage of these opportunities to broaden their programs. Students interested in experimental and/or theoretical research, whose backgrounds are strong in chemistry and physical chemistry or who are willing to commit themselves to coursework in these areas, may specialize in aqueous geochemistry by arranging an Applied Earth Sciences Special Program tailored specifically to their own interests. Sample course lists are available. Advance correspondence or consultation with the faculty is suggested.

GEOLeGIC REMOTE SENSING

Remote sensing covers a wide range of inter-related 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.

The following courses constitute a core sequence:

<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</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 233</td>
<td>Measurement of the Environment</td>
<td>W 4</td>
</tr>
<tr>
<td>A.E.S. 295(A,B,C,D,E)</td>
<td>Research Seminar (3 of any sequence)</td>
<td>A,W,S 3</td>
</tr>
<tr>
<td>A.E.S. 296</td>
<td>Radar for Structural Mapping Alt.</td>
<td>S 4</td>
</tr>
<tr>
<td>A.E.S. 297</td>
<td>Airborne Exploration-Lithology</td>
<td>Alt. S 4</td>
</tr>
<tr>
<td>Geol. 193</td>
<td>Intro. to Probability &amp; Statistics</td>
<td>W 3</td>
</tr>
<tr>
<td>Stat. 110</td>
<td>Statistical Methods in Engineering and Physical Sciences</td>
<td>S,Sum 4</td>
</tr>
<tr>
<td>or Stat. 116</td>
<td>Theory of Probability</td>
<td>A,S,Sum 3-4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>28-29 units</td>
</tr>
</tbody>
</table>

GEOMECHANICS

This program emphasizes the use of solid, fluid, and fracture mechanics to explain the evolution of geologic structures and to understand how geologic processes operate. Particular attention is given to rock fracture studies applied to earthquake and volcanic hazards. Theoretical models and laboratory experiments form the basis for interpreting detailed field observations of faults, joints, dikes, and other fractures in rock.

Students are expected to have taken courses equivalent to those of the Stanford undergraduate core sequences in Geology, as well as calculus and analytical geometry, computer programming, physics, and chemistry. Students with an engineering mechanics background and some geology are also encouraged to apply. A thesis is required for the M.S. degree. The following core courses are suggested, however, substitutions in the program based on research needs may be approved by petition.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 280</td>
<td>Stress Analysis and Elastic Deformation</td>
<td>A 4</td>
</tr>
<tr>
<td>A.E.S. 281</td>
<td>Strain Analysis and Viscous Deformation</td>
<td>W 4</td>
</tr>
<tr>
<td>A.E.S. 282</td>
<td>Rock Fracture</td>
<td>S 4</td>
</tr>
<tr>
<td>A.E.S. 380A,B,C</td>
<td>Research Seminar: Geomechanics</td>
<td>A,W,S 3</td>
</tr>
<tr>
<td>A.E.S. 258</td>
<td>Role of Fluids in Geol. Processes</td>
<td>W 2</td>
</tr>
<tr>
<td>Chem. Engr. 140</td>
<td>Fluid Mechanics</td>
<td>A 3</td>
</tr>
<tr>
<td>Mat. Sci. and Eng. 203</td>
<td>Mechanics of Materials</td>
<td>S 3</td>
</tr>
<tr>
<td>Mat. Sci. and Eng. 238</td>
<td>Fracture of Solids</td>
<td>S 3</td>
</tr>
<tr>
<td>Geophys. 262</td>
<td>Rock Physics</td>
<td>W 3</td>
</tr>
<tr>
<td>Geophys. 290</td>
<td>Tectonophysics</td>
<td>S 3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

Students must take nine units selected from the following courses: A.E.S. 252; Chem. Engr. 150; Civ. Eng. 201, 292, 292, 295; Geol. 317, 318; Geophys. 150, 174, 190, 195; Mat. Sci. and Engr. 237; Mech. Engr. 200, 238, 239, 240.

GEOSTATISTICS FOR NATURAL RESOURCES EVALUATION

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

The following courses constitute the core sequence:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 292</td>
<td>Applications of Computers in Geology</td>
<td>W 3</td>
</tr>
<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 Simulated Deposits</td>
<td>S 5</td>
</tr>
<tr>
<td>A.E.S. 293</td>
<td>Topics in Advanced Geostatistics</td>
<td>A,S 3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>28</td>
</tr>
</tbody>
</table>

The student is expected to take introductory courses in some field of specialization such as ore deposits (A.E.S. 120), petroleum exploration (A.E.S. 251), remote sensing (A.E.S. 233), environmental sciences (A.E.S. 130), reservoir simulation (Pet. Eng. 171), rock physics (Geophys. 262.)

Other recommended courses:

- Comp. Sci. 135. Numerical Methods 3
Geol. 293. Application of Probability and Statistics in Geology 3

Reading credits will be offered. A thesis is required for the M.S. degree. A summer job in exploration or an operating site may be required, depending on the previous experience of the applicant.

A Ph.D. Program in Geostatistics is available for advanced research and/or applications.

ORE DEPOSITS AND EXPLORATION

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

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

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 275.</td>
<td>Solution-Mineral Equilibria</td>
<td>W 4</td>
</tr>
<tr>
<td>A.E.S. 277.</td>
<td>Field Mapping of Mineral Deposits</td>
<td>Spr. vac &amp; Spr. qtr. 3</td>
</tr>
<tr>
<td>A.E.S. 220.</td>
<td>Geochemistry of Mineral Deposits</td>
<td>W 5</td>
</tr>
<tr>
<td>A.E.S. 290.</td>
<td>Geo-statistics for Exploration and Development</td>
<td>A 5</td>
</tr>
<tr>
<td>Geophys. 191.</td>
<td>Geophysical Field Techniques</td>
<td>A 3</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 163.</td>
<td>Optical Mineralogy</td>
<td>W 4</td>
</tr>
<tr>
<td>Geol. 171.</td>
<td>Introduction to Geochemistry</td>
<td>A 4</td>
</tr>
<tr>
<td>A.E.S. 120.</td>
<td>Introduction to Mineral Deposits</td>
<td>A 4</td>
</tr>
<tr>
<td>A.E.S. 192.</td>
<td>Computing in Geology or Comp. Sci. 106. Introduction to Computing</td>
<td>A 3-4</td>
</tr>
<tr>
<td>Geophys. 190.</td>
<td>General Geophysics</td>
<td>A 4</td>
</tr>
<tr>
<td>Geol. 151.</td>
<td>Introduction to Sedimentary Facies</td>
<td>W 3</td>
</tr>
<tr>
<td>Geol. 181.</td>
<td>Igneous Petrology</td>
<td>A 3-5</td>
</tr>
<tr>
<td>Geol. 182.</td>
<td>Metamorphic Petrology</td>
<td>S 5</td>
</tr>
<tr>
<td>Geol. 193.</td>
<td>Introduction to Probability and Statistics in Geology</td>
<td>W 3</td>
</tr>
</tbody>
</table>

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 will 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, each student must have adequate background (usually from a prior degree) in stratigraphy (e.g. Geol. 152), sedimentation (e.g. Geol. 151), structural geology (e.g. Geol. 110), and basic field geology (e.g. Geol. 102). A thesis is required for the M.S. degree.

REQUIRED CORE COURSES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 251.</td>
<td>Oil Field Exploration and Development</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 252.</td>
<td>Sedimentary Basins</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 253.</td>
<td>Petroleum Geology</td>
<td>S 3</td>
</tr>
<tr>
<td>Geol. 251.</td>
<td>Continental Margins</td>
<td>A 4</td>
</tr>
<tr>
<td>Geol. 254.</td>
<td>Sedimentary Facies and Environments</td>
<td>alt. A 3</td>
</tr>
<tr>
<td>Geol. 278.</td>
<td>Organic Geochemistry</td>
<td>W 2</td>
</tr>
<tr>
<td>Geophys. 180.</td>
<td>Geologic Interpretation of Reflection Seismograms</td>
<td>W 3</td>
</tr>
<tr>
<td>Pet.Eng. 150A.</td>
<td>Well Log Analysis I</td>
<td>A 3</td>
</tr>
<tr>
<td>Pet.Eng. 150B.</td>
<td>Well Log Analysis II</td>
<td>W 3</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

In addition to these core courses, the following elective courses offer students the opportunity to further cultivate special interests. Students must take for credit three courses from these electives: Geology 230, 241, 242, 243, 244, 253; Geophysics 150, 262, 280, 284; Applied Earth Sciences 258, 290, 292, 296, 297, 298; Petroleum Engineering 103, 151A, 151B, 250, 267.

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 eighteen months after initial registration.

Courses—The student must pass the M.S. core courses required for his or her option with an average grade of "B" or higher, or demonstrate that he or she has done the equivalent elsewhere. In addition, the student must take a series of courses approved by his or her Program Committee.

Departmental Oral Examination—The student must pass the department oral examination, which is a test of mastery of the major option and at least one related area, 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. Normally, a maximum of four years of graduate study is allowed and a further year is allowed only if the Department Curriculum Committee is satisfied that the work can be completed in that time.

COURSES
UNDERGRADUATE

120. Introduction to Mineral Deposits—A survey course emphasizing the geological environment of metallic mineral deposits. Topics include: processes that lead to cycling and concentration of metals in the earth's crust (magmatic, magmatic-hydrothermal, sedimentary basinal brines, submarine and subaerial hot springs, weathering); geological and resource/reserve characteristics of different classes of mineral deposits in the context of petro-tectonic settings; evolution of metal-concentrating processes through geologic time. Laboratory consists of hand lens inspection of rock suites from classic mining districts. Prerequisite: Geology 80.

4 units, Aut (Einaudi) MWF 9 plus 1 lab per week, by arrangement

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

2 units, Win (Parks) by arrangement

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

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

131. Environmental Earth Sciences II—(See course sequence description under 130.) Topics include geologic constraints to development, stream and air pollution, environmental systems analysis, responses to landslides, 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.

5 units undergraduates, 3 units graduates; Win (Mader, Remson) MWF 11; labs, seminars, and field trips by arrangement
132. Environmental Earth Sciences III—(See course sequence description under 130, 131.) Topics include waste disposal and sanitary landfill, non-renewable resources and geologic hazards, planning responses to earthquakes, new towns and visionary planners. Laboratories include use of air photos in planning, economics of mineral resources, and site selection for a new community. Prerequisite: 131 or consent of instructor.

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

133. Measurement of the Environment—Remote Sensing—(Graduate students register for 233.) Survey course covering the methods of rapid reconnaissance of the environment stressing those 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 computer to analyze LANDSAT satellite coverage of campus. Introductory physics recommended.

3 units, Spr (Lyon) TTh 1:15 plus lab 2:15-4:05

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

4 units, Aut (Rubin) TTh 3:15-5:05 alternate years, given 1987-88

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

3 units, Spr (Remson) MWF 9

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

3 units (Thiers) by arrangement

180. Introduction to Earth Structures—A first course in structural geology and rock mechanics for students of applied earth sciences and geotechnical or petroleum engineering. Structures in rock (e.g. faults, folds, joints, and fabrics) are identified, described, idealized, and analyzed to explain their origins and mechanical behaviors. Methods for measuring and evaluating these structures are developed through computer modeling and laboratory experiments. The roles of these structures in environmental and engineering problems, resource recovery, and earthquake hazards are discussed. Prerequisites: Geology 1, Mathematics 19, 20.

3 units, Spr (Pollard) TTh 10 plus one lab by arrangement


3 units, Aut (Journel) TTh 11

192. Computing in Geology I—Introduction to computing with stress on geological applications. Topics include 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

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 are designed to integrate field, theoretical, and laboratory data on the origin of mineral deposits and application to exploration concepts. Laboratory consists of an introduction to the reflected light microscope, followed by advanced study of rock suites from district collections. Individual projects. Prerequisites: 120, Geology 163, 171.

5 units, Win (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. Course is based on lectures and problem sets. Prerequisites: Geology 171 or equivalent experience with thermodynamics.

3 units, Aut (Leckie) TTh 11 F 2:15
225. Surfaces and Interfaces—Detailed study of the influence of surfaces and interfaces on chemical equilibria in water systems, emphasizing particle size effects on solubility, and adsorption on solids. Useful in geochemistry, water chemistry, hydrology, chemical oceanography, water pollution abatement, etc. Purpose is to provide background necessary for interpretation of observed phenomena and, where possible, for quantitative prediction of effects. Prerequisite: Physical Chemistry 135, or Material Science 181, or equivalent and A.E.S. 227A or Geology 175.

3 units, Spr (Parks) by arrangement

227A. Problems in Applied Aqueous Thermodynamics—A systematic, self-study review of principles and strategies needed for solving quantitative problems in low temperature aqueous thermodynamics and an introduction to the use of computer methods using the MINEQL family of programs. Course requires completion of a set of homework problems, guided by a small number of lectures and a weekly diagnostic workshop. Prerequisite: 224 or equivalent.

3 units, Win (Parks) TTh 9, plus one hour by arrangement

227B. Low Temperature Aqueous Thermodynamics—Lectures, student seminars, and a term project on selected subjects in low temperature aqueous thermodynamics. Topics include non-ideality models and correction methods, sources, evaluation and estimation of thermodynamic data, trends in metal complex stabilities, and student-suggested topics submitted the preceding quarter. Prerequisites: Geology 175 or A.E.S. 227A and a working knowledge of chemical thermodynamics.

3 units, Win (Parks) TTh 9, plus one hour by arrangement, alternate years, given 1987-88


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 given 1987-88

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

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

253. Petroleum Geology and Exploration—The basics of petroleum geology origin and occurrence of hydrocarbons and exploration for hydrocarbons. Subjects include thermal maturation history in hydrocarbon generation, significance of sedimentary and tectonic setting, principles of accumulation, geological and geophysical exploration techniques, economic considerations, and unconventional hydrocarbon resources. Prerequisites: Geology 110, 151; Geophysics 180 recommended.

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. Course is designed for earth scientists and for engineers interested in water and environmental problems. Prerequisites: Freshman chemistry, either Geology 232 or Civil Engineering 201.

2 units, Aut (Rubin) Th 3:15-5:05

258. Role of Fluids in Geologic Processes—An introduction to principles which govern a number of geologic processes in which fluids (groundwater) play an important role. Processes include: regional flow of groundwater, especially in sedimentary basins; movement and entrapment of petroleum; development of anomalous fluid pressures, both high and low; role of fluid in tectonic movements, particularly in controlling friction; 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
291. Practice of Geostatistics on Simulated 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


4 units, Aut (Pollard) MWF 10

282. Rock Fracture—Survey of the nature, origin, and physical behavior of joints, faults, and other fractures in rock. Field observations, principles of fracture mechanics, and the elastic theory of cracks are developed to form a basis for interpreting fractures in outcrop and on maps. The important roles of fractures in rock deformation, fluid motion, and heat transportation in the Earth are considered. Potential applications include earthquake and volcanic hazard assessment, nuclear waste isolation, geothermal energy and oil recovery, structural and geotechnical analysis. Prerequisite: 290.

4 units, Win (Pollard) MWF 10

290. Geostatistics for Exploration and Development—The theory of spatially correlated random variables applied to the valuation of natural resources and more generally to the characterization of spatio-temporal phenomena. Variograms for analysis of spatial continuity. Kriging for computing best estimates and their reliability. Simulations for building numerical models of ore deposits. Case studies from mining and petroleum industries, ground water surveys and other earth sciences. Prerequisites: Introductory Calculus, Geology 193 or Statistics 110.

5 units, Win (Journel) TTh 10-12; plus lab by arrangement

291. Practice of Geostatistics on Simulated Deposits—The course is based on a numerical model of a deposit. 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: 290, Fortran programming.

5 units, Spr (Journel) TTh 8-10

292. Computing in Geology II—Focuses on construction and utilization of detailed, three-dimensional dynamic computer models that simulate geological processes. Students participate in the development and calibration of models as part of project STANSIM, which deals with simulation of interdependent processes in sedimentary basins, including erosion, transportation and deposition of clastic sediment, compaction, fluid migration, isotatic response of the crust, and progressive deformation by folding and faulting. Stress on interactive graphic display, using high resolution color facilities. Extensive use of Gould 9080 computer, with speeds of ten million instructions per second, and which is operated as an aspect of the Applied Geomathematics program. Previous programming experience is essential. Students engage in individual research projects.

3-5 units, Spr (Harbaugh) by arrangement

293A-C. Topics in Advanced Geostatistics—Topics chosen 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. Course may be repeated for credit. Prerequisites: 290, advanced calculus.

3 units, Aut, Spr (Journel) by arrangement

294A-B-C-D-E. Research Seminar in Remote Sensing—Weekly two-hour discussion of recent advances covering aspects of remote sensing, especially those which may be applied to mineral exploration. Open to all interested participants, who will be expected to 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. Radar for Structural Mapping—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 will be 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.

4 units, Aut (Lyon) TTh 1:15 and lab TTh 2:15-4:05

Airborne Exploration: Lithologic Mapping—An advanced course covering the multispectral and multitemporal response of terrain (rock, soil, vegetation and water) from ultraviolet to infrared and microwave energy, principally for use as an exploration tool. Spectral and temporal signatures will be stressed as means of determining rock lithologies directly. Geobotanical and biogeobotanical aspects will be covered. Labs supported by field measurements, and data analysis. Prerequisite: 133, 233. A photogeologic course is essential.

4 units, Aut (Lyon) TTh 1:15 and lab TTh 2:15-4:05 alternate years, given 1987-88

Decision Analysis in Petroleum Exploration—Analytical decision analysis involving objective estimation of exploration outcome probabilities and their utilization in financial forecasts, course involves a manual of problem sets and incorporates a computerized exploration game in which teams compete in a simulated exploration context.

3 units, Spr (Harbaugh) MTW 11

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

any quarter (Staff) by arrangement


any quarter (Staff) by arrangement

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

2 units, Win, Spr (Einaudi)

Research Seminar: Geomechanics—Selected topics. Course 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 geostatis-
The geology courses that are required form an integrated core course sequence totaling a maximum of 64-67 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>
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<tbody>
<tr>
<td>Sophomore Year</td>
<td></td>
<td></td>
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<tr>
<td>Geol. 1. Interpreting the Earth</td>
<td>W,S 5</td>
<td></td>
</tr>
<tr>
<td>Geol. 2. Earth History</td>
<td>A 3</td>
<td></td>
</tr>
<tr>
<td>Geol. 3. Earth History Lab</td>
<td>A 2</td>
<td></td>
</tr>
<tr>
<td>Geol. 80. Rocks and Minerals</td>
<td>S 5</td>
<td></td>
</tr>
<tr>
<td>Geol. 102. Introduction to Field Geology</td>
<td>Sum 3</td>
<td></td>
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</tbody>
</table>

(Required basic science and mathematics courses, if not completed earlier, can be taken during this year. Geol. 3 may be taken in the junior year rather than concurrently with Geol. 2.)

Junior Year

| Geol. 161. Crystal Chemistry and Mineralogy | A 5         |
| Geol. 163. Optical Mineralogy              | W 4         |
| Geol. 151. Sedimentary Geology and Petrology | W 3       |
| Geol. 151L. Introduction to Sedimentary Petrography | W 2   |
| Geol. 110. Structural Geology              | S 5         |
| Geol. 152. Stratigraphy and Paleocology     | S 4         |
| Geol. 103A,B. Advanced Field Geology       | Sum 12      |

(Required basic science and mathematics courses can be completed during this year. Electives may be chosen from list below.)

Senior Year

| Geol. 181. Igneous Petrology | A 5         |

(Electives may be chosen from list below.) In addition to the 58 units of the basic curriculum above, the student is required to take a minimum of two courses from the list below: total 64-67 units.

| Geol. 143. Principles of Paleontology | W 5         |
| Geol. 170. Introduction to Chemistry of the Earth | A 4       |
| Geol. 171. Introduction to Geochemistry | A 4        |
| Geol. 182. Metamorphic Petrology        | S 4         |
| Geol. 193. Statistics in Geology        | W 3         |
| App. Earth Sci. 120. Introduction to Mineral Deposits | A 4   |
| Geophys. 150. Plate Tectonics           | W 3         |
| Geophys. 190. General Geophysics        | A 4         |
| Geophys. 180. Geologic Interpretation of Seismic Reflection Records | W 3   |

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 Geology 2 to avoid delay in obtaining the bachelor's degree.

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

### Mathematics

1. For students who wish to complete the requirements for calculus and analytic geometry in three quarters: Mathematics 41, 42, 43
   Units: 15
2. For students who wish to cover the same subjects in five quarters: Mathematics 19, 20, 21, 22, 23
   Units: 15

### Physics

1. For students with average interest and ability in physics and with mathematical preparation through Mathematics 20 or 41 and concurrent registration in Mathematics 21 or 42: Physics 51 (Mechanics), 53 (Electricity), and 55 (Light and Heat)
   Units: 12
2. For a student with exceptional interest in physics, higher physics sequences may be approved by the department provided the student has the required mathematics.

### Chemistry

1. For the majority of students majoring in geology: Chemistry 31 (Chemical Principles) and Chemistry 135 (Physical Chemical Principles)
   Units: 7
2. In some instances the following sequence may be substituted for Chemistry 31 and 135 with consent of the advisor: Chemistry 31 (Chemical Principles) and Chemistry 33 (Structure and Reactivity; organic chemistry)
   Units: 8

Required units in mathematics, physics, and chemistry: 34-35

### 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 elec-
tive 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. 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.

HONORS PROGRAM IN GEOLOGY

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 of at least 3.5 in their earth science courses and a letter grade indicator 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 Honor's candidate shall present a public seminar on the work proposed for credit.
6. The decision as to whether a given project and report does or does not merit award of Honors shall be made jointly by the Honors Subcommittee and the student's advisor.
7. The work completed for the Honors Program cannot be used as a substitute for regularly required courses.

GEOLOGY 35

COTERMINAL B.S. AND M.S. PROGRAM

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

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

Both degrees may be granted simultaneously, provided:

1. The student completes 15 full-time quarters or the equivalent (or 3 full quarters after completing 180 units). (Partial tuition registration is possible after the completion of 12 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 opportunities 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, metamorphic petrology, igneous petrol-
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, igneous and metamorphic petrology, ore deposits, hydrothermal systems, mineral surface and colloid reactions, and the fundamental structure of earth materials. Applications include field-oriented studies, detailed trace and major element analysis, computer prediction and modeling, and laboratory experimention 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 Brown, Bird, Coleman, Einaudi, Liou, Mahood, Parks, and Stebbins.

Sedimentary Geology and Paleontology—Sedimentary geology at Stanford emphasizes the relationships between the tectonic, depositional, and paleoceanographic development of continental margins and associated basins. Current studies include a full array of margin settings in North America, the Caribbean, 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, and application of organic geochemistry and computer simulation of basin evolution. Faculty with special interests in these topics include Professors Clifton, Graham, Ingle, Kvenvolden, Larue, 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, and for the Ph.D. twelve full-time quarters including both course work and thesis research. 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; the Advanced Test in Geology is also required. 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 residency) and recommendation of the student's advisor.

2. The student must complete a minimum of 36 units of coursework.
   a) Not more than 15 units of the 36 shall normally consist of formal lecture courses, the remainder to be research or special problem units or seminars.
   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 of the academic year 1985-86 are required to serve as a quarter-time teaching assistant for one quarter.

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

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

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

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

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

**Quarter Procedure**

1. Complete counseling test; plan coursework for first year with academic advisor.

2-3 Planned coursework; selection of thesis advisor and thesis topic; submit short research proposal to thesis advisor; begin thesis research.

3-5 Select second reader and apply for M.S. degree candidacy to Graduate Studies Office.

5-6 Present a complete draft of thesis to thesis advisor and second reader at least three weeks prior to deadline for filing M.S. thesis with Graduate Studies Office; complete M.S. thesis; file thesis; present results publicly.

**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**—During registration, 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. An academic advisor will be appointed by the Graduate Committee of the department 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 choose a research advisor within the first year of residence. The academic advisor supervises completion of the departmental requirements for the Ph.D. program (as outlined below), until the student passes the Research Examination, when this responsibility passes to the research advisor. The student may change either research or academic 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 departmental 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 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. The departmental procedure involves three steps: preparing a research proposal; establishing a Research Committee; and passing the Research Examination. By University rules, these three are expected to be completed before the end of the student's sixth quarter at Stanford. If the student is unable to meet this requirement, an explanatory petition requesting an extension, endorsed by the research advisor must be approved by the Graduate Committee.

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.

Research Proposal—Each student must prepare a research proposal, not to exceed ten double-spaced pages, describing the scientific goals of the intended Ph.D. research, the relevant literature, and the investigative approach. The proposal must be approved by the research advisor before the Research Examination may be scheduled.

Research Examination—During the Research Examination the student will defend his or her proposal and answer general questions in his or her field of specialization in an Oral Examination. The Examining Committee will consist of at least five members of whom a minimum of four must be professors in the School of Earth Sciences. The Examining Committee will be appointed by the Graduate Committee in consultation with the student and the student's research advisor. The examination must be passed by the end of the student's second year.

Research Advisory Committee—Once the student has passed the Research Examination, a Research Advisory Committee is to be selected in consultation with the research advisor. The Committee shall consist of three to five members, at least two of whom, including the research advisor, must be geology faculty. The primary responsibility of the Research Advisory Committee is to aid the student in accomplishing his or her research program.

Upon the satisfactory completion of the Research Examination and assembling of a Research Advisory Committee, the department will certify to the University Committee on Graduate Studies that the student has successfully fulfilled the departmental requirements for candidacy for the Ph.D. degree. Students are expected to file for candidacy by the end of their second year.

Doctoral Dissertation—Under the supervision of the Research Advisory Committee the candidate must prepare a doctoral dissertation which is a contribution to knowledge and is the result of independent research. The dissertation must be concise and the student is strongly urged to prepare it in a format directly suitable for publication either in parts or as a whole.

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

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

Quarter Procedure
1 Complete counseling test; plan coursework for first year with academic advisor.
2-6 Preparation of research proposal; Research Examination; certification and petition for Ph.D. Candidacy; admission to candidacy for the Ph.D.
2-12 Ph.D. research; University Oral examination; complete dissertation.

COURSES

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

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

1. Interpreting the Earth—Introduction to and survey of the physical and chemical pro-
cesses, both 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 continents. Considers ways in which man interacts with the earth, both constructively and destructively. Course begins with surficial processes involving water, water's role in erosion, and in the production of rocks called sediment. Processes acting within the earth's interior are defined and discussed with emphasis on the global tectonics. Course concludes with non-renewable resources, energy, earthquake prediction and environmental 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 will be charged for field trips. High school chemistry and physics strongly recommended. (DR:7)

5 units, Aut (Hall) MWF 9; lab and field trips by arrangement

Win (Hall) MWF 8; lab and field trips by arrangement
Spr (Brown) MWF 8; lab and field trips by arrangement
Sum (Staff) MWF 9; lab and field trips by arrangement

2. Earth History—The earth has never ceased to change. Its ever- 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 had produced our present world and will produce that of tomorrow. Geology is history, a concept of eternal time, of sometimes gentle, sometimes catastrophic change. Our view of our planet, modified greatly by a revolution in geological thinking continues to bring us new and sometimes 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 more 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—Provides an introduction in the methods and materials of historical geology essential for those planning to major in geology. The 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 all students taking Geo-2; required for Geology majors who took Geo-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 will emphasize use of a hand lens in making observations, and field trips will demonstrate rock structures and genetic associations. Prerequisite: 1, with introductory chemistry strongly recommended.

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

102. Introduction to Field Geology—Instruction and practice in the basic methods of geologic investigation and recording in the field. Primary emphasis is placed upon techniques of systematic observation on the outcrop and the construction of geologic maps and sections from the data obtained. The field area studied may vary from year to year, but each site used will be selected to display a variety of rock types and landforms related to clearly defined structures. The course is conducted from the White Mountains Research Station in Bishop, Ca. during the two-week interval between Labor Day and the beginning of the Autumn Quarter. Details of the schedule each year are given in the bulletin, Summer Session. Prerequisite: 1, and 80, or consent of instructor.

3 units, Sum (Ruetz) Sept. 4-18

103A,B. Advanced Field Geology — Provides an opportunity of junior- and senior-level students to become involved in a substantial field investigation of professional scope and assumes familiarity with elementary techniques of field mapping and a proficiency in basic geologic concepts. The aim is to provide an in-depth exposure to independent analysis of relatively complex geologic problems in the field and the presentation of research results in the form of a professional geologic report; conducted from a tent camp at one or more localities in the western states and involves a coordinated field study of mapping, description, and interpretation of a relatively unknown field area. Emphasis in the field is placed on observation of lithologic and structural features, measurement of stratigraphic and structural sections, application of various survey methods, and plotting of geologic data on topographic maps and aerial photographs. Graduate students must obtain the permission of the instructor(s) to enroll. Prerequisites: 1, 2, 80, 102, 110, and 151; or consent of instructor(s).

103A. Introduction to advanced field techniques; detailed stratigraphic and structural mapping; description and interpretation of
interpretation of ancient environments. Labora-
tory correlation, the record of evolution, and the
tory introduction to several major groups of
record, the use of fossils for geologic dating and
how they are studied; emphasis on principles.

Course is open to all undergraduates.

Reading and lectures on the nature of the fossil
landscape to bear on our understanding of our
discourse of rural economics and geomorphology,
and bringing reconstructions of the ancient
to draw conclusions regarding the interdepen-
dence, coastal changes, and climate, attempting
to understnth the distribution of
inorganic constituents, oceanic circulation, and
biologic productivity. The course closes by
examining real and potential marine resources
together with attendant legal conflicts. Lectu-
res, occasional demonstrations and one coast-
side field trip required. (DR: 7)

2 units, Win (Ingle) MWF 11; demonstra-
tions, and field trips by arrangement

151. Introduction to Sedimentary Facies—In-
quiry into depositional systems. Topics explored
include grain size analysis, origin of bedding
and sedimentary structures, origin of sedi-
mentary facies. Siliciclastic depositional sys-
tems studied include alluvial, fluvial, eolian,
deltaic, nearshore, shelf, deep-sea. Summary of
carbonation: reef models, tidal flats and shelves, evaporites and deep-sea. Three
field trips, one with write-up, are required. Students desiring a more complete understand-
ing of sedimentary geology are urged to take
151L concurrently. Prerequisites: 1, 2.

3 units, Win (Ingle) MWF 9
field trips by arrangement

151L. Introduction to Sedimentary Petrog-
raphy—Lecture and lab concentrate on origin
and evolution of siliciclastic and carbonate
rocks. Lectures and labs in 151L coordinate
with lectures of 151. Descriptions of sedi-
mentary particles, introduction to point count-
ting, tectonics and sandstone composition,
cementation and diagenesis, thermal matura-
tion. Coerequisites or prerequisites: 151, 163.

2 units, Win (Larue) M 12
plus lab M or W 1:15-4:05

152. Stratigraphic Geology—Rudiments of
interpreting sedimentary rocks with emphasis
placed on the utility of integrating paleontologic
and sedimentologic evidence to reconstruct
depositional environments. Characteristic vari-
atations of modern and ancient biofacies and litho-
facies 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. An investigation of a stratigraphic problem serves as a basis for a required term paper. Lectures and discussions are supplemented by extensive reading from classic and current scientific literature. Prerequisites: 1, 2, 102, and 151.

4 units, Spr (Ingle) MWF 10; two required field trips; research conferences by arrangement

161. Crystal Chemistry and Mineralogy—Introduction to the crystallographic groups and the theory of x-ray diffraction. Principles of crystal chemistry. Factors affecting the stability of minerals and the solid contaminants of our environment. Systematic examination of the structures, chemistry, physical properties and paragenesis of the major rock-forming minerals with emphasis on silicates. Introduction to the principles of optical mineralogy. Laboratories will be concerned with determinative mineralogy including hand specimen, optical and x-ray methods. One field trip. Prerequisites: 1, 80, 102 and Chemistry 31 (may be taken concurrently).

5 units, Aut (Brown) MWF 10

lab MW 1:15-4:05

163. Optical Mineralogy—Provides a familiarity with polarizing microscopes to study rocks and minerals. It covers fundamental principles of optical properties and systematic study of common rock-forming minerals. Prerequisites: 161.

4 units, Win (Liou) TTh 9 and lab TTh 1:15-4:05 or MW 1:15-4:05

170. Introduction to the Chemistry of the Earth—The broad picture of how chemical elements are distributed in the earth, oceans, and atmosphere, processes which cause this distribution, and conceptual and analytical tools needed to explore these questions. Lectures will be 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 units, Fall (Stebbins) MWF 11

lab by arrangement

171. Geochemical Thermodynamics—An introduction to the application of chemical principles and concepts to geologic systems. The course concentrates on (1) developing an understanding of the chemical behavior of fluids, minerals, and gases and (2) using simple equilibrium approaches to modeling the geochemical consequences of diagenetic, hydrothermal, metamorphic, and igneous processes. Topics include reversible thermodynamics, solution chemistry, mineral-solution equilibria, and the distribution and transport of elements by geo-logic processes. Prerequisites: 102, 161, and Chemistry 135.

4 units, Aut (Bird) MWF 9

175. Solution-Mineral Equilibria: Theory—Develops procedures for calculating and evaluating the thermodynamic properties of reversible reactions among rock-forming minerals and aqueous solutions in geologic systems. A review of the concepts and principles of chemical thermodynamics relevant to geochemical processes is followed by a systematic investigation of the thermodynamic behavior of minerals, H₂O, CO₂ and electrolyte solutions at high temperatures and pressures. Emphasis is 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 projects. Prerequisite: 171.

4 units, Win (Bird) MWF 10

181. Igneous Petrology—Origin of igneous rocks, emphasizing magmatic differentiation processes displayed in the chemistry of volcanic rocks. Subjects include the physical properties of magmas, role of volatile components, applications of trace elements and isotopes to petrogenesis, modelling of crystal fractionation and partial melting, relevant experimental data and phase diagrams, relation of magma types to tectonic setting, and classification schemes. Designed for seniors and new graduate students. May be taken without the lab for 3 units by students who are not undergraduate geology majors. Prerequisites: 161 for lecture portion; 163 for lab.

3-5 units, Aut (Mahood) MWF 8
lab TTh 1:15-4:05

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

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

185. Volcanology—Types of eruptions; eruptive mechanisms; models of emplacement of
185L. Volcanology Laboratory—Hand sample and petrographic microscope examination of volcanic rocks. Labs are key to lectures in Geology 185 Volcanology, which must be taken concurrently. Prerequisite: 163 is required; 181 is helpful but not required.

1 unit, Spr (Mahood) W 1:15-4:05

186. Chemistry of Melts and Magma Systems—Qualitative and quantitative aspects of the chemistry of melt-crystal-vapor systems in both nature and the laboratory, emphasizing the applications of thermodynamics to petrologic problems. The derivation, interpretation, and use of phase diagrams, the theory behind and the use of geothermometers and geobarometers, the basic principles and mechanisms that control trace element behavior. Solution models, which allow the prediction of solid-melt phase equilibria will be introduced. Laboratories involve calculations about specific geological applications.

4 units, Spr (Stebbins) by arrangement

193. Introduction to Probability and Statistics in Geology—Discrete and continuous probability theory; applications of probability to model building; the role of probability in sampling and experimentation; statistical techniques in the analysis of sample data; statistical verification of models and statistical estimation of model parameters; introduction to stochastic processes and correlation analysis. Prerequisite: Introductory calculus.

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

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 are considered 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—Examines 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 analytical data into petroleum exploration.

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

230. Hydrogeology—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 9; seminar M 2:15-4:05; lab by arrangement


3 units, any quarter (Remson) by arrangement

241. Introduction to Micropaleontology—Study of microscopic marine fossils including diatoms, ostracods, and radiolarians with emphasis on foraminifera. Detailed study of principles of classification, evolutionary trends, common genera, and ecology of foraminifera. Application of planktonic and benthic foraminifera to problems of paleoecology, paleoceanography, and correlation of marine sediments. An original and quantitative investigation of a fossil or a modern foraminiferal fauna serves as a basis for required term paper. Instruction in laboratory and field techniques. Prerequisite: 152, with 143 highly recommended.

5 units, Aut (Ingle) MWF 11; two lab discussion periods by arrangement, alternate years, given 1987-88

244. Advanced Micropaleontology—Discussion and practice in use of marine microfossils (mainly benthonic and planktonic foraminifera) to solve fundamental geologic and oceanographic problems of geochronology, correlation, paleoecology, and paleoceanography. Individual analyses of a series of unknown samples provide an intensive laboratory experience in applying basic concepts of biostratigraphy and paleoenvironmental analysis to interpretation of Paleozoic, Mesozoic, and Cenozoic microfossil assemblages. Lectures focus on classic and current examples of research in this field. One week field trip. Prerequisite: 241.

3 units, Win (Ingle) T 11
lab TTh 1:15-4:05 or by arrangement alternate years, given 1987-88

250. Ocean Basins—Physiography, tectonics and sedimentation of the modern and ancient ocean with emphasis on familiarization with the current marine geological literature and with
directions of advanced research in marine geology and marine geophysics. Topics include the morphology, tectonics and volcanism of the deep-sea, processes of deep-sea sedimentation, the carbonate and silica cycles, sedimentary history of the deep ocean, Cenozoic and Mesozoic paleoceanography. Course restricted to the geology of the deep-sea; the geology of the ocean margins is treated in 251. Term project required. Prerequisites: 1, 150, or consent of the instructor.

4 units, Aut (van Andel) MWF 9
alternate years, not given 1987-88

251. Continental Margins—An overview of the current knowledge of continental margins past and present. Emphasis is on the structure and the sedimentary history and facies of the margins of the world, and present nearshore and shelf sedimentation processes are treated only in this light. Topics include morphology and structure, sediment facies patterns and sediment petrology of coastal, shelf and slope sediments; origin of passive and active continental margins; cause and effect and role of transgressions and regressions in geological history, problems in the utilization of continental margins. A term project is required. Prerequisites: 1, 150 or consent of the instructor. 151 recommended.

4 units, Aut (van Andel) MWF 9
alternate years, given 1987-88

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

2 units, Spr (Larue) TTh 9
alternate years, given 1987-88

253L. Sedimentary Petrology Laboratory—Each 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 (Larue)
alternate years, given 1987-88

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 (Larue) MWF 2:15
3 field trips by arrangement
calculations and graphical analysis to interpret the physical and chemical processes that were responsible for the development of mineral zoning and paragenesis. Prerequisites: 171, 175, Applied Earth Sciences 220.

2 units, Win (Bird, Einaudi) Th 9-11

278. Organic Geochemistry—Course unites aspects of geology and chemistry in study of origin and occurrence and fate or organic materials in geological environments. Principles of organic geochemistry are applied to sedimentology, paleontology, petroleum geology, and environmental science. Introductory courses in geochemistry and organic chemistry are helpful.

2 units, Win (Kvenvolden) TTh 4:15

280. Rock Sample Preparation and Analysis—Practical instruction on the use of rock-crushing and mineral separation equipment and technique; introduction to use of school analytical facilities. Designed for graduate students and advanced undergraduate students who will be using these techniques for their research.

1 unit, Win (Staff) F 1:15-4:05 alternate years, given 1987-88

289. Teaching Experience.

0-3 units, Aut, Win, Sum (Staff) by arrangement

293. Applications of Probability and Statistics in the Earth Sciences—A variety of techniques are presented along with their applications to geological problems. Students are expected to offer critical reviews of selected published research papers with respect to the appropriateness and correctness of statistical usage. Prerequisite: 193 or consent of instructor.

0-3 units, Spr (Switzer) TTh 11-12:15

310. Surface Analytic Chemistry—A practical, hands-on approach to the most widely used surface analytic techniques including x-ray and ultraviolet photoelectron spectroscopy, Auger electron spectroscopy, scanning electron and Auger microscopy, and low energy electron diffraction. Students instructed on a VG ESCALAB Mk II instrument. Lecture topics include design and function of surface analytic instrumentation, technique fundamentals and application, sample preparation, and general procedures in working with ultra-high vacuum equipment. A term project allows students to perform surface analytic experiments on materials of their choice. Course required for those who wish to independently use the VC ESCALAB Mk II at Stanford’s Center for Materials Research. Class size limited. Pre-requisites: Consent of instructor.

3 units, Aut (Hochella) MW 10 lab by arrangement

317. Advanced Field Mapping—Ten to fourteen days mapping in a structurally complex region. Emphasis is on collected detailed microscopic structural data as well as stratigraphic and sedimentologic data. Goal is to help 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 (Larue) by arrangement

351. Seminar in Ocean Science—Advanced level discussion of current research problems in the tectonics, sedimentation, climate and paleoclimate, and history of the ocean basins.

2 units, Aut (van Andel) by arrangement

358. Seminar in Sedimentary Geology.

1-3 units, Win, Spr (Larue) by arrangement

361. Seminar in Mineralogy.

1 unit, Win (Staff) by arrangement


1-3 units, Aut, Win, Spr (Mahood) by arrangement

382. Seminar in Metamorphic Petrology—Discussion of selected topics in the area of 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—Seminar brings together students interested in doing experiments and in using experimental data who wish to trace how various types of 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 will be presented.

2 units, Win (Stebbins) by arrangement

Problems in Various Fields of Geology.

units, quarter, and time by arrangement (Staff). All courses.

309. Problems in General Geology.

319. Problems in Structural Geology.

339. Problems in Environmental Earth Sciences and Hydrogeology.

349. Problems in Paleontology, Palynology, and Paleoeology.

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: Jon F. Claerbout, Allan V. Cox, Robert L. Kovach, Amos M. Nur, Norman H. Sleep, George A. Thompson, Mark Zoback.
Assistant Professor: Michael O. McWilliams
Professor (Research): Zvi Ben-Avraham
Lecturer: Andrew Michael
Consulting Professors: David M. Boore, Cecil Green, Walter Mooney, Francis Muir, William Ostrander, Carl Wentworth
Research Associate: Rosemary Knight

OFFERINGS AND FACILITIES

Geophysics is the branch of earth science concerned with exploration of the earth and its history by physical measurements. The undergraduate and graduate programs are designed to provide (1) a background of fundamentals in science and (2) courses in geophysics to coordinate the fundamentals with principles of geophysics. The program leading to the Bachelor of Science in Geophysics permits many electives and a high degree of flexibility for each individual student. Graduate programs give specialized training for professional work in exploration, research, and education. The Department of Geophysics is housed in the Ruth Watts 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 minicomputers, 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 study of present-day tectonics, near field seismology, seismic studies of the continental lithosphere, palomagnetic 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 185, Section A, B, C, D, E, F, G, H, J) during the senior year. Seniors in Geophysics who expect to do graduate work are urged to take the Graduate Record Examination as early as is convenient in their final undergraduate year.

CURRICULUM

Course No. Subject
Chem. 31. Chemical Principles
Chem. 135. Physical Chemical Principles, or Physics 170, 171, Thermodynamics
Electrical Eng. 141. Electromagnetic Fundamentals or Physics 120. Electricity and Magnetism
Geol. 1. Interpreting the Earth
Geol. 80. Rocks and Minerals
Geol. 102. Introduction to Field Geo.
Geol. 110. Structural Geology
Geophy. 185 (A, B, C, D, E, F, G, H, J) Research Seminar
Math. 21, 22, 23 and 44, or 41, 42, 43 and 44. Analytical Geometry and Calculus
Math. 130. Ordinary Differential Equations
Physics 51, 53, 54, 55 and 56. Elementary Physics
Physics 110, 111. Mechanics
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 and 285. Elective courses which do not fill the 9 unit requirement, but are recommended are: C.S.105 or C.S.106, Geology 103A and B, Geology 181, Physics 57, 58, 64A, 64B, 120, 121, 122, 210, 211, or Electrical Engineering 142; Mathematics 101, 106, 113, 114, 131, 132, Engineering 44, and Chemical Engineering 140, 150.

HONORS PROGRAM IN GEOPHYSICS

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 their advisor.
2. Submit proposal to department, which will decide on its suitability as an Honors project. Necessary forms are in 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 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 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 a 2-week field geology course (Geology 102) given just before registration in the Autumn for students entering without an equivalent course. 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 include 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

<table>
<thead>
<tr>
<th>Autumn Quarter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophys. 190.  General Geophysics</td>
<td>4</td>
</tr>
<tr>
<td>Electrical Engr. 261. Fourier Transform and its Application</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 174.  Seismology</td>
<td>3</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 Log Analysis</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>
Winter Quarter
Geol. 151. Sedimentary Geology 3
Geophys. 180. Geologic Interpretation of Reflection Seismograms 3
Geophys. 180A. Seismic Data Processing Lab 1
Geophys. 262. Rock Physics 3
Geophys. 397. Contemporary Geophysics Seminar 1
One of following 3 courses:
A.E.S. 298. Decision Analysis in Petroleum Exploration 3
Electrical Engr. 263. Digital Signal Processing 3
Geophys. 150. Plate Tectonics 3
FORTRAN Short Course 0 14

Spring Quarter
A.E.S. 253. Petroleum Geology and Exploration 3
Geol. 50. Rocks and Minerals 5
Geol. 110. Structural Geology 5
Geophys. 284. Reflection Seismology I 3 16

Second Year
A.E.S. 252. Sedimentary Basins 3
Geophys. 191A. Geophysical Field Techniques 4
Geophys. 285. Reflection Seismology II 3
Geophys. 380B. Seminar: Exploration Geophysics 3 13

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 one of these years, ordinarily the last, must be spent as a registered student at Stanford. During their first year, candidates will take three quarters of Research Seminar (Geophysics 385, Sections A, B, C, D, E, G, H, J, K, L). 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. Additional advanced courses are to be selected from the following topics: applied physics, astrophysics, atomic and nuclear physics, communications theory, computer sciences, electromagnetic theory, civil engineering, chemical engineering, engineering mechanics, geology, geophysics, materials science, physics of solids, thermodynamics. Students who wish to waive any of the required courses 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 which is given annually in January, by his or her second year; pass the Departmental Oral Exam by presenting and defending a written research paper or proposal by the end of the second year; fulfill the requirements of the minor department, if a minor is elected; 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 departmental 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

102. Paleomagnetism—An introduction to the application of paleomagnetic methods to problems in tectonics, structural geology and stratigraphy. Topics covered include: origin and spherical harmonic analysis of the geomagnetic field, origin of thermal, chemical and depositional remanent magnetization in geological materials, techniques of measurement, data
reduction and analysis, apparent polar wandering and plate motion, analysis of terrane displacement. A 3-5 day field trip is conducted to learn techniques of sample collection and orientation. Students conduct a small-scale paleomagnetic study as a research project. Prerequisites: Geology 1 or 2. Recommended: Geophysics 150, Geology 110 and Physics 53.

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

150. Plate Tectonics—Measurement, description and evolution of movements between lithospheric plates as determined from geologic and geophysical data. Topics include: determination of relative velocities between plates; analysis of magnetic anomalies to determine age of sea floor; interpretation of paleomagnetic data; seismicity at plate boundaries; geologic processes at rises, trenches, and transforms; causes of plate motions; development of plate tectonics as a unifying concept in earth science including 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

174. Seismology—Introduction to earthquakes and seismic wave propagation. Topics to be discussed include: principles of seismographs, seismicity, earthquake magnitude and energy, construction of travel-time tables, general theory of elastic waves, interpretation of seismograms, determination of earthquake source mechanisms, seismicity and its relation to tectonics and engineering seismology. Prerequisites: Math 130, Physics 55 or equivalent and some familiarity with simple computer programming.

3 units, Aut (Kovach) MWF 10

180. Geologic Interpretation of Reflection Seismograms—Elementary principles of reflection seismology, seismic data processing, and field operations, including 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 and lab W 1:15-4

180A. Seismic Data Processing Lab—Workshop experience in computer enhancement of reflection data. Prerequisites: Electrical Engineering 261, concurrent or previous registration in 180.

1 unit, Win (Zoback, Okaya) by arrangement

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

185A. Research Seminar: Reflection Seismology—Departmental research in reflection seismology and petroleum prospecting.

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

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

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


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

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

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

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

185K. Research Seminar: Borehole Geophysics—Research in areas of petrophysics,
seismology, in situ stress, and other subjects related to characterization of physical properties of rock in situ.

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

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. Basic 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. Prerequisite: 190 suggested.

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 is placed 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. The student who elects 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

276M. Advanced Seismology—Techniques of seismology to determine earthquake source mechanisms, necessary theory will be covered but the emphasis is on current applications and techniques, including programs currently available at Stanford and at the USGS. A hands on approach utilizing the wealth of seismic data available in this area. Topics include: reading of seismograms, available data bases, design of seismographic instruments and networks, location of earthquakes, representation of seismic sources, determination of source mechanism (fault plane solutions, moment tensor inversion, waveform modeling), magnitude and moment determination, and automatic processing techniques. Prerequisites: 174. Knowledge of Unix helpful.

3 units, Spr (Michael) by arrangement

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

3 units, Spr (Claerbout) MWF 10


3 units, Aut (Claerbout) MWF 10

290. Tectonophysics—The physics of plate tectonics. Topics include crustal deformation and flexure, application of dislocation theory to faulting and the earthquake cycle, and the state of stress in the crust. Recommended: 262, Applied Earth Sciences 280.

3 units, Spr (Zoback, Nur) MWF 11

301. Problems in Geophysics.
any quarter (Staff) by arrangement
380A,B. Seminar: Exploration Geophysics—This seminar gives master's candidates an opportunity to frame and pursue their thesis research. Second year students in the Exploration Program report on summer jobs and develop their independent research projects, culminating in a written report and oral presentation to the department. First year students register in 380A. Second year in 380B.

380A. 1 unit, Aut (Cox) by arrangement
380B. 1 or 3 units, Aut (Cox) by arrangement

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

385A. Research Seminar: Reflection Seismology—Departmental research in reflection seismology and petroleum prospecting.
2 units, Aut, Win, Spr (Clarebout) by arrangement

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

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

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

385E. Research Seminar: Tectonics—Research topics on the origin, major structures, and tectonic processes of the earth's crust. 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 types of geophysical data to understand structure and processes in seismically active areas.
2 units, Aut, Win, Spr (Zoback) by arrangement

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

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

400. Research in Geophysics—
any quarter (Staff) by arrangement
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.
Acting Assistant Professor: Abraham Sageev

OFFERINGS

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

- Drilling 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

Scientific disciplines involved include geology, geophysics, chemistry, mathematics, physics, and computer science. Breadth in engineering disciplines is required. The rapidly evolving energy and fluid production industries require professionals of versatility interested in wide-ranging technological, sociological, and geographical subjects. Qualified students are encouraged to take graduate study because typical assignments often lead to responsible positions in industrial management and research.

Graduate research is conducted in specialties such as geothermal engineering, improved oil recovery, water production and reclamation, well log analysis, well bore heat and fluid flow, drilling, production, pressure transient analysis, flow of non-Newtonian fluids, solution mining, natural gas engineering, mineral resource management and development, and mathematical simulation of these systems. Undergraduate participation in both research and industrial practice is encouraged and aided.

The main objective of this program is to produce mature engineers of broad scientific base qualified to grow in the evolving fields of energy resource production and environmental and social responsibility of technology. Because of the international nature of this field, special opportunities exist for persons interested in language, culture, and travel. Participation in the Stanford Overseas Centers is encouraged, and summertime employment in the energy industries is required for at least one summer prior to the baccalaureate degree and for certain graduate students. Industrial summertime employment is usually available for petroleum engineering students. Graduate programs lead to the degrees of Master of Science, Engineer, Engineer (Management Option), and Doctor of Philosophy.

FACILITIES

The department occupies portions of the Mitchell Earth Sciences Building, the Henry Salvatori Building, and the Lloyd Noble Laboratory of Petroleum Engineering. The Lloyd Noble Building contains six laboratories for high temperature fluid flow and geothermal energy research, oil recovery research, adsorption studies, a classroom, a machine shop, an analytical laboratory, the main office for the Stanford University Petroleum Research Institute (SUPRI), faculty offices, a computer room, and office study space for graduate students. Other faculty and departmental offices are in the Mitchell Earth Sciences Building, and the Salvatori Building which also houses the department’s VAX 11/750 computer. Computer terminals are available in student and faculty offices in all three buildings, and several dial-in lines are available from residences. Laboratories and additional student study rooms and research laboratories are also located in the Mitchell Building. Research is conducted in all three buildings. All graduate and undergraduate students have easy access to the department computer facilities and are required to use these facilities 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 Tech-
nology (ABET). The department undergoes accreditation inspections with the School of Engineering and further information may be found in the School of Engineering portion of this bulletin. Basic sciences and engineering are stressed to provide depth sufficient for the wide spectrum of careers possible in this field.

COURSE PROGRAM FOR
UNDERGRADUATES

The requirements for the B.S. degree in Petroleum Engineering are similar to those described for any engineering degree in the School of Engineering portion of this bulletin. In brief the credit and subject requirements are:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>6</td>
</tr>
<tr>
<td>Western Culture</td>
<td>15</td>
</tr>
<tr>
<td>Mathematics</td>
<td>21 (min)</td>
</tr>
<tr>
<td>Science</td>
<td>24 (min)</td>
</tr>
<tr>
<td>Engineering depth</td>
<td>36 (min)</td>
</tr>
<tr>
<td>Engineering breadth</td>
<td>36 (min)</td>
</tr>
<tr>
<td>Free electives</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
</tr>
</tbody>
</table>

Although there is ample opportunity to modify a particular program to meet special objectives such as pre-law, a typical course of study would include the following:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pet. E. 103</td>
<td>Survey of the Energy Industries</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>150A. Well Log Analysis -I</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>150B. Well Log Analysis-II</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>151A. Earth Fluids</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>151B. Fluid Flow in Porous Media</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>151D. Reservoir Fluids Laboratory</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>151E. Core Analysis Laboratory</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>152A. Drilling Technology</td>
<td>3,4</td>
</tr>
<tr>
<td></td>
<td>152B. Production Technology</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>152C. Drilling Fluids</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>160. Report on Energy Industry Training</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>170. Elements of Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>171. Reservoir Simulation Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>172. Gas Engineering</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>175. Well Test Analysis</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>App. Ear. Sci. 180. Introduction to</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Earth Structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chem 31, 33, and 135. Basic Organic</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>and Physical Chemistry</td>
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<tr>
<td></td>
<td>Comp. Sci. 106-Introduction to</td>
<td>4</td>
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<tr>
<td></td>
<td>Structured Programs</td>
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<tr>
<td></td>
<td>Engr. 10N, 11, 21, 32, 60-Mechanics, Stress, Thermodynamics, Economics</td>
<td>17</td>
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<tr>
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<td>Geol. 1, 2, 3, 151-Earth Interpret,</td>
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</tr>
<tr>
<td></td>
<td>History, Structure, Sedimentology</td>
<td>15</td>
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<tr>
<td></td>
<td>Math 19, 20, 21, 22, 23, 44, and 130</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calculus and Differential Equations</td>
<td>3 ea.</td>
</tr>
<tr>
<td></td>
<td>Physics 51 and 53-Mechanics, Electricity</td>
<td>4 ea.</td>
</tr>
<tr>
<td></td>
<td>and Magnetism</td>
<td></td>
</tr>
</tbody>
</table>

Selected courses often taken as electives include:

App. Earth Sci. 193, 251, 253; Comp. Sci. 135; Chem. 110, 140, 150, 160; Engr. 40, 50, 102, 103; Geophys. 180; Ind. Eng. 101, 133; Math 113, 131, 132; Mech. Engr. 103, 250; Pet. Engr. 173, 190, 190, 267; Physics 55; Stat. 110.

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. Extensive use of computers is made in most petroleum engineering courses. Students must develop programming skills through self study and appropriate course work.

Several other requirements are: (1) one summer’s work experience and a one unit report (Pet. E. 160) is required, (2) engineering breadth and depth courses should be taken for letter grades, and (3) ABET accreditation requires engineering students to have one half year (22½ credits) of engineering design. The latter requirement will normally be met on completion of engineering depth and breadth requirements.

The general university requirements for writing, western culture, and foreign language must also be completed within the 180 unit minimum requirement for the Bachelor of Science in Petroleum Engineering.

HONORS PROGRAM

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 grade average of at least B in all course work in the University. In addition to the minimum requirements for the B.S. degree, the student must complete six units of advanced petroleum engineering courses and complete at least three units of undergraduate petroleum engineering research (Pet. Eng. 190). An overall 3.5 average 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 average 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.
2. Complete 45 units with at least a B average; normally 6 of these units must be independent work on a research problem.
3. Make up deficiencies in previous training; not more than 10 units of such work may be counted as part of the minimum total of 45 units.

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

4. 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 industry management, pipeline transportation, and certain groundwater hydrology and environmental problems.

COURSES SUGGESTED FOR THE MASTER'S DEGREE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 200A</td>
<td>Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 200B</td>
<td>Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
</tr>
<tr>
<td>Pet.E. 270A</td>
<td>Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet.E. 270B</td>
<td>Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet.E. 271A</td>
<td>Reservoir Simulation Theory</td>
<td>3</td>
</tr>
<tr>
<td>Pet.E. 271B</td>
<td>Advanced Reservoir Simulation</td>
<td>3</td>
</tr>
<tr>
<td>Pet.E. 275</td>
<td>Advanced Well Test Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Electives†</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>


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

Students wishing to concentrate on numerical reservoir simulation may take the petroleum engineering course sequence 171, 271A, and 271B. This sequence provides fundamental background in preparation, development and operation of numerical reservoir simulators.

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 "B" average in courses given by the School of Earth Sciences. The student must prepare a thesis representing 15 units of research, meeting the approval of the supervising instructor, another faculty member, and the University Committee on Graduate Studies.

ENGINEER
(MANAGEMENT OPTION)

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

A minimum of two years (six 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. 210-211</td>
<td>Accounting I and II</td>
<td>4 ea.</td>
</tr>
<tr>
<td>Bus. 220</td>
<td>Business Finance I</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 261</td>
<td>Decision Making under Uncertainty</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 270</td>
<td>Organizational Behavior</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 290</td>
<td>Strategic Management</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 321</td>
<td>Investment Management</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 351</td>
<td>Negotiation and Intervention</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 352 Small Business Management</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Bus. 354</td>
<td>Energy-Business Issues</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 397</td>
<td>Business and the Law</td>
<td>4</td>
</tr>
<tr>
<td>I.E. 270</td>
<td>Managing Technical Companies</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional units needed to make up the required 90 may be electives. The student must secure at least "Pass" grades in Graduate School of Business courses. In all other courses the student must maintain a "B" average. The student must prepare a thesis on a combined engineering and economic study representing 15 units of research. It is to have the approval of the supervising instructor, 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 90 units beyond the 45 units required for the master's degree. Approximately 65 units of course work are generally required, exclusive of research units. The 65 units in question should represent graduate courses in petroleum engineering offered at Stanford, courses picked from the following list, and other courses approved by the department.

MATH AND APPLIED MATH

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aero. &amp; Astro. 192</td>
<td>Vector Analysis and Cartesian Tensors</td>
<td>3</td>
</tr>
<tr>
<td>Aero. &amp; Astro. 291A and B</td>
<td>Linear Transforms and Their Applications to Engineering Problems I and II</td>
<td>3 ea.</td>
</tr>
<tr>
<td>Comp. Sci. 106</td>
<td>Introduction to Structured Programming</td>
<td>3</td>
</tr>
<tr>
<td>Comp. Sci. 135</td>
<td>Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>Comp. Sci. 137A and B</td>
<td>Numerical Analysis</td>
<td>3 ea.</td>
</tr>
<tr>
<td>Comp. Sci. 234</td>
<td>Numerical Methods of Optimization</td>
<td>3</td>
</tr>
<tr>
<td>Math. 106</td>
<td>Introduction to Theory of Functions of a Complex Variable</td>
<td>3</td>
</tr>
<tr>
<td>Math. 113</td>
<td>Linear Algebra and its Applications</td>
<td>3</td>
</tr>
<tr>
<td>Math. 114</td>
<td>Linear Algebra and Matrix Theory</td>
<td>3</td>
</tr>
<tr>
<td>Math. 115</td>
<td>Fundamental Concepts of Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Math. 131</td>
<td>Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Math. 132</td>
<td>Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Mathematical Methods in Mechanical Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 201</td>
<td>Applications of Complex Variables</td>
<td>3</td>
</tr>
</tbody>
</table>
examination, which is essentially a defense of the dissertation problem. The student must prepare a dissertation which is a significant contribution to knowledge and the result of independent work.

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

Ph.D. MINOR
To be recommended for the degree of Doctor of Philosophy with Petroleum Engineering as a minor subject, a student must take fifteen units of selected graduate-level lecture courses in the department. These should include 270A and 270B. The remaining courses must be selected from 170, 171, 271, 272, 275, 280A and 280B.

COURSES

103. Survey of the Energy Industries—Arranged to give the students a comprehensive view of organization and operation of energy industries. Exploration; drilling and offshore drilling; development and production methods; transportation and storage; refining and petrochemicals; marketing; geothermal energy; oil shales; tar sands; coal; and renewable resources. (DR:8)
3 units, Aut, Spr (Horn) MWF 9 and 11

150A. Well Log Analysis I—An interdisciplinary course for all earth scientists and engineers. The main objective is development of a practical understanding of the interpretation of well logs by use of real field examples. Lectures, problems. Methods for evaluating commercial significance of rock formations penetrated in exploratory drilling. This is the first part of a two-part course and concentrates on the fundamentals of all types of logs including electric and nonelectric logs.
4 units, Aut (Staff)

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

151A. Hydrocarbon Fluid Phase Behavior—Lectures, problems. Chemical, physical, and thermodynamic properties of underground earth fluids. Use of computers for design problems. Gas laws, behavior of liquids, phase equi-
libria, viscosities of hydrocarbons; properties of subsurface waters and steam. Prerequisite: 103. Recommended: Computer Science 106.

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


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

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

3 units, Win (Staff) by arrangement

151E. Core Analysis Laboratory—Porosity, permeability, capillary pressure, irreducible saturations, formation resistivity factor of porous media. Prerequisites: 151B and 151D (may be taken concurrently).

3 units, Spr (Marsden) T 1:15

152A. Drilling Technology—A course designed to provide a comprehensive picture of modern drilling operations, practices, and equipment both onshore and offshore. Lectures, field trips, problems. Graduate students may register for 3 units.

4 units, Win (Horn) T 10-11:50 Th 11 not given 1987-88

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

3 units, Spr (Staff) T 10-12, Th 11 alternate years, given 1987-88

152C. Drilling Fluids Laboratory—Lecture, Clay mineralogy, rheology of drilling fluids. Standard measurements of well drilling muds.

3 units, Aut (Castanier) MW 2:15

lab MW 3:15-5:05


1 unit, any quarter (Staff) by arrangement


3 units, Spr (Staff) MWF 1:15


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


3 units, Aut (Aziz) MWF 8


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.

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

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

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


3 units, Aut (Orr) T 1:15-3:05 Th 2:30-3:45

267. Engineering Valuation and Appraisal of Oil and Gas Wells, Facilities, and Properties—Seminar, problems. Appraisal of development and remedial work on oil and gas wells; appraisal of producing properties; estimation of productive capacity, reserves; operating costs,
depletion and depreciation; value of future profits, tax returns, fair market value. Prerequisite: Consent of instructor.

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

268. Seminar in Petroleum Engineering,
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


3 units, Aut (Staff) MWF 9


3 units, Win (Sageev) MWF 10

271A. Reservoir Simulation Theory—Lectures and problems. Advanced work in numerical analysis of partial differential equations used in reservoir simulation. Numerical dispersion, stability, convergence, conservatism, phase error. Solution of large matrix systems. Comparative class problems. Prerequisites: 171 or consent of instructor, Mechanical Engineering 200A.

3 units, Spr (Horne) alternate years, given 1987-88

271B. Advanced Reservoir Simulation—Lectures and problems. Various methods of solving coupled system of partial differential equations arising in reservoir simulation. Discussion of coning, compositional and thermal models. Special topics of current interest to industry. Prerequisites: 171, 270A, 270B, or consent of instructor.

3-4 units, Win (Aziz) MWF 11

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

3 units, Spr (Ramey) MWF 10


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 (Orr) alternate years, given 1987-88

Prerequisites: Mechanical Engineering 200A or Mathematics 131, and consent of instructor.

3 units, Spr (Home)

283. Chemical Aspects of Mineral and Energy Fluid Production—Properties and applications of non-Newtonian fluids in both drilling, completing, cementing, fracturing, improving production of wells; transportation and recovery. Prerequisite: Graduate standing.

2 units, Spr (Marsden) MWF 9

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

3 units, Win (Marsden) MWF 1:15 alternate years, given 1987-88

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

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

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


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


1 unit, Aut, Win, Spr (Horne, Ramey, Sageev) 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 will be evaluated by both students and the regular instructor.

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


any quarter (Aziz, Brigham, Ellis, Dykstra, Homsy, Horn, Horne, Marsden, Miller, Orr, Ramey, Sageev, Sanyal) by arrangement
SCHOOL OF EDUCATION


Dean: Marshall Smith
Associate Dean: Larry Cuban (Academic Affairs)
Associate Dean: Anne Caddy (Administration)
Assistant Dean: Ralph Keller (Alumni Affairs)
Director of Student Services: Deborah Sutherland

Professors: J. Myron Atkin, Paul Brest (by courtesy), Edwin M. Bridges (on leave, Spring), Robert C. Calfee, Martin Carnoy (on leave, Autumn), Elizabeth G. Cohen (on leave, 1986-87), Arthur Coladarci, Larry Cuban, Sanford M. Dornbusch (by courtesy), Elliot W. Eisner, Nathaniel L. Gage, Richard E. Gross, Shirley Heath (by courtesy), Robert D. Hess, Alex Inkeles (by courtesy), Herant Katchadourian (by courtesy), Michael W. Kirst, John D. Krumboltz, Henry M. Levin, James G. March (by courtesy), Lewis B. Mayhew, John W. Meyer (by courtesy), Nel Noddings, Ingram Olkin, Denis C. Phillips, Robert L. Politzer, W. Richard Scott (by courtesy), Lee S. Shulman, Alberta E. Siegel (by courtesy), Richard E. Snow, Herbert Solomon (by courtesy), David Rogosa, Joel Samoff (by courtesy), Carl E. Thoresen, David B. Tyack, Hans N. Weiler (teaching overseas, Autumn, Winter)

Associate Professors: Arthur Applebee (on leave, Autumn), Michael Bratman (by courtesy), Martin Ford, Jerome Karabel, Milbrey McLaughlin, David Rogosa, Joel Samoff (on leave, Autumn, Winter), Pamela L. Strathairn (by courtesy), Myra H. Strober (on leave, 1986-87), Decker F. Walker

Associate Professor (Research): Judith Langer
Assistant Professors: M. Beatriz Arias, Michael Garet, Edward Haertel, Thomas C. Huebner, Teresa D. LaFromboise, Joan E. Talbert

Lecturers: Raymond F. Bacchetti, Ronald B. Herring, Robert P. Huff, James W. Lyons

Acting Associate Professor: Nelly P. Stromquist
Acting Assistant Professors: David Grossman, Rachel Lotan

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 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.
program. Students in such a program receive an A.B. in their undergraduate major and an A.M. in Education. Approval of the student's undergraduate department and of the School of Education is required. Applications may be made upon completion of 105 units, but no later than the end of the eleventh quarter of undergraduate work. Students study for both the bachelor's and master's degrees simultaneously and must complete fifteen 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 Education. The Graduate Record Examination (General Test) is required for all coterminal admissions. (Coterminal applicants should also consult with the Graduate Program Office regarding eligibility for coterminal study.)

In addition to the coterminal program, the school offers a variety of opportunities to undergraduates 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 in relation to degrees and credentials. Many students entering the School of Education are seeking both degrees and credentials. In that case, both applicable sections should be consulted. Below are listed degrees offered by the School of Education with which credentials may be associated. (There is no necessary association between degrees and credentials. Requirements for degrees and credentials may differ.)

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

Admission to graduate standing by the University 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 program 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 within the limits described in this bulletin.

Students who are candidates for a master's or doctoral degree should consult also the University's general requirements described in the "Degrees" section in this bulletin, noting in particular, registration and residence requirements.

MASTER OF ARTS

The degree of Master of Arts (A.M.) in Education 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 Programs (General Curriculum, Curriculum Evaluation, Elementary Education, Mathematics Education, Secondary Education, Teacher Education)
  - Language, Literacy and Culture (Bilingual/Bicultural Education; Second Language Education; Writing, Reading and Language-English)
  - Dance Education
  - Social Studies Education
  - International Development Education (SIDEC)
  - International Educational Administration and Policy Analysis
  - Mathematical Methods in Educational Research
  - 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 another 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 Program Office, School of Education.

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*A program for candidates who are seeking initial preparation for the Single Subject Teaching Credential (secondary) as well as for the master's degree. See "Credentials for Public School Service" for pertinent 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 of these must be taken for a letter grade and the candidate must achieve at least a "B" average. Eighteen (18) units of the program must be in the School of Education. University residence requirements must be met. The minimum residence requirement for the master's degree is registration at Stanford as a graduate during at least three quarters and the payment of the equivalent of at least three full quarters' tuition at Stanford as a graduate. Only one quarter of nonmatriculated study may be counted toward the 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.

Information on program requirements and the order of procedure for applying for candidacy for the master's degree 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 grade point average 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-time residence (or equivalent).
2. A minimum of 45 quarter units of graduate study. At least 36 of these units must be completed at Stanford. University residence requirements must be met. The minimum residence requirement for the master's degree is registration at Stanford as a graduate during at least three quarters and the payment of the equivalent of at least three full quarters' tuition at Stanford as a graduate. Only one quarter of nonmatriculated study may be counted toward the residence requirement for this degree.
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. Both the preliminary plan of study and the applications for candidacy 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" average in approved Stanford courses in the teaching subject and in professional education, or grades in these courses equivalent to those required for the academic department's Master of Arts degree.
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.

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

EDUCATIONAL SPECIALIST IN EVALUATION

The degree of Educational Specialist (Ed.S.) is offered in the field of Evaluation for those students admitted to the School of Education's Evaluation Training Program, 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 during at least three quarters and the payment of at least three full quarters' tuition at Stanford as a graduate.

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 Admissions Office.

Note—Application for candidacy for the Ed.S. degree must be filed with the Degree Program Office, School of Education, no later than two weeks before the last day of class of the quarter preceding the quarter in which degree conferral is expected.

DOCTORAL DEGREES

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

The program areas for the doctorate are listed below:

Administration and Policy Analysis Education, with specialization in Curriculum and Teacher Education 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 (SIDE)
*Mathematical Methods in Educational Research
*Psychological Studies in Education, with specializations in:
Child Development and Early Education Counseling Psychology (Health Psychology)
Educational Psychology
Social Sciences in Education, with specializations in:

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

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

A timetable for the student's expected progress toward the Ed.D. or Ph.D. degree is available for each program area. In general the timetable is as follows:

First year—Selection of program area and advisor; development of program plan; course work; preliminary review (qualifying examination in some areas).

Second year—Continuation of course work; qualifying examination or review; admission to candidacy; dissertation planning and proposal; oral examination (defense of proposal option).

Third year—Work on dissertation; completion of course work.

Fourth year—Completion of dissertation; oral examination (defense of dissertation option).

**DOCTOR OF EDUCATION**

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

**Residence**—Nine full tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the doctorate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. See sections on "Advanced Degrees" and on "Nonmatriculated Graduate Study" in the front of this bulletin. In such cases, candidates for the degree will be expected during the course of work to register at Stanford for a minimum of two academic years (six full quarters or 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. Admission to candidacy is granted by the School of Education and expires five years from the end of the quarter in which the candidacy is established.

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

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

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

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

**DOCTOR OF PHILOSOPHY**

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

**Residence**—Nine full tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the doctorate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. (See sections on "Advanced Degrees" and on "Nonmatriculated Graduate Study" in the front of this bulletin.) In such cases, candidates for the degree will be expected during the course of work to register at Stanford for a minimum of two academic years (six full quarters or 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. Admission to candidacy is granted by the School of Education and expires five years from the end of the quarter in which the candidacy is established.
quarters of non-matriculated study may be counted toward the residence requirement for this degree.

Application for formal admission to candidacy for the Ph.D. degree must be made no later than the sixth quarter 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 relevant and acceptable work taken elsewhere up to a maximum of 36 quarter units. Graduate course work taken seven or more years ago ordinarily will not be included in the doctoral program.

Organization of Program—Considerable flexibility is allowed in projecting a program for the Ph.D. degree. The candidate will be expected to organize a program of work for the degree in conference with advisors relevant to the field of concentration. All programs require the approval of the relevant School of Education Area Committee and the Associate Dean for Academic 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 in Education—Candidates for the Ph.D. degree in other departments or schools of the University who elect a minor in Education will be expected to choose a field of concentration, and to take a minimum of 30 units in graduate courses in education. In the organization of the program, the student who applies for a minor in the School of Education will consult with the school's advisor for the minor.

CREDENTIALS FOR PUBLIC SCHOOL SERVICE

The 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. In some cases, prior experience and/or course work can help 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 does not offer training for a teaching credential at the elementary level (Multiple Subject Credential) at this time.
The Stanford Teacher Education Program (STEP) is a twelve-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 nearby schools. During the academic year, students take courses in their academic fields and in professional education; they also teach part time in local schools. Stanford offers training for the credential in the following areas: English, Foreign Language (French, German, Latin, Spanish), Mathematics, Science (Biology, Chemistry, Physics), and Social Science.

Eligibility—Graduates in the humanities and sciences from colleges and universities of recognized standing are eligible to be considered as candidates for admission to the Stanford Teacher Education Program, if they have maintained at least a B- academic average in undergraduate and graduate courses. Applicants must have 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 education.
7. The course in special education.
8. 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.
9. Passing score on California Basic Educational Skills Test (CBEST).

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.
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.

2-3 units, Aut, Win, Spr, Sum (Staff) by arrangement

101. **UPSE Seminar** — Designed 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. Particular focus of seminar may vary from quarter to quarter. Sponsored by Undergraduate Program in the School of Education.

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

105. **American Education and Public Policy** — (Same as History 158B, Political Science 186K.) Drawing on history and political science, this course treats policy issues in education. Who influences schooling and how? How have American schools responded to human diversity? What consequences does schooling have? What are the prospects for reform in public education? Issues analyzed in lectures and in small group discussions. (APA, SSE)

3 units, Aut (Kirst, Tyack) MWF 2:15-3:05

125X. **Issues in Education** — The analysis of key topics and problems in the field of education selected by seminar members. It is provided as an introductory offering open to interested undergraduates. (CTE)

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

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

3 units, Spr (La Fromboise)

154. **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, Sum (Calfee)

158X. **Discourse Analysis** — Purpose will be to survey fundamental issues in discourse analysis and to establish methods of collecting and analyzing oral written texts as discourse. Topics include cohesion and coherence, processing models of frames, scripts, and schemata, and contextualization conversions. Current methods will be considered in the context of the historical background of discourse analysis and its links to conversational analysis, cognitive science, literary theory, and pragmatics. (CTE)

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

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

3 units, Spr (Herring) by arrangement

169X. The New Families: Implications for Education and Employment—Examines the implications for education and employment of the increasing number of two-earner families, divorced families, step-families and female-headed families with children. Critically reviews theoretical analyses by economists, sociologists, political scientists and lawyers from diverse schools of thought (e.g., neoclassical, institutional, feminist, Marxist) and empirical analyses from a variety of quantitative and qualitative methodologies. Emphasis placed on the importance of attending to differences of race, class, and ethnicity when analyzing the new families. Topics include the economics of the household, individual, and family decision-making about education and employment, extrafamily child-care, the accommodation of schools and work organizations to the new families, and legal and legislative responses to the new families. (APA, SSE)

4 units, Win (Strober) MW 3:15-4:05 alternate years, given 1987-88

170. Sex and Education—(Same as Sociology 112, Feminist Studies 130.) Examines gender as a critical variable in educational institutions and labor markets. Interdisciplinary approach to issues such as the distribution of power in schools, the determinants of occupational choice, the relative payoff of schooling for women and men, the causes of differential behavior and treatment between the sexes in schools and in the work force, and the legal redress of inequalities. Readings, lectures and discussions on theoretical, empirical and policy materials. Coordinated with the Center of Research on Women's (CROW) Wednesday noon lecture series. The three primary disciplines in the course will be economics, history and sociology, but professors of psychology and the law will also take part in the analysis. (SSE)

4 units, Spr (Talbert, Staff)

172. Status Attainment: Education and Work—(Same as Sociology 137.) Introduction to sociological research on educational, occupational and economic attainment processes. Special attention is focused on gender differences in work careers over the life cycle and on organizational and institutional structuring of careers. The U.S. status-attainment research tradition contrasted with alternative theoretical and empirical perspectives on educational and work-career process. (SSE)

4 units, Spr (Talbert) T 3:15-6:05

175X. Women and Development in Africa—(Same as African and Afro-American Studies 175X, Anthropology 109, Feminist Studies 138.) A survey of women's roles and experiences in both formal and informal development activities in Africa. Major topics include: 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. The course will review relevant theoretical orientations and empirical research, drawing on concrete case studies. There are no formal prerequisites, though prior or concurrent work on Africa and/or women in the Third World will be useful. (IDE, SSE)

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

180. Directed Reading in Education—For master's degree students. (All Areas.) any quarter (Staff) by arrangement

188. Microcomputers in Instruction and Educational Equity—(Same as Chicano Studies 188.) Introduction to and examination of how microcomputers have been used in U.S. schools, especially at the primary and secondary levels. The types of computer offerings available to middle- and upper-socioeconomic status (SES) students are compared/contrasted with computer instruction generally provided to lower-SES students, especially minorities. Issues of gender, language, and geography. Educational and economic implications are analyzed from the perspective of educational equity, and the elements of computer access, degree of participation, and types of benefits derived.

3 units, Spr (Devillar) TTh 4:15-5:45

190. Directed Research in Education—For master's degree students. (All Areas) any quarter (Staff) by arrangement

195. An Introduction to Africa Through Film: Tarzan, Terrs, and Liberation — The images of Africa that reach American audiences are dominated by a vision of primitive backwardness (Tarzan), armed conflict and terrorists (Terrs), and the struggle for self-determination (Liberation). Class will work to understand both the African reality that the images often obscure and the factors that explain the persistence of the images themselves. Through an intensive exposure to and critique of films on Africa, students develop a basic familiarity with the contemporary African situation and with the use of film as an instructional medium. Students who have already done some work on Africa will focus on the images of Africa projected to external audiences. (IDE)

4 units, Aut (Staff) alternate years, given 1987-88

200. History of Education — Foundational course in educational history meeting advanced
degree requirements. Survey; emphasis upon European backgrounds, educators, schools, covering period from “Golden Age” of Greece to twentieth century. (CTE, SSE) (DR:5)

3-4 units, Win (Gross) 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 such topics as religion, political socialization, race relations, immigration, and urbanization. (SSE)
3 units, Spr (Tyack) MW 10
and by arrangement

202. Teachers, the Constitution, and the School— Designed for the beginning secondary school teacher. Readings, lectures and class activities will involve the application of concepts and analytical techniques from the social sciences to problems of the beginning teacher. The approach will be interdisciplinary and will involve a team of two faculty members with differing social science specialities. (SSE)
4-6 units, Spr (Kirst) MW 3:15-5:05

203. Models of the Child in Contemporary Educational Thought—Introductory course intended to focus critical attention on a number of influential views of the child that have been formulated by psychologists, political theorists and philosophers, and to place them in historical and philosophical perspective. (SSE)
3 units, Spr (Phillips) T 7-10 p.m.

204. Introduction to Philosophy of Education: Curriculum Focus—Aims at introducing current approaches and techniques in philosophy of education, but material has been selected also for its general relevance to students of education; the introductory philosophic material will be presented in the context of issues concerning the curriculum. (SSE)
4 units, Spr (Phillips) MW 3:05-5:15
alternate years, given 1987-88

206A. Introduction to the Study of International Development Education—Introduction to the theoretical orientations and the research agenda in International Development Education, and to resources for study and research at Stanford. Required for all first-year students in SIDEC: others by consent of instructor. (IDE)
2-3 units, Aut (Stromquist) M 12-2:05
and by arrangement

206B. Project Workshop in International Development Education—This course concludes the 4-quarter A.M. program in SIDEC, and is required of all A.M. students. It is organized around the students’ “Master Project”, and will provide in-depth reviews of draft project reports. The final version of the report is due at the end of the course. (IDE)
3 units, Sum (Staff) W 2:15-4:05

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 special attention to the role of international organizations (World Bank, Unesco, OECD), and of national development assistance agencies. (IDE, SSE)
5 units, Spr (Stromquist, Weiler) 
MW 1:15-3:05

208A. Introduction to Curriculum—An introduction to curriculum theory and the history of curriculum as a field of study. Aims and objectives; pre-active and interactive views; explicit and implicit curricula; introduction to problems of program evaluation. (CTE)
4 units, Aut (Eisner) MW 3:15-5:05

208B. Introduction to Curriculum—An introduction to 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 (Noddings) MW 1:15-3:05

209X. Implementing Educational Reform—Examination of efforts to devise and implement educational reform policies in a single Third World country, focusing on: (1) the problem(s) the new policies are expected to address (and thus the political economy of the country studied); (2) the formation and articulation of alternative policies, emphasizing the social location of ideas and values; and (3) the policy making process and the implementation of the new policies, especially organizational characteristics, bureaucratic imperatives, political mobilization, and external influences. Organized as a seminar; each participant will study intensively a particular reform policy. Previous Third World course work and/or professional experience and familiarity with Education 306A-D topics helpful. (IDE, SSE)
4 units, Win (Staff) 
alternate years, given 1987-88

210. Sociology of Education— (Same as Sociology 210.) Introduction to sociological approaches to educational phenomena. Topics include school organization and environment, the relationship of education to adult roles, the impact of social class and ethnicity on classroom learning and the social structure of the classroom. Course work includes reading and evaluating social science research. Features short written assignments and individual feedback. 210/310 meet together. (SSE)
4-6 units, Win (Talbert, Staff) MW 3:15-5:05
211. Introduction to Philosophy of Social Science—(Same as Psychology 166.) Intended for upper division undergraduates who are majoring in one of the social sciences, and for beginning graduate students in related areas such as education. Focuses upon the differences writers have noted between the natural and social sciences, and moves on to several topics of importance in the social sciences: explaining human action, the functional explanation of social phenomena, and holistic versus reductionist orientations. Examples from contemporary social science research literature. (SSE)

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

212. Practicum in Ethnographic Futures Research — (Same as Anthropology 269.) Instructs in the rationale and guidance in the practice of Ethnographic Futures Research (EFR), a non-directive, semi-structured, open-ended technique for eliciting from a sample of interviewees their middle-range perceived and preferred alternative cultural scenarios for a given social group. EFR is (1) an auxiliary technique for research on sociocultural change; (2) a means of augmenting conventional planning and policy-making approaches; and (3) an educational technique for both interviewer and interviewee. Instruction will include ways of combining EFR with conventional ethnography and other research methodologies. (IDE, SSE)

5 units, Spr (Textor) alternate years, given 1987-88

213. Aesthetic Foundations of Education—Examines the aesthetic foundations of education. Addresses questions such as what is meant by “the art” of teaching. Examines several major conceptions of art and their contribution to cognitive development, to human understanding and to the role that the arts can play in education. (CTE)

4 units, Aut (Eisner) MW 3:15-5:05 alternate years, given 1987-88

214. Evaluation Research Methods — (Same as Communication 253.) Nature of evaluation and evaluation design, problems of field work, construction of instruments. Prerequisites: Basic statistics, Communication 206 (or equivalents). (IDE)

3-5 units, Win (Flora) by arrangement

215. Psychological Foundations of Education—(Same as Psychology 145.) Introductory application of psychological principles to educational practices. (CTE, PSE) (DR:4)

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

217S. Teaching a Global Perspective: Cross-Cultural Approaches — An overview of current research and practice in the field of global education with special emphasis on the work of the Stanford Program on International and Cross-Cultural Education (SPICE). Includes an examination of selected global and cross-cultural issues in some depth, with particular reference to the problems and prospects of teaching such issues in American classrooms. Offers 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

218. Perspectives in Dance—(Same as Dance 268.) History of dance in Western Culture as a framework for examining a variety of theoretical issues: dance in education, dance and the companion arts, contemporary problems and current trends. Lectures amplified by readings, films and discussion. (CTE)

3 units, Aut (Cushion)

219. Artistic Development of the Child—Designed to introduce students to research in the behavioral sciences having relevance for understanding of the child’s artistic development. (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 the program in Administration and Policy Analysis and open to all students. Each quarter emphasizes the contribution of a particular social science, but also stresses the interrelationships among the social sciences.

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

4-5 units, Aut (Levin) MW 2:15-4:05 and by arrangement

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—(Same as Political Science 187.) Overview of relationships between political analysis and policy formulation in education; focus on alternative models of the political process, the nature of interest groups, political strategies, community power, the external environment of organizations and the implementations of policy. Applications to
educational settings and problems emphasized. (APA, SSE)
4 units, Win (Kirst) MW 11-12:30
and by arrangement

220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education—(Same as Sociology 143.) Effects of schools and schooling on individuals; the stratification system, and society. Education as socializing individuals and as legitimizing social institutions—social and individual factors affecting the expansion of schooling, individual educational attainment, organizational structure of the schools. (APA, SSE)
5 units, Spr (Meyer) MWF 9-11

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

221A. Administration and Organization of Educational Institutions in Context: Administration and Organization of Complex Organizations—Introduction to the nature of managerial work in various types of organizations including but not limited to educational institutions. Five topics are examined from the viewpoint of the manager: leadership, change, decision making, conflict resolution, and communication. Case studies of management oriented problems form an integral part of the course. (APA, SSE)
4 units, Aut (Cuban) MW 10:30-12:15

221B. Administration and Organization of Educational Institutions in Context: Administration and Organization of Post-Secondary Institutions—An analysis of the nature of post-secondary educational institutions, how they are administered and governed and tactics and strategies available in the performance of administrative roles. (APA, SSE)
4 units, Win (Mayhew) MW 9-11

221C. Administration and Organization of Educational Institutions in Context: American Educational Institutions—(Same as History 301C.) An analysis of the nature of local educational agencies, schools and districts, how they are administered and controlled, how leadership is exerted and the tactics and strategies available to administrators. (APA, SSE)
4 units, Spr (Tyack) MW 1:15-3:05

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

222A. Decision Analysis in Education I—An introduction to the use of statistics to summarize data and to decision making in the face of uncertainty. Topics include elementary probability theory, sampling methods, descriptive statistics, inferences about populations, the value of uncertain outcomes, statistical decision theory, risk, and utility. Assignments will involve actual data and cases, and students will use the computer where appropriate. Intended for educational administrators and policy analysts who must consider and act upon limited or uncertain information. (APA, SSE)
5 units, Aut (Garet) MW 8:30-10

222B. Decision Analysis in Education II—Considers problems of optimization and design and evaluation of decision experience. Marginal analysis, cost-benefit accounting, constrained maximization, mathematical modeling, program evaluation. Introduction to linear models for large-scale data analysis provided. Particular attention paid to sensitivity of implications to model assumptions. (APA, SSE)
4-5 units, Win (Levin) MW 1:15-3:05

222C. Decision Analysis in Education III—Application of simple quantitative models to administrative problems through structured computer-based simulations of educational processes, procedures, and institutions. Introduces Markov models, queuing theory, and elementary difference equations. Participants will work briefly with existing simulation models and then spend much of the quarter constructing programming, and testing small-scale computer simulators. Prerequisite: 222A and 222B or their equivalents. (APA, SSE)
4 units, Spr (Garet) MW 10:30-12
and by arrangement

223. Effective Schools: Research, Policy, and Practice—The course offers a critical examination of the recent studies of schools that exceed the expectations of school officials and citizens in producing high student achievement. Research methodologies, results of the studies, and efforts to implement these results and improve schooling are examined. The various components of effective schools are looked at: effective teaching, principal leadership, organizational processes in the school, parent involvement, and the role of the superintendent. A project is required that involves a study of a school and a determination of its effectiveness. (APA)
4 units, Win (Cuban) MW 9-10:45

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

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

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

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 will be reviewed and compared. Topics include 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, Spr (Inkles) TTh 10-12

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

4 units, Aut (Thoresen) MW 9-11

233. Seminar in Cross-Cultural Counseling—(Same as Psychology 235.) An examination of 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, cultural adaptation of existing counseling interventions, and present mental health service delivery models with special emphasis on cultural appropriate-
needs. Considerable stress placed on social psychological research relevant to curricular concerns. (APA, CTE)

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

250A,B. Statistical Analysis in Educational Research I—This two-quarter sequence follows the prerequisite Statistics 160 and is designed 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 (Rogosa) MWF 11-12:30

250B. 4 units, Spr (Rogosa) MWF 11-12:30


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

250D. Statistical Analysis in Educational Research II: Experimental Design—Advanced analysis of variance and design of experiments. Topics include factorial, blocked and fractional designs, linear contrasts, and repeated-measures designs; applications of BMD and SPSS computer packages will be covered. (MME)

4 units, Sum (Calfee) MWF 11-12:30

251. Experimental Methods in Educational Research—Introduction to psychological methods of experimentation as applied to problems in education. Research topics will include process areas (perception, memory, verbal and concept learning, cognition) with examples from selected content areas (e.g., reading, mathematics). For graduate students with little or no background in Psychological Studies. Enrollment limited to 20, with preference given to first- and second-year students. (MME, PSE)

3 units, Aut (Calfee) MWF 9-10

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. Prerequisites: Statistics 60 or Psychology 60 or equivalent (PSE).

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

253X. Finance of Higher Education: Financial Aid—Explores through readings and discus-
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—The course blends practical approaches with an examination of alternative goals. (CTE)

2-3 units, Aut (Staff) 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) MW 1:15-3:05

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) MW 3:15-5:05

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

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) TTh 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 3:15-5:05

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

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

270X. Productivity in Higher Education: Information Technology, Human Resources, and Organizational Culture—Course will focus on the factors affecting productivity in colleges and universities, the potential for productivity improvement, and the kinds of planning and action steps that can be used to realize the potential. The factors examined in depth are information technology, human resources policy and management, and organizational culture in the academic and administrative areas. Students will engage in a significant individual research project. (APA)

3-5 units, Spr (Massy) TTh 3:15-5:05

273. Education as a Social Science—Intended only for first year doctoral students in the Social Sciences in Education. The students will 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. Students will have the opportunity to interview faculty and to plan with them the topic of discussion for the evening of their course session. Each session will be planned with relevant readings. In addition, this course will assist the student in course planning and in strategies for developing a problem question for the doctoral thesis. The class will have the opportunity to develop sessions to meet orientation and adjustment needs, as they arise. (SSE)

1 unit, Aut (Phillips) W 4:15-6:05

274A,B,C. Ethics of Development in a Global Environment (EDGE)—(Same as Anthropology 133A,B,C; Engineering 297A,B,C; Political Science 140A,B,C.) The EDGE seminars present a series of speakers on current development issues with emphasis on the problems of the poorer nations. Autumn quarter speakers discuss world resources—energy, food, housing, population and environment. Winter quarter speakers address the role of institutions affecting the transfer of technology—political systems, world bank, transnationals, etc. Spring addresses the role and responsibilities of the individual who wants to affect development. Speakers present widely differing case studies from their own experience. (IDE)

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 (lecture only) or 4 units (lecture plus workshop) Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel, Textor) lecture W 7:30-9:30 p.m., workshops by arrangement

275X. Contemporary European Psychology—(Same as Psychology 277.) Introduces the broad range of contemporary European psychological theory and research and examines its contrasts and complementarities with U.S. work. Cognitive, instructional, and differential psychology emphasized but research on human
perception, motivation, volition, personality, life-span development, and social behavior also addressed. (PSE)

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

276X. Feminist Perspectives on Ethics and Education—Ethics and education will be examined from a transformative perspective of feminism. (There are, of course, other points of view that are called “feminist.”) After reading and discussing some background material, we will concentrate on the problems of ethics and evil with particular attention to their significance for education. (CTE, SSE)

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

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

5 units, Win (Carnoy)

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

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

280. Training Seminar: Ethnography of Schooling—(Same as Anthropology 214.) Focuses on ethnographic approaches to the study of schooling emerging from recent anthropological work. Topics include the development of such approaches in educational anthropology, and the emerging criteria of good ethnography in schools; and problems of ethnographic “evaluation,” ethics and ethnography, and the potential relevance of school ethnography to educational policy. Focus of the seminar will be 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. Students will apply such techniques in modest field research projects that can be carried out in settings accessible to them and write one research report or proposal for research. (SSE)

3 units, Sum (G. and L. Spindler)

280. 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) MW 1:15-3:05


4 units, Aut (Politzer) TTh 2:15-4:05 and by arrangement

288. Introduction to Educational Theories — Introduces students to four kinds of theories important to educators: learning theories, curriculum theories, general educational theories, and theories of teaching. Many of the “theories” examined are more accurately “positions” or “views” or loose collections of principles and maxims. Course will give them careful scrutiny, to sharpen students’ analytical skills in the domain of educational thinking. Main aim is to help students acquire a broad base of familiarity with educational concepts, writers, and points of views. (CTE)

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

290X. Teachers and Administrators: Images, Roles, and Leadership—Course covers 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 will be introduced and discussed. (APA)

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

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

2 units, Aut (Lohnes) by arrangement

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

3-5 units, Spr (Haro) MWF 12

293. Methods of Teaching French—(Same as French 293.) Second language acquisition with specific references to French: theory and practice, including frequent observations of a demonstration class at 10 a.m. (CTE)

4 units, Spr (Hester)
297. 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. (Limited to teaching credential candidates.) (CTE) 3 units, Sum (Calfee) TTh 1:15-3:05

298X. Oral and Written Language Learning—Provides an overview of the cultural and psychological factors that affect approaches to language use and literacy learning within home and school settings. It is based on the belief that literacy learning is socially based, and that this foundation affects cognitive behaviors, communicative interactions, and interpretations of instructional events. Course readings and discussions will help students to broaden their understandings of sociocultural issues as they intersect with literacy and schooling. (CTE). 4 units, Spr (Longer) T 1:15-4:05

299X. Development in Adulthood—(Same as Human Biology 172X.) Explores biological, psychological, and social perspectives on adulthood as a phase of life. Topics will include: the concept of adulthood, historical and cross-cultural views, stage theories and longitudinal studies, biological aspects of development to adulthood; consolidation of psychosocial and gender identity, interpersonal relationships, patterns of vocational choice, physiological changes, menopause, psychological stress, and aging. (PSE) 4 units, Spr (Katchadourian)

301. Colloquium on the Historiography of American Education—(Same as History 301.) Analysis of the literature of American education history, designed for students who wish to do further work in the field. In addition to weekly colloquium discussions, students will have an opportunity to pursue specialized topics in small group tutorial sessions. (SSE) 4-5 units, Aut (Tyack) T 7-9:30 p.m.

305. Philosophy and Empirical Research—Problems of relevance to the researcher will be explored from the point of view of philosophers of science such as Karl Popper and Carl Hempel, but much of the material dealt with will have been written by researchers themselves. For relevant course material see Philosophy 164. (SSE) 3 units, Aut (Phillips) alternate years, given 1987-88

306A. Education and Economic Development—An introduction into the analysis of the role of education in economic growth and development. Case material will consider development problems both in the U.S. and abroad. Discussion sections will deal with special economic aspects of educational development. (IDE, SSE) 5 units, Win (Carnoy) TTh 2:15-4:05 and by arrangement

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. Special attention will be given 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, Spr (Samoff) TTh 2:15-4:05 and by arrangement

306C. Education and Sociocultural Change—Utilizes a variety of theories and models to examine processes of sociocultural change worldwide, especially processes of modernization and development. Examines the effectiveness, or lack thereof, of educational inputs in promoting sociocultural change. Considers such factors as demographic shifts, ecological system breaks, mineral and energy constraints, pollution and congestion, the potential of the tele-microelectronic and biotechnical revolutions, dependency and exploitation, and culturally engendered value conflicts. Seeks to promote a non-ethnocentric, culturally sensitive, ethically aware understanding of the needs of non-Western peoples whom development and educational programs are intended to benefit. (IDE, SSE) 3-5 units, Spr (Staff) TTh 2:15-4:05 and by arrangement

306D. Sociology of Development and Education—A systematic comparison between modernization and dependence approaches to development, emphasizing the different treatment education receives in each of them, and the consequent different approach toward educational reforms in developing countries. (IDE, SSE) 5 units, Aut (Stromquist) TTh 1:15-3:05

307X. Knowledge and Legitimation: The Politics of Educational Research—(Same as Political Science 328.) Within the theoretical framework of legitimation theory, the course develops the notion of "compensatory legitimation" for the analysis of the national and international politics of educational research. Case studies review the work of agencies for research support, cooperation, and dissemination. Research
310. Sociology of Education—(Same as Sociology 310.) For doctoral and master's students. Meets with Education 210 (see course description). Emphasis on conceptualizing and analyzing applied sociological research in education. Features short written assignments, individual feedback and back with actual research data. (SSE)

4 units, Win (Weiler) M 3:15-5:05 and by arrangement, alternate years, given 1987-88

311. 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, sequence of culturally constructed experiences in life careers, cultural analysis and sensitization. Attention to education in the U.S.A. and other complex societies, as well as in non-literate cultures. (SSE)

4 units, Win (G. and L. Spindler)

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. Course will cover principles for design and evaluations of group work for students and teamwork for teaching staff. Topics include social processes of influence, role differentiation and evaluation. Methods for systematic evaluation and observation are included; students will receive practical experience in using these methods. (SSE)

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

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

5 units, Win (Staff)

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

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

315. Cultural Transmission: 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, sequence of culturally constructed experiences in life careers, cultural analysis and sensitization. Attention to education in the U.S.A. and other complex societies, as well as in non-literate cultures. (SSE)

4 units, Win (G. and L. Spindler)


3 units, Aut (Calfee) MWF 10-11

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

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

321A,B,C. Qualitative Methods of Educational Research: Issues in Design and Data Collection—Survey of types of qualitative research methods from a variety of disciplinary perspectives (e.g. anthropology, cognitive psychology, criticism, history, political science), with intensive experience in the collection, analysis and reporting of data. 321A surveys qualitative research methods, the epistemological underpinnings of qualitative research, research design, site selection and entry, and proposal writing. 321B addresses an array of qualitative data collection strategies with particular emphasis on participant observation and semi-structured interviews. 321C emphasizes data reduction and methods of analysis (e.g. protocol and content analysis) and final report writing. 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 all three quarters. No auditors. (CTE, PSE)

321A. 4-5 units, Aut (McLaughlin, Shulman) TTh 2:15-4:05

321B. 4-5 units, Win (McLaughlin, Shulman) TTh 2:15-4:05

321C. 4-5 units, Spr (McLaughlin, Shulman) TTh 2:15-4:05

322. Policy Decisions on Adoption, Implementation, and Incorporation of Local Schools—Offers students a working knowledge of how local, state and federal decisions are implemented at the local school, in addition to the chance for students to strengthen analytic skills in anticipating and diagnosing implementation problems. A project is required that involves a study of a school that is about to, or already has, implemented a local, state, or federal policy decision. (APA)

4 units, Win (Cuban) MW 10:30-12:15

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

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

330X. Research Seminar in Language, Literacy, and Culture—Designed for second year students in the LLC program. Students enroll for a total of 4 units across the three quarters. Providing a forum within which students critically examine selected recent research, prepare a critical and integrated review of a research question, and present an original research design based on the review. Increases familiarity with recent research, provides a forum for critical thinking and debate, integrates students’ work during the second year of the program, and aids the planning dissertation topics.

2-4 units, Aut, Win, Spr (Staff) by arrangement

332. Curricular Response to Educational Equity—A review of curricular programs which have been developed as a result of legislative intervention in the classroom. A critical review of the research on domestic bilingual, desegregation and multicultural programs will be followed by identification of the variables related to successful program implementation. For doctoral students interested in curricular issues related to national origin minority students. (CTE)

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

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

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

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

342A, 3 units, Win (Walker) W 7-10 p.m.
342B, 3 units, Spr (Walker) W 7-10 p.m.

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

4 units, Spr (Ford) TTh 12-2

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

4 units, Spr (Shulman) MW 3:15-5:05 alternate years, given 1987-88

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

4 units, Spr (Eisner) MW 9-11

349. Professional Education of Teachers—Provides for students of teacher education and teaching (a) an historical overview of American teacher education from 1960 to the present, which leads to (b) a systematic framework for teacher training (particularly in-service) based on an adaptive conception of the teaching-learning process, and (c) exemplary training content material for use within the framework. Developed at the Center for Educational Research at Stanford, the “Systematic Teacher Training Model” represents a set of recommendations for research and practice. Students will learn the theoretical and research bases of the model, experiment with various content material at each stage, and apply the model to specific training needs in actual or hypothetical training situations. (CTE)

4 units, Spr (Gage)
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 (Gage, Hess) T 3:15-5:05

350B, C, D. Research Seminar in Educational Psychology—A four quarter seminar for graduate students in the program of the committee on Psychological Studies in Education. All CPSE students are required to enroll in 350A during the Autumn Quarter of their first year in the program. Members of the CPSE lecture on areas of major importance within the various domains of the field. Students write a brief commentary on each lecturer's prior reading assignment. Students from the specialty in educational psychology are required to enroll in 350B, C, D during the Autumn, Winter, and Spring Quarters of their second year. The B, C, D sequence provides a forum in which students describe their ongoing research activities, prepare a critical and integrated review of a research question, and present an original research design based on the review. The purpose is to integrate the student's research experience and to aid the student in planning a dissertation topic. (PSE)

350B.—Required for all second year Psych Studies in Education students.

3 units, Aut (Ford, Staff) Th 10-12 plus 1 hour by arrangement

350C. D. 1-2 units, Win; Spr (Ford, Staff) 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. The course will cover 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

352. Psychology of Instruction—Treats the implications of psychological research and theory for the development and evaluation of instruction. The emphasis is on a cognitive perspective, but the course 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. (CTE)

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 (Haertel) MW 3:15-4:35

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

4-5 units, Aut (Langer) M 3:15-6:05 p.m.

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 10:30-12:00

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)

5 units, Spr (Carnoy)

377. Organization and Style in Research Reports—Some major considerations in preparing formal reports of scholarship and inquiry, including theses and dissertations. Emphasis on organization; the achievement of clarity, technical, ethical and legal considerations; alternative conventions; general stylistic practices. (All Areas)

3-5 units, Aut, Spr (Colardarci) Th 10-12 and by arrangement

378X. Current Issues in Reading, Writing, and Language: A Socio-Communicative View of Literacy Instruction—Focuses on issues of instruction in its social context, taking the view that learning to think and reason, to gain content knowledge, and to achieve literacy competence occurs in settings where language is used in interaction among students and teachers to refine and develop new knowledge and skills. Examines a social-communicative view of learning and its relation to reading and writing in-
struction. Current research in literacy instruction will be critically reviewed in light of these views. (CTE).

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

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

4 units, Spr (Eisner) alternate years, given 1987-88

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 will be arranged. Each student will prepare a critical review of these programs as a class project. Of particular interest for 1986-87 is a review of culturally appropriate microcomputer courseware. (CTE, IDE)

4 units, Aut (Applebee) M 3:15-6:05
and by arrangement, alternate years, given 1987-88

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

4 units, Win (Politzer) MW 10-12

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

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

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

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

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 will be examined for methodological soundness. Specific considerations in effectively conduct-
research workshop for the review of (1) key issues in the methodology and epistemology of social research in education, and (2) research proposals and findings by students and faculty. Prerequisite: 306A-D or equivalent. Limited enrollment; priority given to advanced doctoral students in SIDEC and SSE. (IDE, SSE)

408A. Research Workshop in IDE I. 2-5 units, Aut (Staff) MW 3:15-5:05
408B. Research Workshop in IDE II. 2-5 units, Win (Carnoy) MW 3:15-5:05
408C. Research Workshop in IDE III. 2-5 units, Spr (Weiller) MW 3:15-5:05

411. Research Seminar in Child Development and Early Education—Oriented toward current research in child development and early education. Ongoing projects, dissertation proposals, results of recently completed studies and trends in research will be the focus of discussion. (PSE)

1-3 units, Aut, Win, Spr (Hess, Ford) Th 12-1:15 and by arrangement

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

2-4 units, Win (Calfee)

alternate years, given 1987-88

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

419. Seminar in Research on Teaching—A critical examination of research on teacher behaviors and characteristics considered as either dependent or independent variables. Prerequisite: 317. (PSE)

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

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

422A. 1-3 units, Aut (Staff) by arrangement
422B. 1-3 units, Win (Bridges) by arrangement
422C. 1-3 units, Spr (Staff) by arrangement

423A,B,C. Research on Educational Administration and Policy Analysis—This is a sequence of three courses designed for advanced doctoral students to help increase their research skills and develop sound dissertation proposals. Students in administration and policy analysis are urged to take two and possibly three of these courses including the "A" Sequence. (APA)

423A. Research on Educational Administration and Policy Analysis: The Dissertation Proposal—An elaboration of the problems of developing doctoral research plans and ways of solving those. Will include such matters as choosing an advisor and committee, review or relevant literature and the nature of evidence and scholarly citations.

3-5 units, Win (Bridges) TTh 1:15-3:05


3 units, Win (Staff)

alternate years, given 1987-88

423C. Research on Educational Administration and Policy Analysis: Planning Policy Oriented Research—Working seminar for doctoral students who plan to carry out policy studies. Emphasizes the careful translation of policy concerns into researchable questions. Topics include the use of existing literature and of peer reviews to guide research design; the choice of research procedures, the susceptibility of designs and procedures to overt and inadvertent biases, and the ethical and substantive criteria which should guide policy research. Emphasizes and provides exercise in clear, cogent writing and persuasive argument. Students will prepare, exchange, criticize, defend and revise research proposals, which will in turn underlie much of the substantive discussion. Intended for students who have identified a dissertation problem area and are prepared to begin work on a proposal draft. Consent of the instructor is required.

3-5 units, Spr (Staff)

alternate years, given 1987-88

426. Theory and Practice in Criterion-References 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

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

1 unit, Aut, Win, Spr (Krumboitc, LaFromboise, Thoresen)
T 5:15-7:05 p.m., biweekly

438. Culture in the Curriculum—Research Practicum—Seminar designed to assist students in developing techniques for research in multi-racial classrooms. Students will familiarize themselves with various methodologies applied to the analysis of the cultural components in the curriculum. Selected classrooms from local school districts provide the necessary research setting. Of particular interest for 1986 is how the community context mediates classroom dynamics. Prerequisite: Consent of instructor. (CTE)

3-6 units, Sum (Arias) T 1:15-4:05 and by arrangement

450. Seminar on Ethical Concerns in Research and Evaluation — Consideration of ethical obligations, issues and dilemmas in planning, conducting, disseminating and applying educational research, with particular attention to research involving interventions. Codes of ethics developed by relevant scientific and professional organizations are examined and evaluated. (All Areas)

3 units, Win (Coladarci) Th 10-12 and by arrangement

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

460. Advanced Seminar in Evaluation Design —The major traditions in the design of evaluation research. Assesses the strengths and weaknesses of standard evaluation models in view of the different objectives for evaluation and with particular attention to 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)

3 units, Spr (McLaughlin, Bridges) by arrangement

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

1-5 units, Win (Eisner) T 7-9 p.m.

462X. Assessing the Consequences of Teaching with Computers—Seminar on the conceptualization and measurement problems encountered in such studies, but will also give considerable attention to research methods and to the design of such studies. Does not cover studies of effects on institutions, the polity, society, or culture. (CTE)

3 units, Sum (Walker) TTh 8:30-10:00

464X. Research Seminar: Reading, Research, and Instruction—(CTE).

4 units, Spr (Langer) M 3-6 p.m. and by arrangement

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 examined will be drawn from such fields as rhetoric, linguistics, anthropology, psychology, and education. (CTE)

4 units, Win (Applebee) M 3:15-5:05 and by arrangement, alternate years, given 1987-88

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 in a relatively intimate setting about research activities in which they are engaged and the kinds of problems that they believe to be important in the field. Intended to introduce doctoral students to research and scholarship related to the DEEP program at Stanford. All DEEP faculty participate, along with other Stanford faculty and outside speakers. Upon completing the seminar, students should be acquainted with the major problems in this field and ways these are addressed by current investigators. (CTE)

1-5 units, Win (Eisner) T 7-9 p.m.

470. Practicum—For advanced graduate students. (All areas)
MW 4:15-6:05

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

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

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

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, Win, Spr (Olkin, Rogosa)
T 12-2

496. Seminar in Social Studies Education—Seminar in social studies education for advanced degree candidates. Comprehensive analysis of social studies education for the purpose of identifying researchable problems. (CTE)
2-4 units, Win (Gross) W 3:15-5:05

ADMINISTRATION AND POLICY ANALYSIS (APA)

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

105. American Education and Public Policy (Same as History 158B, Political Science 186K.)
169X. The New Families: Economics Implications for Education and Employment

220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education
220B. The Social Sciences and Educational Analysis: Introduction to the Polities of Education (Same as Political Science 187.)

220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education (Same as Sociology 143.)

221A. Administration and Organization of Educational Institutions in Context: Administration of Complex Organizations
221B. Administration and Organization of Educational Institutions in Context: Administration and Organization of Post-Secondary Institutions

221C. Administration and Organization of Educational Institutions in Context: American Educational Institutions

222A. Decision Analysis in Education I
222B. Decision Analysis in Education II
222C. Decision Analysis in Education III

223. Effective Schools: Research, Policy and Practice

249. Curriculum and Instruction in Higher Education

253X. Finance of Higher Education: Financial Aid
270X. Productivity in Higher Education: Information, Technology, Human Resources, and Organizational Culture

390X. Teachers and Administrators: Image, Roles and Leadership

313A,B. Economics of Education

322. Policy Decisions on Adoption, Implementation, and Incorporation of Local Schools
369. Personnel Administration
377. Organization and Style in Research Reports
422A,B,C. Internship in Educational Administration
423A,B,C. Research on Educational Administration and Policy Analysis

450. Seminar on Ethical Concerns in Research and Evaluation

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

CURRICULUM AND TEACHER EDUCATION (CTE)

125X. Issues in Education
154. Psychology of Literacy
158X. Discourse Analysis
200. History of Education
205A,B. Introduction to Curriculum
213. Aesthetic Foundations of Education
215. Psychological Foundations of Education (Same as Psychology 145.)

217S. 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 Culturally Diverse Populations

240. Adolescence: Health and Special Needs
246A,B,C,D. Secondary School Teaching Practicum

249. Curriculum and Instruction in Higher Education

255. Curriculum and Instruction in English: The Teaching of Writing

262A. 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
276X. Feminist Perspectives on Ethics and Education
276X. Linguistics and the Teaching of English as a Foreign/Second Language (Same as Linguistics 298.)
283. Foreign Language Education and Bilingual Education in the Elementary School
288. Introduction to Educational Theories
289. Methods of Teaching German (Same as German Studies 302.)
290. Methods of Teaching Spanish (Same as Spanish 301.)
293. Methods of Teaching French (Same as French 293)
297. Language and Literacy in Secondary Schools
299X. Oral and Written Language Learning
314. Seminar in Citizenship Education
321A, B, C. Qualitative Methods of Educational Research: Issues in Design and Data Collection
332. Curricular Response to Educational Equity
342A, B. Curriculum Construction
347. Problems of Teacher Education
348. Educational Connoisseurship and Educational Criticism
349. Professional Education of Teachers
352. Psychology of Instruction
366. Literacy: Social and Historical Perspectives
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
385. The Role of Non-Standard Dialects in Education
386. Second Language Acquisition
388. Recent Research in Bilingual Education: A Critical Appraisal
389. Language and Mental Development: Implications for Schooling
396. Recent Developments in Secondary School Social Studies
438. Culture in the Curriculum: Research Practice
448X. Experimental Design for Evaluation
450. Seminar on Ethical Concerns in Research and Evaluation
460. Advanced Seminar in Evaluation Design
461. Seminar in Art Education for Doctoral Students
462X. Assessing the Consequences of Teaching with Computers
464X. Research Seminar: Reading, Research, and Instruction
465. Research Seminar in the Writing Process and Writing Instruction

466. Doctoral Seminar in the Design and Evaluation of Educational Programs (DEEP)
470E. Practicum in Evaluation
482. Research Seminar in Problems in Teaching and Learning of a Second Language
496. Seminar in Social Studies Education

INTERNATIONAL DEVELOPMENT EDUCATION (IDE) (SIDEIC)

161. Introduction to Teaching and Learning in Asia
175X. Women and Development in Africa—(Same as Feminist Studies 138, African and Afro-American Studies 175X, Anthropology 109.)
195. Introduction to Africa Through Film: Tarzan, Terrs, and Liberation
206A. Introduction to the Study of International Development Education
206B. Project Workshop in International Development Education
207X. International Cooperation in Educational Development (Same as Political Science 248.)
209X. Implementing Educational Reform
212. Practicum in Ethnographic Futures Research (Same as Anthropology 269.)
214. Evaluation on Research Methods (Same as Communications 253.)
217S. Teaching a Global Perspective: Cross Cultural Approaches
257. Educational Assessment of Culturally Diverse Populations
231. Social Structure of World Society (Same as Sociology 152, Values, Technology, Science and Society 155).
254A. Ethnographic Monitoring of Rapid Change I (Same as Anthropology 192A.)
254B. Ethnographic Monitoring of Rapid Change II (Same as Anthropology 192B.)
277X. Education and Work
306A. Education and Economic Development
306B. Education and Political Change (Same as Political Science 221.)
306C. Education and Sociocultural Change
306D. Sociology of Development and Education
307X. Knowledge and Legitimation: The Politics of Educational Research (Same as Political Science 328.)
366. Literacy: Social and Historical Perspectives
376X. Education and the Theories of the State
377. Organization and Style in Research Reports
382. Practicum in Cultural Pluralism
395. Education and Radical Change: African Experiences (Same as Political Science 221S.)
408A, B, C. Research Workshop in International Development Education
450. Seminar on Ethical Concerns in Research and Evaluation
470E. Practicum in Evaluation

MATHEMATICAL METHODS IN EDUCATIONAL RESEARCH (MME)
250A. Statistical Analysis in Education Research I
   (Same as Psychology 152.)
250B. Statistical Analysis in Education Research II
   (Same as Psychology 255.)
250C. Statistical Analysis in Educational Research II: Advanced Regression and Multivariate Analysis
250D. Statistical Analysis in Educational Research II: Experimental Design
251. Experimental Methods in Educational Research
351A. Advanced Statistical Analysis in Educational Research: Design and Analysis of Longitudinal Research
353. Problems in Measurement (Same as Psychology 249.)
377. Organization and Style in Research Reports
450. Seminar on Ethical Concerns in Research and Evaluation

470E. Practicum in Evaluation

493A,B,C. Seminar on Methodological Problems in Educational Research

PSYCHOLOGICAL STUDIES IN EDUCATION (PSE)
130. Counseling and Therapy: An Introduction (Same as Psychology 144.)
134. Counseling for Career Planning
215. Psychological Foundations of Education (Same as Psychology 145.)
229. The Development of Social Competence: Theory, Research and Practice
232. Science and Research in Counseling Psychology (Same as Psychology 253.)
233. Seminar in Cross-Cultural Counseling (Same as Psychology 131.)
234. Individual Counseling Psychology (Same as Psychology 250.)
238A,B,C. Counseling (Health) Psychology: Supervised Applications
251. Experimental Methods in Educational Research
252. Introduction to Test Theory (Same as Psychology 248.)
255. Human Abilities (Same as Psychology 155.)
275X. Contemporary European Psychology (Same as Psychology 277.)
299X. Development in Adulthood
316. Cognitive Psychology of Education
317. Psychological Research on Teaching
321A,B,C. Qualitative Methods of Educational Research: Issues in Design and Data Collection
338A,B,C. Internship in Counseling (Health) Psychology

434. Motivational Processes in Education
350A. Psychological Studies in Education
350A,B,C,D. Research Seminar in Educational Psychology
353. Problems in Measurement—(Same as Psychology 249.)
377. Organization and Style in Research Reports
411. Research Seminar in Child Development and Early Education
415. Seminar in the Psychology of Reading
416. Seminar on Aptitude
419. Seminar in Research on Teaching
426. Theory and Practice in Criterion-References Test Interpretations
431. Doctoral Seminar: Counseling (Health) Psychology
448X. Experimental Design for Evaluation

SOCIAL SCIENCES IN EDUCATION (SSE)
105. American Education and Public Policy (Same as History 158B; Political Science 186K.)
169X. The New Families: Implications for Education and Employment
170. Sex and Education (Same as Sociology 112, Feminist Studies 130.)
172. Status Attainment: Education and Work (Same as Sociology 137.)
175X. Women and Development in Africa (Same as Feminist Studies 138, African and Afro-American Studies 175X, Anthropology 109.)
200. History of Education
201. History of Education in the United States (Same as History 158.)
202. Teachers, the Constitution, and the School
203. Models of the Child in Contemporary Educational Thought
204. Introduction to Philosophy of Education: Curriculum Focus
207X. International Cooperation in Education Development (Same as Political Science 248.)
209X. Implementing Educational Reforms
210. Sociology of Education (Same as Sociology 210.)
211. Introduction to Philosophy of Social Science (Same as Philosophy 166.)
212. Practicum in Ethnographic Futures Research (Same as Anthropology 269.)
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 (Same as Political Science 187.)
220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education (Same as Sociology 143.)
221A. Administration and Organization of Educational Institutions in Context: Administration of Complex Organizations
221B. Administration and Organization of Educational Institutions in Context: Administration and Organization of Post-Secondary Institutions

221C. Administration and Organization of Educational Institutions in Context: American Educational Institutions

222A. Decision Analysis in Education I
222B. Decision Analysis in Education II
222C. Decision Analysis in Education III

231. Social Structure of World Society (Same as Sociology 152; Values, Technology, Science and Society 155.)

254A. Ethnographic Monitoring of Rapid Change I (Same as Anthropology 192A.)
254B. Ethnographic Monitoring of Rapid Change I (Same as Anthropology 192B.)

273. Education as a Social Science
276X. Feminist Perspectives on Ethics and Education

278. Introduction to Issues in Evaluation
280. Training Seminar: The Ethnography of Schooling (Same as Anthropology 214.)

301. Colloquium on the Historiography of American Education (Same as History 301.)
305. Philosophy and Empirical Research
306A. Education and Economic Development
306B. Education and Political Change (Same as Political Science 221.)
306C. Education and Sociocultural Change
306D. Sociology of Development and Education
307X. Knowledge and Legitimation: The Politics of Educational Research (Same as Political Science 328.)

310. Sociology of Education (Same as Sociology 310.)
312B. Interaction Processes in Education (Same as Sociology 242B.)

313A,B. Economics of Education
315. Cultural Transmission: Education in Cross-Cultural Perspective (Same as Anthropology 266.)
327. Research Practicum: Social Sciences in Education
366. Literacy: Social and Historical Perspectives
377. Organization and Style in Research Reports
404. Advanced Seminar in Philosophy of Education
408A,B,C. Research Workshop in International Development Education
450. Seminar on Ethical Concerns in Research and Evaluation
460. Advanced Seminar in Evaluation Design

470E. Practicum in Evaluation

DIRECTED READING AND RESEARCH, DISSERTATION AND PRACTICA

180. Directed Reading in Education—Master's degree students.
   any quarter (Staff) by arrangement

190. Directed Research in Education—Master's degree students.
   any quarter (Staff) by arrangement

   any quarter (Staff) by arrangement

470. Practicum For advanced graduate students. Not for STEP students.
   by arrangement

450. Directed Reading—For advanced graduate students.
   by arrangement

490. Directed Research—For advanced graduate students.
   by arrangement
Dean: James F. Gibbons
Associate Deans: Robert H. Eustis (Academic Affairs), Kenneth S. Down (Business Affairs), James D. Meindl (Research), Gilbert Masters (Student Affairs), Dwain N. Fullerton (Development)
Assistant Deans: Mary Lou Allen, Linda Bradford
Consulting Professors of Engineering: Hans M. Mark, Chauncey Starr

Faculty Teaching General Engineering Courses
Associate Professors: Bruce Lusignan, M. Elisaeth Paté-Cornell, J. David Powell, Robert Sinclair
Assistant Professors: Lambertus Hesselink
Lecturers: Gerd Wallenstein, David Lougee

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, the Institute for Energy Studies, and the program in Product Design. Petroleum Engineering is offered through the School of Earth Sciences.

Instruction in engineering is offered during the Autumn, Winter, and Spring Quarters of the regular academic year. During the Summer Quarter a few undergraduate and graduate courses are offered.

UNDERGRADUATE ADMISSION

Students admitted to the University may declare a major in the School of Engineering if they elect to do so; there are no additional procedures, course requirements, or examinations for admission to the school.

PREPARATION RECOMMENDED FOR FRESHMEN

Students who plan to enter as freshmen intending to major in engineering should take mathematics in high school to as high a level as is offered. (See Mathematics Department, School of Humanities and Sciences, for information on advanced placement in mathematics.) High school courses in physics, chemistry, and computer science are strongly recommended but not required. Additional elective course work in English is also recommended.

PREPARATION RECOMMENDED FOR TRANSFER STUDENTS

Students who do the early part of their college work elsewhere and then transfer to Stanford to complete their engineering programs should follow an engineering or pre-engineering program at the first school, selecting insofar as possible courses applicable to the requirements of the School of Engineering, i.e., courses comparable to those discussed under “Undergraduate Programs.” 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 grade point average 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, Electrical, Industrial, Materials, and Mechanical Engineering majors, the average grade for all courses taken in fulfillment of the Engineering Fundamentals and Engineering Depth components of the major must be at least 2.0. In addition, for Electrical Engineering, majors must receive at least a "C" grade in the courses in the E. E. depth sequence. The average grade for all courses taken to satisfy major requirements for Computer Science must also be at least 2.0.

For School of Engineering Majors, the average grade 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 Engi-
neering, 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**

<table>
<thead>
<tr>
<th>Mathematics: 21 units minimum</th>
<th>Science: 20 units minimum*</th>
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<tbody>
<tr>
<td>Engineering Fundamentals:</td>
<td></td>
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<tr>
<td>5 courses**</td>
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<tr>
<td>VTSS: 1 course</td>
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</table>

**Engineering Depth:**

- Engr. 21 or M.E. 33. Mechanics of Fluids
- Chem. 36. Chemical Separations
- Chem. 130. Theory and Practice of Identification
- Chem. 131. Organic Polyfunctional Compounds
- Chem. 173. Physical Chemistry
- Chem. 175. Physical Chemistry
- Chem. Eng. 110. Equilibrium Thermodynamics
- Chem. Eng. 120. Separations Processes
- Chem. Eng. 140. Fluid Mechanics

Chem. Eng. 160. Chemical Engineering Plant Design

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

**CIVIL ENGINEERING**

Mathematics: 21 units minimum
Science: 20 units minimum

**Engineering Fundamentals:**

5 courses*
VTSS: 1 course

**Engineering Depth:**

- Engr. 11. Mechanics of Materials I
- Engr. 21. Mechanics of Fluids
- C.E. 130. Intro. to Urban Planning
- or
- C.E. 171. Environmental Planning
- C.E. 150. Legal and Professional Aspects of C.E.
- C.E. 160. Water Resources Engineering
- C.E. 170. Environmental Science and Technology
- C.E. 180. Elementary Structural Analysis
- C.E. 190. Geotechnical Engineering

**Additional Civil Engineering Courses**

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

Specialty areas in Civil Engineering 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 E10, Statics; E60, Engineering Economics; and E70, 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.
Mathematics: (28 units)
Math 41, 42, 43. Calculus and Analytic Geometry 15
Math 103 or 113. Linear Algebra 3
Phil./Math 160A. First-order Logic 4
or
C.S. 257A and C.S. 257B 4
Other Math* 6
Science: (12 units)
Phys. 51. Mechanics 4
Phys. 53. Electricity and Magnetism 4
Other Science** 4
Engineering Basics: (10 units)
C.S. 106X. Intro. to Software Engineering 5
or
C.S. 106A and 106B 5
Engr. 40. Basic Electronics 5
Computer Science Courses: (44 units)
C.S. 108A,B,C. Fundamentals of Computer Science 15
C.S. 140 Intro to Systems Programming 3
C.S. 140L. Systems Programming Lab 1
C.S. 143A. Compilers 4
C.S. 223. Fundamentals of Artificial Intelligence 3
C.S. 240A. Operating Systems 3
C.S. 254. Automata and Computability 3
C.S. 261. Intro. to Algorithms and Data Structures 3
E.E. 182. Computer Architecture 3
Project Courses† 6
— 94
* Acceptable math courses are: Math 44, either Math 120 or 109, either Stat. 110 or 116, either C.S. 135 or 237A, and C.S. 260.
** Other science courses are to be taken from the School of Engineering list (see Note 2), plus Psych. 102, Psych. 106, Psych. 108. Physics 61 and 62 may be taken instead of Physics 51 and 53.
† 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). Further details can be found in the School of Engineering Undergraduate Handbook.

Since this is the first year that a Computer Science major is being offered, some students who are currently Juniors or 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
Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals: 5 courses* (See Note 3)
VTSS: 1 course (See Note 4)
Engineering Depth:
E.E. 101, 102. Circuits 6
E.E. 111, 112, 113. Electronics 9
E.E. 121, 122. Digital, Analog Laboratory 6
Engr. 102E. Writing for Electrical Engineering 1
C.S. 106B. Software Engineering 5
E.E. 141. Electromagnetic Fundamentals 3
Specialty Courses** 9
Electrical Engineering Electives 7

* Engineering Fundamentals should include Engr. 40 and 70A.
** Three specialty courses from one of the specialty areas shown below (consultation with an advisor in the selection of these courses is especially important):

Communications: E.E. 139, 278, 279, 244A, 244B, 244C
Controls: Engr. 105, 206, 207, 208, 209
Electronics: E.E. 139, 211, 216, 221, 231, 238
Signal Processing: E.E. 104, 261, 263, 264

INDUSTRIAL ENGINEERING
Mathematics: 21 units minimum* (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals:
5 courses** (See Note 3)
VTSS: 1 course (See Note 4)
Engineering Depth:
Stat. 110. Statistical Methods 4
C.S. 106B. Software Engineering 5
O.R. 152. Intro. to Operations Research I 4
O.R. 153. Intro. to Operations Research II 4
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. Intro. to Financial Decisions 3
I.E. 260. Analysis of Production Systems 3
I.E. 180 or 183 or 186. Senior Project 4
— 45
* 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
Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals:
5 courses (See Note 3)
VTSS: 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

Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals:
5 courses (See Note 3)
VTSS: 1 course (See Note 4)
Engineering Depth:
Engr. 10. Applied Mechanics: Statics 3
Engr. 11. Mechanics of Materials I 4
M.E. 33. Introductory Fluids Engineering 4
M.E. 101. Visual Thinking 3
M.E. 103. Manufacturing Technology 4
M.E. 111. Stress, Strain & Strength 3
M.E. 112. Mechanical Systems 3
M.E. 113. Engineering Design 3
M.E. 131A. Fluid Mechanics 4
M.E. 131B. Heat Transfer 5
M.E. 131C. Thermosciences 5
M.E. 161. Mechanical Vibrations 4

PETROLEUM ENGINEERING

Petroleum Engineering is offered through the School of Earth Sciences. Consult the appropriate sections of this Bulletin for their requirements.

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

Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals:
5 courses (See Note 3)
VTSS: 1 course (See Note 4)
Engineering Depth:
Engr. 10. Applied Mechanics: Statics 3
Engr. 11. Mechanics of Materials I 4
Engr. 104. Dynamic Response 3
M.E. 33. Intro. Fluids Engineering 4
M.E. 131A. Fluid Mechanics 4
A.A. 100. Intro 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. Fund. of Compressible Flow 3
C.E. 114. Mechanics of Materials II 3
Math 130. Differential Equations 3
Restricted Electives* 6


COMPUTER SYSTEMS ENGINEERING

Mathematics: (21 units)
Math 41, 42, 43, 44. Calculus 18
Math 103 or 113. Linear Algebra 3
Science: (12 units)
Phys. 51. Mechanics 4
Phys. 53. Electricity and Magnetism 4
Phys. 55. Light and Heat 4
Basic Engineering: (10 units)
Engr. 40. Electronics 5
Engr. 70X. Software Engineering 5
Depth: (48-49 units)
C.S. 108A,B,C. Fundamentals of Computer Science 15
C.S. 140. Intro. to Systems Programming 3
C.S. 140L. Systems Programming Lab 1
C.S. 143A. Compilers (4 units) 3-4
or
C.S. 240A. Operating Systems (3 units)
E.E. 101. Circuits 3
E.E. 111, 112. Electronics 6
E.E. 121. Digital Laboratory 2
E.E. 182. Digital Computer Organization 3
E.E. 183. Digital Logic Laboratory 3
E.E. 271. Intro. to VLSI Systems 3
Senior Project* 6

* Senior projects can be either course-based or independent study. The courses E.E. 272A and B satisfy the requirement as do C.S. 143B and/or C.S. 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.

Total Units: 91-92

THE SCHOOL OF ENGINEERING
Mathematics: 21 units minimum
Science: 20 units minimum*
Technical Electives: 15 units minimum**
VTS:** 1 course

**Engineering Depth:**
- Engr. 11. Mechanics of Materials I 4
- M.E. 101. Visual Thinking 3
- M.E. 103. Manufacturing Technology 4
- M.E. 111. Stress, Strain and Strength 3
- M.E. 112. Mechanical Systems 3
- M.E. 115A. Human Values in Design 3
- M.E. 115B. Concept Presentation 3
- M.E. 191. Engr. Problems 1
- Art 60. Basic Design 3
- Art 160. Design I 3
- Art 161. Design II—Type and Symbol Design 3
- Art 164. Color 3

45

* From the approved list for Departmental Majors (see Note 2) plus up to 3 units of behavioral science.
** Engineering Fundamentals courses (see Note 3) plus I.E. 100, I.E. 133, and M.E. 102.

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.


**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: Phys. 51, 53, 54, 55, 56, 57, 58 (preferred sequence for engineers); Phys. 21, 22, 23, 24, 25, 26; Phys. 61, 62, 63; Chem. 31, 33, 35, 36 (and, by petition, Chem. 30); Geo. 1 or Geo. 2, Geo. 3; Biology 31, 32.

**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
- **Engr. 60.** Engineering Economy, or, **Engr. 62.** Introduction to Operations Research I
- **Engr. 70A** or **Engr. 70X.** Introduction to Software Engineering

**Note 4 (V.T.S.S.):** 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.

The following courses satisfy this requirement:


**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
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 and file candidacy forms through his or her graduate department.

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

**Procedure for Applying for Admission to the Coterminal Degree Programs**—A Stanford undergraduate may apply (using the white University petition form) for admission to the coterminal A.B./B.S. program during the student's tenth or eleventh quarter. The student may apply for admission to the coterminal bachelor/master program after the beginning of the eighth quarter of undergraduate work and before the end of the eleventh quarter. Students seeking a graduate degree in engineering will apply to the pertinent department.

**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 ob-
GRADUATE REGISTRATION
New graduate students should follow procedures for registration as listed in the Time Schedule. Advisor assignments can be obtained from the Department Office.

GRADUATE CURRICULA
Departments and divisions of the school offer graduate curricula, as follows:

AERONAUTICS AND ASTRONAUTICS
Acoustics
Aeroelasticity
Aerophysics
Aerospace Structures
Aerospace Systems Synthesis and Design
Analytical and Experimental Methods in Solid and Fluid Mechanics
Biomedical Solid and Fluid Mechanics
Computational Fluid Dynamics
Flight Mechanics
Gaskinetics
Guidance and Control
Physical Gasdynamics
Propulsion
Robotics
Waves and Vibrations

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
Orthopaedic Biomechanics
Neuromuscular Biomechanics
Rehabilitative Engineering
Transport Phenomena in Biological Systems
Water Quality Control

CHEMICAL ENGINEERING
Applied Chemical Thermodynamics and Kinetics
Applied Statistical Mechanics
Bioengineering
Electrochemical and Photochemical Energy Conversion
Equilibrium and Transport Properties of Colloidal Dispersions
Hydrodynamic Stability
Kinetics and Catalysis
Membrane Separation Processes
Newtonian and Non-Newtonian Fluid Mechanics
Polymer Adsorption
Polymer Science
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 and Geotechnical Engineering
Earthquake Engineering
Reliability and Risk Analysis
Structural Analysis and Design
Foundation Engineering
Soil Mechanics
Structural Mechanics

Environmental and Water Studies

ELECTRICAL ENGINEERING
Bioelectronics
Communications and Information Theory
Computer Applications and Systems
Computer 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

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
Air Pollution
Biomechanics
Combustion
Composites, Fracture of Solids
Continuum Mechanics
Controls
Dynamics
Energy Conversion
Engineering Design
Environmental Measurements
Experimental Mechanics
Fluid Mechanics
Heat Transfer
High Temperature Gasdynamics
Kinematics
Manufacturing Systems Engineering
Nuclear 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.

For further details about the above programs, see the department sections in this bulletin.

Related aspects of particular areas of graduate study are commonly covered in the offerings of several departments and divisions. Graduate students are encouraged, with the approval of their departmental advisors, to select courses in departments other than their own to achieve a broader appreciation of their field of study. For example, most departments in the school offer courses concerned with properties of materials, and a student interested in an aspect of materials engineering can often gain appreciable benefit from the related courses given by departments other than her or his own.

ENGINEERING IN BIOLOGY
AND MEDICINE
School of Engineering Advisory Committee on Engineering in Biology and Medicine:
Charles R. Steele (Mechanical Engineering) Chairman,
I-Dee Chang (Aeronautics and Astronautics), Dennis Carter (Mechanical Engineering), Lambertus Hesselink (Aeronautics and Astronautics), Channing R. Robertson (Chemical Engineering), Gio Wiederhold (Computer Science), Felix Zajac (Mechanical Engineering).

Though Stanford does not have a formal department of bioengineering, there are approximately ten faculty in the School of Engineering whose primary research activities are in the general area of bioengineering. 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 elasticity, knee mechanics, spinal stabilization, 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, Doppler-shift blood flowmeters and micropower implantable electronics for neural prostheses and biological microsensors. Also in Electrical Engineering advanced analysis techniques are applied to signal processing EKG, EEG, and X-ray image. Most research projects are carried out in collaboration with faculty of the Medical School or members of the local medical community.

A major new opportunity for bioengineering experience is now available in the Rehabilitation Research and Development Center, a Veterans Administration sponsored cooperative program with the School of Engineering. (Contact Professor Leifer, 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 Master of Science in Engineering in Biology and Medicine are available, there is no prescribed program and these degrees are not encouraged. An interdepartmental committee must approve these special programs for the rare 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. The Engineering degree is appropriate to all other cases including programs in fields lying between two departments. Further information may be obtained from the particular department in which the student is interested.

**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 depart-
ment 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 of course 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.

PRIMARY FOR UNDERGRADUATES

5. The Microscopic World of Technology—An introduction to the microscopic world of technology through the use of optical and electron microscopes. A combination of classroom discussion and student participation in the application of various microscopes to study technological components. Typical experiments will involve examination of silicon integrated circuits or broken metal parts at magnifications ranging from 10X to 1,000,000X. (Open to freshmen).

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

6. Engineering at Stanford — Weekly seminar designed for freshman and undeclared sophomore interested in engineering. Provides information on the various engineering majors and the resources available for engineering undergraduates. Speakers include departmental representatives, faculty and industry researchers, and representatives from Overseas Studies, Career Planning and Placement, and the Undergraduate Advising Center.

1 unit, Aut (Masters) M 3:15-4:45

7. Professional Development for Minority Engineers—(Same as African and African American Studies 127.) Designed to assist 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 ones own business; opportunities for Black engineers and businesses in Third World countries; trips to industrial and academic laboratories. Each student has weekly reading assignments with a short paper due each week; a final term paper will be assigned.

3 units, Spr (Bates)
10. Applied Mechanics: Statics—Equilibrium of particles; moments, couples; equilibrium of rigid bodies; analysis of trusses, frames, machines, dry friction; hydrostatic forces. Vectors and vector algebra are introduced and used in the course. Prerequisites: Physics 51. (DR:8)

3 units, Aut (Gere) MWF 9
Win (Bershader) MWF 10
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. Additional topics such as Mohr’s circle, pressure vessels, and columns. Prerequisite: 10.

4 units, Win (Shah) MWF 9
problem sessions by arrangement
Spr (Sheppard) MWF 11
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 (Bryson) MWF 9
Spr (Ashley) MWF 10, problem sessions by arrangement

20. Introduction to Chemical Engineering—An overview of the field of chemical engineering through discussion and engineering analysis of physical and chemical processes. First part of course develops concepts of mass and energy transport in equilibrium processes; second part focuses on kinetics of chemical reactions, including concentration and temperature dependencies of reaction rates and interpretation of batch reactor data. Topics also include rate processes and heat and mass transport, as well as the application of all these concepts to areas of current technological importance, such as 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; real fluid effects—laminar and turbulent flows; specific engineering applications. Laboratory exercises. Prerequisites: 10,

Physics 51 and Math 23 or 43; Engineering 12 recommended but not required.

4 units, Aut (Staff) MWF 10 lab M 2:15 and one hour by arrangement
Spr (Staff) MWF 9 lab M 1:15 and one hour by arrangement

30. Engineering Thermodynamics—Introduction to the concepts of energy and entropy from elementary considerations of the microscopic nature of matter. Use of basic thermodynamic concepts in the solution of engineering problems. Methods and problems in the socially responsible economic generation and utilization of energy in central power stations, solar systems, gas turbine engines, refrigeration devices, automobile engines, etc. Prerequisites: Freshman calculus and physics. (DR:8)

3 units, Aut (Kays) MWF 10
Win (Eustis) MWF 10

35. Automotive Technology—An engineering description of today’s automobile, how it works and why its designed the way it is. How the auto affects air pollution and aspects of engine design for improving exhaust emissions. A description of alternate power plants and fuels and the options they offer for the long term. Course is aimed at non-scientists. (DR:8)

3 units, Aut (Powell) MWF 2:15

40. Basic Electronics—Electronics for the non-specialist. Electrical quantities and their measurement including the operation of the oscilloscope. Digital logic circuits and their functions including an elementary microprocessor. Function of electronic components including diodes and transistors. Amplifiers including operational amplifiers. Amplitude modulation and de-modulation. The necessary laboratory assignments are timed to complement the lecture content. Prerequisite: Calculus and college physics. (DR:8)

5 units, Aut (Pease) MWF 11-12:15
Win, Spr (Manning) MWF 11-12:15
one 3-hour lab weekly
by arrangement

43. Electromechanics—Energy conversion, magnetic fields and devices, electromechanical devices, rotating machinery, automatic control. Prerequisite: 40 or equivalent.

3 units, Win (Lindau) TTh 10-11:15
Spr (Helliwell) TTh 11-12:15
one 3-hour lab weekly
by arrangement

50. Introductory Science of Materials—Study of crystalline structure and of the microstructures that determine the important physical properties of engineering materials. Introduc-

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. This course provides information necessary for materials selection and processing for engineering applications. Prerequisite: Math 41 or equivalent. Recommended: Previous knowledge of elementary probability. 4 units, Aut (Huggins) TTh 11-12:15

52. Materials Engineering of Microelectronic Devices—Brief discussion of 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, Win (Wadsworth) MWF 1:15

60. Engineering Economics—Economic analysis for decision making among alternatives in engineering, business, government and personal finance. Use of compound interest calculations. Effects of depreciation national and state income taxes, and selection of appropriate minimum attractive rates of return. Problems relating to multiple alternatives, sunk cost, incremental cost, replacement, resource allocation and publicly financed projects. Analysis of decision under uncertainty, sequential decisions and capacity planning. May be taken by freshmen, but recommended for second year or higher students. Three lectures per week. Prerequisite: Math 41 or equivalent. Recommended: Previous knowledge of elementary probability.

3 units, Aut (Paté-Cornell) MWF 11
Aut (Staff) MWF 2:15
Win (Hodder) TTh 9:30-10:45
Sum (Staff) MWF 10

62. Introduction to Operations Research I—Theory and computation of optimal selection of decisions under certainty. Linear programming (simplex method and duality theorem), network flows, dynamic programming, convex programming (convex sets and functions, Lagrange multipliers, Kuhn-Tucker conditions, algorithms), integer programming. Applications drawn from problems in pricing resources, production planning, inventory control, transportation, pollution control, personnel assignment, construction management. Prerequisites: Mathematics 43 or consent of instructor.

4 units, Aut (Hillier) MWF 1-2:05
Win (Veinott) 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. 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, unique speaking situations. Weekly practice speaking. Students serve as apprentice speech tutors. Students who successfully complete this course may become paid speech instructors in the Technical Communications Program. Admission by consent of instructor after brief interview.

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

101. Teaching Technical and Expository Writing—Theory and practice of teaching technical and expository writing. Discussions of composing and writing process; review of writing conventions; description of tutorial and evaluation techniques. Supervised field work conducting individual tutorials. Admission by consent of instructor after review of student’s writing. Students who complete the course successfully may become paid writing instructors in the Technical Communications Program.

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


1 unit, Win, Spr (Lougee, Staff) Th 1:15

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 appropri-
ate report materials, structuring clear and convincing reports, designing and drafting effective reports, and editing reports that are clear, concise, emphatic, and mechanically and grammatically "clean." Weekly writing assignments and individual conferences. Recommended especially for upperclassmen or graduate students who have worked or will soon work as professionals.

3 units, Aut, Win, Spr (Lougee)

102S. Writing: Special Projects — Writing assistance 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)

103. Public Speaking—Introduction to the full range of speaking activities, from impromptu speaking to carefully rehearsed formal professional presentations. Teaches students to organize and write speeches for a variety of occasions, to analyze audiences, to create and use visual aids, to combat nervousness, to deliver informative and persuasive speeches effectively. Helps students develop confidence in their speaking ability through weekly practice in class, rehearsals in one-on-one tutorials, and videotaped feedback. Open to all students, but priority given to engineering students.

3 units, Aut, Win, Spr (Staff)


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


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

Win (Cannon) MW 11-12:15

170. Introduction to Modern Optics—Introduction to recent developments in modern optics. The course material is of a general pur-

pose nature. Emphasis is on understanding of physical principles. Topics include: geometrical optics and ray matrices, Maxwell's equations, optical properties of materials, interferometry, diffraction phenomena, Fourier optics, lasers, holography. Applications of optical techniques in engineering and science will be discussed and classroom demonstrations given. Prerequisite: Some familiarity with fourier transforms.

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

176. Nuclear Energy—Theory, design and applications of nuclear energy systems; radio-isotope heat sources, fission chain reactors and concepts of fusion reactors. The information developed is applied to a number of 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 VTSS 181, Industrial Engineering and Engineering Management 201.) An investigation of problem solving with particular emphasis on problem definition, creativity, and interpersonal and organizational factors that influence thinking. Common blocks to problem solving will be explored and methods of dealing with them will be present-
ed. The advantages of integrating various problem solving strategies will be stressed through use of reading, abstracted problem situations, and projects. Open to undergraduates and graduates in any field.

3 units, Spr (Adams) given 1987-88

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

205. International Telecommunication Agreements—(Same as Communication 230.) Examination of the International Telecommunication Union (ITU) as a model for worldwide collaboration in resource allocation, standardization, and planning of services. Interdisciplinary focus on outcomes achieved by voluntary agreement. Case studies of ITU action, particularly in new services. Lectures and study projects.

3 units, Sum (Wallenstein)

206. Control System Design and Simulation—Sequel to Engineering 105. Analog com-
puters are used for simulation and troubleshooting techniques. Design of differential actuators and sensors. Model instruction techniques. Student teams design, build, and test a miniature control system. Emphasis on qualitative aspects of synthesis, generation of candidate design and engineering trade-offs in system selection. Prerequisite: 105.

4 units, Win (DeBra) MWF 1:15; lab by arrangement

207. Digital Control I—Study of the digital computer in feedback control. Sampling, z-transforms, digital filters, discretization of continuous compensation, discrete compensation design, quantization errors, state variable design of digital controllers and observers. Laboratory experiments on a microcomputer with interface for an analog computer system. Limited enrollment. Prerequisite: 105.

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

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

3 units, Aut (Franklin) TTh 1:15-2:30
 Spr (DeBra) TTh 11-12:15
 lab by arrangement


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

213. Current Progress in Worldwide Telecommunications—(Same as Communication 232.) A seminar format survey of trends in worldwide standardized services. Examined are Integrated Services Digital Networks (ISDN), use of fiber optics for broadband services, broadcasting satellites in competition with video cable. Based on ITU (International Telecommunications Union) documents. Focus is on interaction of technology, entrepreneur-ship, and governmental regulation for divergent national markets. Individual study of technical standardization and related cases may be continued under Engineering-Economic Systems 292, Directed Reading.

1-3 units, Win, Spr, by arrangement
3 units, Sum (Wallenstein)


3 units, Aut (Staff)

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

3 units, Win (Staff)

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

3 units, Spr (Staff)

221. The Social Impact of Technology—The functions of science and technology in various cultures; historical development; underlying patterns and concepts. Unifying frameworks to enable simultaneous consideration of technical factors, human needs and ecological requirements. The adequacy of "traditional" and "scientific" philosophies as criteria for judging the satisfying of these needs. Systems, system methods, and their limits; the role of disciplines. For graduate students in engineering and science; run conjointly with VTSS 106.

4 units, Spr (Kline) TTh 10 plus section T or W 2:15-4:05

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, several International Weather Systems, a Communications and Educational Satellite System for Developing Countries, and a shuttle-launched Science Platform System. About 20 invited speakers from government and industry give the class 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; Education 274A,B,C; Political Science 140A,B,C.) The EDGE seminars present a series of speakers on current development issues with emphasis on the problems of the poorer nations. Autumn Quarter speakers discuss world resources — energy, food, housing, population and environment. Winter Quarter speakers address the role of institutions affecting the transfer of technology — e.g., political systems, world bank, transnationals, etc. Spring Quarter addresses 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 option-al workshops treating selected issues in more depth and writing a term paper. (Sequential registration is not required.)

1 unit (lecture only) or 4 units (lecture plus workshop) Aut, Win, Spr (Fagen, Fuenzalida, 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 students presenting talks.

1 unit, Aut, Win, Spr (Staff) T 4:15

299. Special Studies in Engineering—Special studies, laboratory work, or reading under the direction of a faculty member. By consent only.

1 or more units, any quarter (Staff) by arrangement

AERONAUTICS AND ASTRONAUTICS

Emeriti: (Professors) Nicholas J. Hoff, John V. Breakwell, Chi-Chang Chao, Krishnamurty Karamcheti, Erastus H. Lee, Jean Mayers, Walter G. Vincenti
Chairman: Robert H. Cannon, Jr.
Associate Chairman: Daniel Bershader
Associate Professors: Brian J. Cantwell, Lambertus Hesselink

Assistant Professors: Fu-Kuo Chang, Ilan Kroo
Professors (Research): Dean R. Chapman, Bradford W. Parkinson, Leonard Roberts
Professor (Teaching): Richard S. Shevell
Visiting Professor: Nicholas Rott
Consulting Professors: David Altman, Robert T. Jones, Harvard Lomax, Emery Reeves, Vincent Salmon, Fredric H. Schmitz, Clarence A. Syvertson

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
- Computational Solid and Fluid Mechanics
- Composite Materials
- Computational Fluid Dynamics
- Flight Mechanics
- Gaskinetics
- Guidance and Control
- Hypersonic and Physical Gas Dynamics
- Modern Optical Diagnostics in Fluid Mechanics
- Propulsion
- Waves and Vibrations

Requirements for all degrees include courses on basic topics in aeronautics and astronautics, as well as in mathematics, physics and applied mechanics.
The current research activities cover a number of advanced fields, with special emphasis on:

- Aerodynamic Noise
- Aeroelastic Optimization
- Aircraft Performance and Control
- Astrodynamics
- Bio-Fluid Mechanics and Physiological Acoustics
- Computational Fluid Dynamics
- Control of Flexible Spacecraft
- Control of Robots, including Space Robots
- Differential Games
- Experimental Space Sciences
- Geophysics
- Hypersonic Aerophysics and Trans-Atmospheric Flight
- Hypersonic Flow
- Inertial Instruments
- Laser Methodology for Fluid Flow Studies
- Multiphase Flows
- Nonequilibrium Flow
- Nonlinear Structural Mechanics
- Optical Diagnostics in Fluid Dynamics
- Optimal Control and Estimation
- Plasticity and Viscoelasticity
- Propulsion
- Shock Tube Studies of Vortex Interactions
- Structural Aeroacoustics
- Conventional and Composite Structures/Materials Systems Optimization
- Wave Propagation

**INSTRUCTION AND RESEARCH FACILITIES**

The work of the department is centered in the William F. Durand Building for Space Engineering and Science. This 120,000 square foot building houses advanced research and teaching facilities and concentrates in one complex the Department of Aeronautics and Astronautics as well as the activities of other engineering organizations allied in space exploration and aerospace technology.

The Guidance and Control Laboratories include a wide spectrum of specialized facilities for making and testing novel instruments of extremely high precision. The facilities include active table-leveling (0.1 arc sec); low-level accelerometer evaluation chamber ($10^{-4}$ to $10^{-10}$ g); spacecraft thruster test stand with 10 kHz bandwidth; spherical gyro rotor alignment facility (optical- to-principal-axis alignment less than 1 arc sec); air cushion vehicle to simulate the Stanford Drag-Free Satellite in an orbital dynamic environment to 275 km altitude; air-bearing simulator for spinning-spacecraft attitude control to a few arc secs, plus facilities for a number of inertial instrument test stands on an isolated test pad having visual access to Polaris. Clean facilities, ultra-precision machining, and advanced electronics design and fabrication capability support the guidance, control, and instrumentation experiments using these facilities. 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 ten 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. Sev-
eral 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" × 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 is complemented by a "satellite" computer facility in the adjacent Terman Engineering Center which is readily available to department researchers and students. Terminals in the facility provide for individual on-line, time-shared computation with the campus facility IBM 3033 and with the campus academic computer system (LOTS). They are available to all students at no cost for their course work or unsponsored research. Three digital 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 E206, E207, and E208 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 participate in the newly formed Center for Space Science and Astrophysics. Graduate students in the department have the opportunity to arrange a program which emphasizes aeronautics, planetary and space sciences, and to work with faculty associated with CSSA.

At the master's level a program in Computational Fluid Mechanics (CFD) is an option within the general structure of the master's requirements. At this level, students interested in a still greater emphasis on CFD may register for the M.S. in Engineering or Engineering Science. In consultation with specialized needs. Students intending to seek a Ph.D. degree with an emphasis on CFD should prepare for the post master's series in CFD (A.A.214A-C and A.A.215A-B) by planning an M.S. program strong in mathematics and numerical analysis (M.E. 200A-C or the equivalent) and in advanced fluid mechanics (e.g., A.A.200A-B, M.E.251A-B, A.A.210A-B, M.E.261, etc.). Choice of math courses, theoretical and experimental dynamics courses, and electives most suitable for the CFD program should be selected in consultation with the student's advisor. Research topics in CFD are supervised by a number of faculty members in both the Department of Mechanical Engineering and the Department of Aeronautics and Astronautics. Students undertaking theses in CFD generally utilize the large computer facilities of the NASA-Ames Research Center through a cooperative program with the University.

The Joint Institute for Aeronautics and Acoustics, co-sponsored by Stanford University and NASA-Ames Research Center was originated in 1973. Its purpose is to provide long-term cooperative research in conjunction with graduate education. 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 JIAA's faculty, staff and students.

GENERAL INFORMATION
The department sponsors a very active student branch of the American Institute of Aeronautics and Astronautics, which holds weekly technical meetings and comprehensive faculty research-area seminars, and 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 average of 2.75 is required to fulfill the department's M.S. degree requirements and a 3.0 is the minimum required for eligibility to attempt the Ph.D. qualifying examination. Thus it is incumbent upon both M.S. degree and potential Ph.D. candidates to request letter grades in all courses except those which fall into the categories of colloquia and seminars (e.g., AA129, 295, 297, and 298). Insufficient grade points upon which to base the grade point average may delay expected degree award or, if appropriate, result in refusal of permission from the Candidacy Committee to take the qualifying examinations. In any event, candidates with letter grade averages 3.0 through 3.2 must request the permission of the Candidacy Committee to attempt the qualifying examinations.

WAIVERS AND TRANSFER CREDITS
All students who receive 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 and number(s) and title(s) of the course(s) wherein substantially equivalent material was treated, will suffice. Compliance with this procedure will accelerate the approval and forwarding of degree candidacy forms to the Graduate Program Office.

A similar procedure should be followed with regard to transfer credits. Please note, however, that transfer credit is allowed only for courses in which equivalence to Stanford courses is established and a grade of "B" or better has been awarded. The number of transfer credits accepted for each degree (M.S., Engineer, and Ph.D.) is delineated in the "Advanced Degrees" section of 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.

SPECIAL ACOUSTICS PROGRAM

In addition, the department participates in an interdisciplinary program in Acoustics and Noise. Students desiring to acquire special training in the field of Acoustics and Noise are referred to the "Other Departments, Institutes and Programs" section of this bulletin for a description of the program and a list of course offerings at both the undergraduate and graduate levels.

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

(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 *. Courses not listed in Category A which are taken either to rectify deficiencies or to satisfy a prerequisite in Category A can be used for credit toward the M.S. degree requirements only in Category D (Other Electives).

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

AA.200A
AA.210A or AA.206A (ME.258A)
AA.240A and (AA.240B or AA.246, AA.247 or AA.256) or
AA.245A and (AA.245B or AA.246 or AA.247 or AA.249A)
AA.242
AA.271A or AA.279A
AA.280 or AA.283A
AA.131

B. Mathematics Courses—Each candidate is expected to develop a competence in the applied mathematics methods pertinent to his or her major field. This requirement can be met either (1) formally, through a minimum of six units in applied mathematics taken from ME.200A or Math 113 (linear algebra), ME.200B or Math 131 and Math 132 (partial differential equations), ME.201 or Math 106 (complex variables), CS.135 (computer science), and Stat 116E (probability); or (2) informally through matriculation in those basic (breadth) and technical electives (depth) courses which strongly emphasize methods of applied mathematics. Courses to be offered in informal fulfillment of the Category B requirement may appear in either or both of Categories A and C; however, they should not be considered as satisfying the mathematics requirement without obtaining the prior approval of the advisor. Note that the major-field Ph.D. qualifying examination provides for 25%-time devoted to pertinent mathematics. (See "Information on Ph.D. Qualification" available from the Academic Secretary). Note, also, that when the mathematics requirement is being satisfied via the informal route, six units of additional course work must appear in Category C, technical electives. Students may also elect the "science degree option", which consists of taking nine mathematics units. In this case, three less units of technical electives are required.

C. Technical Electives—Candidates, in consultation with their advisors, will select at least four major-field courses (in addition to those taken under Category A) from among the three-digit-series courses offered by the departments and divisions of the School of Engineering and the Department of Physics in the School of Humanities and Sciences. This requirement increases by two additional courses (taken from either the major or peripheral fields) when the mathematics requirement is being satisfied informally.
D. Other Electives—It is recommended that all candidates enroll in at least one humanities or social sciences course. Practicing courses in, for example, art, music, and physical education do not qualify in this category.

ENGINEERING OR ENGINEERING SCIENCE (45 Quarter Units)

For students who do not wish to meet the department's specified requirements for the M.S. degree in Aeronautics and Astronautics, the opportunity is available to pursue programs leading to an M.S. degree in either Engineering or Engineering Science. These programs are described in the School of Engineering "Graduate Programs of Study" section of this bulletin.

As described under the School of Engineering section of this bulletin, each department in the School of Engineering may sponsor students in the more general degrees, Master of Science in Engineering or Master of Science in Engineering Science. Sponsorship by the Aeronautics and Astronautics department requires that the student file a petition for admission to this program; no more than 18 units used for the proposed program may have been completed previously. The proposed program must include at least 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) Aeroelasticity, (c) Aerophysics, (d) Aerospace Structures, (e) Aerospace Systems Synthesis and Design, (f) Analytical and Experimental Methods in Solid and Fluid Mechanics, (g) Biomedical Solid and Fluid Mechanics, (h) Computational Fluid Mechanics, (i) Flight Mechanics, (j) Gas Kinetics, (k) Guidance and Control, (l) 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 average 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 AA290).

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. Forms for the Ph.D. Reading Committee and University Oral scheduling are obtained from the department's academic secretary and submitted with a one-page thesis abstract at least three weeks prior to the date approved for the oral by the student's advisor.

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

FELLOWSHIPS AND RESEARCH ASSISTANTSHIPS

Both fellowships and research assistantships are available to qualified graduate students. For fellowships sponsored by Gift Funds, Stanford University, and Industrial Affiliates of Stanford University in Aeronautics and Astronautics each carries a grant of $18,700 or more for the nine-month academic year to cover tuition and living expenses. Students who have demonstrated research capability are eligible for half-time research assistantships. The stipend for half-time research assistants, on the basis of 20 hours of work per week, ranges from $735-$860 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—Explanation of the principles of fluid flow, flight and propulsion; discussion of the creation of lift and drag, aerodynamic performance including take-off, climb, range and landing performance, structural concepts, propulsion systems, trajectories and orbits outside the atmosphere. Remarks on the history of aeronautics and astronautics. Prerequisites: Math 41, 42, elementary physics or consent of instructor.

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 (L. Chang, Billingham, Clearwater, Cohen, Daunton, Holton, Johnson, Lawless, MacElroy, Sandler, 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—Introduces the student to the basic concepts of acoustics and their applications, on the basis of one-dimensional acoustic motion. The presentation will consist of lectures with experimental demonstrations: one-dimensional acoustic motion of a homogeneous inviscid fluid; wave equation and its general solution; travelling plane sound waves; speed of sound in gases and liquids; sound energy density, flux, and intensity; intensity and pressure levels and the decibel scale; one-dimensional sound propagation in an elastic solid; monochromatic waves; frequency, wave length, wave number and phase speed; reflection and transmission of sound between different media; mass law of transmission through walls; acoustic impedance of surfaces and sound absorption; spherical and cylindrical waves; acoustic source and dipole radiators; analysis of acoustical systems—electrical and mechanical analogies; acoustic resistance, inductance,
capacitance and impedance; combinations of various acoustic elements; filters and transform- ers; 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 (Karamcheti) 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 configura- tion, and the nature of airflows associated with their operation. Equations of motion for rigid flight vehicles and the aerodynamic information needed to apply them. Two-dimensional wings discussed from a historical standpoint; airfoils in incompressible flow treated by means of the complex variable; results of Joukowsky and Theodorsen; boundary-layer displacement. Subsonic thin airfoils by small-perturbation methods; prediction of pressures, lift and other properties. Historical discussion of three- dimensional wings; lifting-line theory, lifting- surface theory, and their application; analysis of slender wings and bodies. Compressibility con- nections; interference; discussion of other topics as time permits. Prerequisites: 100 and 210A or equivalents.

3 units, Win (Ashley) MWF 10

200B. Applied Aerodynamics — Introduction to computational fluid dynamics; Green's theorem for linearized aerodynamics; paneling methods for slender configurations in subsonic and supersonic flight. Finite-difference solution of the fluid equations; organization of data, stability, computational efficiency and other issues. Static and dynamic performance of ve- hicles in the atmosphere. Dynamic stability and response; open-loop modes of the rigid flight vehicle; integrated treatment of aerodynamic stability derivatives. Further discussion of top- ics in flight-vehicle dynamics as student interest and schedule dictate. Prerequisite: 200A or consent of instructor.

3 units, Spr (Ashley, Lomax) MWF 10

201A. Fundamentals of Acoustics—Acoustic equations for a stationary homogeneous fluid; wave equation; sound energy density, flux, in- tensity, and power; r.m.s. pressure; plane, spherical, and cylindrical waves; harmonic (monochromatic) waves; simple sound radia- tors; reflection and transmission of sound at interfaces between different media; multiple analysis of sound radiation—monopole, dipole, and quadrupole distributions; inhomogeneous wave equation; Kirchoff integral representa- tion; scattering and diffraction of sound; propa- gation 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, sci- ences, or consent of instructor.

3 units, Win (Karamcheti) MWF 10

201B. Fundamentals of Acoustics—Continua- tion of 201A with emphasis on the acoustics of moving and inhomogeneous fields. Effects of friction and heat flow on sound propagation in a homogeneous fluid initially at rest—equations, and boundary conditions; energy considera- tions; simple examples of plane wave propaga- tion—longitudinal and transversal waves; gen- eral considerations introducing the notions of dilatational and rotational waves; effects on propagation in ducts; comments on sound ab- sorption 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 inter- face of two differently moving fluids; radiation from a source in a uniformly moving fluid in a duct; acoustics of an inhomogeneous nonuni- formly moving fluid; geometrical or ray acous- tics; propagation in the atmosphere and the ocean. Prerequisite: 210A or equivalent or consent of instructor.

3 units, Spr (Karamcheti) MWF 10

202. Acoustic Measurements Laboratory— Lecture/labatory course dealing with funda- mental concepts and laboratory techniques for the measurement of the physical properties of sound fields in fluids and the development of criteria and measurement practice; use of basic
acoustic instrumentation such as microphones, audio-oscillators, sound level meters, acoustic spectrum analysers, and recorders. Experiments include: classification, calibration, and refrequency response of microphones; speed of sound in fluids and solids; reflection, refraction, and absorption coefficients; sound wave propagation in bounded media; filters and resonators; reverberation time; diffraction, scattering, and dispersion of sound; Doppler effect; analysis of discrete frequency sound fields; analysis of random sound fields; power spectral density and correlation functions. Prerequisite: 135 or 201, or consent of instructor.

3 units, Spr (Staff) TTh 11-12:15
plus lab by arrangement
alternate years, given 1987-88

203. Aerodynamic and Hydrodynamic Noise — Lighthill's formulation of the theory of generation of fluid mechanical noise; Lighthill's equation; representation of solution in unbounded and bounded regions; monopole, dipole, and quadrupole radiations; some general results; consideration of stationary and moving surfaces and source distributions; problem of a systematic theory of generation and propagation of aerodynamic noise—recent approaches; generation of discrete frequency noise—vortex tones and different kinds of edgetones generated by shear layers such as jets, wakes, and separated boundary layers interacting with surfaces; noise generation by turbulence—relevant description of turbulent motion, analysis of the random noise field in terms of the characteristics of the turbulent field; subsonic and supersonic jet noise theory and comparison with experiments; current developments in jet noise theory; jet noise suppression; noise radiation from boundary layers on bodies and on duct walls; analysis of noise generated by propellers, helicopter rotor blades, and blades or rotating machinery; noise radiation from bodies in motion; airfoil and hydrofoil noise; noise from bodies such as those of aircraft shape; sonic boom; current topics in aerodynamic noise. Prerequisite: 201A and B or equivalent or consent of instructor.

3 units, Aut (Staff) MWF 2:15
alternate years, 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 linearization of similarity parameters. Review of elementary aerodynamics and complex variables is required.

2 units, Win (Jones) F 2:15-3:15

205. Current Topics in Aerodynamic Design — Fundamental theory and simple computational methods are employed in a survey of recent aerodynamic design developments. Topics include: airfoil developments (natural laminar flow, low Reynolds number airfoils, supercritical sections), wing design (optimization, winglets, swept forward and oblique wings), unconventional configurations (canard, 3-surface, tailless designs), propulsion (prop-fans, propellers, flapping flight), and applications of CFD in aircraft design. The course involves "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, Spr (I. Chang) TTh 9:30-10:45
alternate years, given 1987-88

210A. Fundamentals of Compressible Flow — Emphasis placed on the development of the full three-dimensional nonsteady field equations and the associated constitutive relations representing the working fluid. Examples given for the specialized cases of flows in one and two dimensions; compressible Couette flow, normal shock wave, potential flow, linearized potential equation, lift and drag of thin airfoils, similarity rules for subsonic and supersonic flow, quasi-one-dimensional flow, conical flow, Prandtl-Meyer flow. Prerequisite: 192 (may be taken concurrently) and Mechanical Engineering 131A or equivalent.

3 units, Aut (Baganoff) 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 nonisentropic flow. Real gas effects in compressible flow. Review of 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 phenomena in flow of gases and mixtures over a wide range of velocities and altitudes. Emphasis on thermochemical equilibrium behavior under hypervelocity conditions, with additional introductory material on nonequilibrium flows. The thermostatical basis for the calculation of energies, specific heats and shock strengths in dissociated and ionized gases is examined. Effects of viscosity and heat conductivity are included 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 are explored. Recommended: Familiarity with the elementary concepts of compressible flow.

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

213A. Atmospheric Entry—High-speed atmospheric entry subjects vehicles to intense heating, decelerations and structural loads. These phenomena will be formulated and their intensity determined for a variety of flight paths. The trajectories to be studied will range from nonlifting (ballistic) to constant lift and variable lift paths. Different heat shielding methods will be studied and their effectiveness compared. Example applications will include the Space Shuttle, aerospace plane, Mars return missions, and atmospheric probe vehicles. Comprehension of fundamental physical principles will be emphasized. Prerequisite: Understanding of compressible, equilibrium, real gas flows desirable (i.e., 210A and/or 212).

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

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

3 units, Aut (Lomax) MWF 9


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 selected 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—Emphasis is on design and understanding of modern optical systems. Topics include geo-
metrical optics, aberration theory, systems layout, applications such as microscopes, telescopes, optical processors. A computer ray tracing program will be 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, given 1987-88

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) MW 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. The course will cover collision processes leading to vibrational or electronic excitation; master equation; quasi-steady-state approximation to master equation; equations governing vibrational, electron, 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, with emphasis given to 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. First studied is the time evolution of probability distributions, linking problems in chemical kinetics, rarefied gas flows, thermodynamic nonequilibrium, and finite difference methods in fluid mechanics. Focus is then turned to 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. Students study various stochastic models on microcomputers as part of their homework assignments.

3 units, Spr (Baganoff) MWF 1:15

226. Modern Photodiagnostics in Gasdynamic Research—The fundamentals of laser-spectroscopic techniques and their application to the nonintrusive diagnostics of aerothermodynamic and combustion flows. Emphasis is on the fundamental physics associated with the methods described. Topics include diagnostic requirements in aerothermodynamic and combustion research; laser velocimetry; linear and nonlinear laser spectroscopic methods including laser-induced fluorescence, coherent Raman processes, and multi-photon processes. Recommended prerequisites: 211 and 212.

3 units, Spr (McKenzie) TTh 2:45-4:05

227. Atmospheric and Space Physics—Introduction to selected topics of geophysics and astronomy with emphasis on conditions in the solar and planetary atmospheres, interplanetary space, and on solar-terrestrial relations. Elements of gravitational theory and orbital mechanics with application to determination of density of the upper atmosphere and the shape and internal structure of the Earth. Properties, time variations, and theoretical representation and interpretation of the upper atmosphere, ionosphere, magnetic field, and magnetosphere of the Earth, the photosphere, chromosphere, the corona of the Sun, and the solar wind in interplanetary space. Theory of Motion of a charged particle in electric and magnetic fields with application to Van Allen particles and cosmic rays. Outline of the principal features of the interaction of the solar wind with the Earth and other objects in the Solar System.

3 units, Spr (Spreiter) TTh 2:45-4:05


3 units, Spr (1. Chang) TTh 9:30-10:45

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 are highlighted. Fundamental aerodynamics of rotors are examined, including general momentum theory, blade element theory, and an introduction to vortex theory. Aerodynamic and mis-
3. Preliminary Design and Experimental Methods for Rotary Wing Aircraft—The preliminary design procedures for rotary wing aircraft are explored using graphical as well as modern computational methods. The important scaling parameters of rotorcraft are developed and procedures for flight testing, wind-tunnel testing, and ground based simulation are explored. A model helicopter is designed, constructed, and flown as a part of this course. 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 1987-88

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, with emphasis given to the unique features of V/STOL configurations, and coupled six-degree-of-freedom control situations pertinent to specific mission applications of the helicopter as well as 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 are noted in conclusion. Prerequisites: 230, 231. Recommended: 232.

3 units, Aut (Schmitz, Franklin) MWF 3.15

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

236. Spacecraft Design—Design of unmanned spacecraft and spacecraft subsystems explored with concentration on identification of design drivers and current design methods. Principal areas covered are 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 are introduced 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 explored and used to predict rotor impulsive noise. Other sources of rotor noise are reviewed and surveyed as to their relative importance commercially. Prerequisite: 230. Recommended: 231.

3 units, Win (Schmitz, Yu) MWF 3.15

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 struc-
tured. 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

240C. Advanced Analysis of Structures—Analysis of structures with geometric and material nonlinearities; calculations of stresses and deformations, determination of structural stability. Analysis of post-buckling behavior. Limit analysis of trusses, frames and plates. Failure analysis and fracture criteria, fracture mechanics. Prerequisite: 240B or consent of instructor.

3 units, Win (F. Chang) TTh 1:15-2:30

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

242. Classical Dynamics—Accelerating and rotating reference frames. Kinematics of rigid body motion; Euler angles, direction cosines. D'Alembert's principle, equations of motion. Inertia properties of rigid bodies. Dynamics of coupled rigid bodies. Lagrange's equations and their use. Dynamic behavior, stability, and small departures from equilibrium are consid-

ered throughout the course. Prerequisite: Engineering 12 or equivalent.

3 units, Aut (Reeves) WF 2:15-3:30

243A. Spacecraft Dynamics I—(Same as Mechanical Engineering 232A.) Kinematics of spacecraft; specification of large orientation changes of a rigid body in terms of direction cosines, Euler parameters, Rodrigues parameters, orientation angles; generalized speeds, partial angular velocities and partial velocities. Gravitational forces and moments. Dynamics of simple spacecraft; effects of gravitational moments and orbit eccentricity; gyrostats.

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


3 units, Spr (Kane) WF 11-12:15

244A. Free and Forced Motion of Structures—Vibrations and forced response of linear systems with a finite number of degrees of freedom. Vibrations and forced response of continuous structures, developed in a framework of analytical dynamics; rods, beams, membranes and other elastic systems. Discussion of approximate methods for analyzing nonuniform and built-up structures. Finite-element methods presented in a dynamic context. Introduction to random responses and to nonlinear systems, with emphasis on stability. Prerequisites: 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. Introduction to aeroelastic operators and unsteady aerodynamics in two dimensions. Forced response, static and dynamic eigenvalues of a simplified system. Aeroelastic analysis of representative onedimensional and two-dimensional systems. Prerequisite: 244A or equivalent.

3 units, Win (Ashley) MWF 8

244C. Aeroelasticity—Continuation of 244B. The unrestrained elastic flight vehicle. Modern unsteady aerodynamic theory, including tran-
sonic flow and numerical methods for three-dimensional surfaces. Review of experimental methods. Special topics of current interest, such as optimization, coupling between aeroelastic phenomena and automatic controls systems, and problems of power machinery, windmills, etc. Prerequisite: 244B.

3 units, Spr (Ashky) MWF 9

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 241B.)

247. Theory of Shells—(Enroll in Mechanical Engineering 241A.)

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.)

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

253B. Wave Propagation — (Enroll in Mechanical Engineering 236B.)


3 units, Spr (Springer) MWF 9

257. Design of Composite Structures—Analyses of stresses and deformations in laminated composite structures, including the effects of inplane and out-of-plane couplings and interlaminar stresses. Application of finite element methods to composites. Buckling and vibrations of composite beams, plates and shells. Failure analyses, failure criteria and fracture mechanics. Strength predictions, analyses of laminates containing holes, cut-outs, bolted and bonded joints. Prerequisites: 240B, 256 or consent of instructor.

3 units, Aut (F. Chang) TTh 1:15-2:30

261A. Introduction to Turbulence—(Enroll in Mechanical Engineering 261A.)

270. Introduction to Linear System Theory—(Enroll in Electrical Engineering 363.)


3 units, Aut (Cannon) TTh 9:30-11 alternate years, given 1987-88


3 units, Aut (Bryson) TTh 9:30-11 alternate years, given 1987-88


3 units, Win (Staff) MW 7:30-8:45 alternate years, given 1987-88


3 units, Spr (Staff) TTh 8-9:15 alternate years, given 1987-88

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. On-Off Control Logic—(Enroll in Engineering 209.)

278A. Optimal Control of Dynamic Systems—Optimization problems for dynamic systems

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


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


3 units, Win (Breakwell) MWF 11

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 (Bryson) 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

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. Prerequisite: 279A, 278A or equivalent.

3 units, Spr (Breakwell) TTh 9:30-10:45 alternate years, given 1987-88

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. Prerequisites: 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 covered include an introduction to L-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 — This is an in-depth course which emphasizes the off-design and dynamic behavior of airbreathing engines. Topics covered include 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

286. Advanced Space Propulsion—Topics selected from recent developments in rocket propulsion, solid-fueled ramjet, ducted rocket, hybrid rockets, dual-fuel and mixed-mode rockets, advanced space propulsion concepts, combustion, ablative heat transfer, electric propulsion and applications to satellite control and station-keeping.

3 units, 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)

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 1987-88

297. Seminar in Flight Mechanics and Control—Problems in all branches of vehicle con-
control, guidance and instrumentation presented by researchers from on and off the campus. Graduate students with an interest in automatic control applications in flight mechanics, guidance, navigation and mechanical design of control systems normally attend. Others are invited. Registration for a unit of credit, without letter grade, is optional; a letter grade is given for students who make presentations.

1 unit, Aut, Win, Spr (DeBra) W 4:15

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

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

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

CHEMICAL ENGINEERING*

Emeriti: (Professor) David M. Mason
Chairman: Robert J. Madix
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. Schwaar
Lecturers: James C. Schlatter, Manesh Shah
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 under the "Degrees" section in this bulletin) which provides a broad background in the fundamentals of chemistry as well as basic training in separations processes, engineering thermodynamics, transport phenomena, polymer science, process analysis and control, plant design, and applied chemical kinetics. In addition, this program includes courses in physics, mathematics, chemistry, and basic engineering. With the exception of these basic courses and the engineering depth sequence, there is no set program which all undergraduate students follow.

A sample B.S. program is available from the Department of Chemical Engineering advisors or the Dean's Office, School of Engineering. It is recommended that the student discuss the prospective program with his or her advisor, especially if transferring from chemistry, physics, or another field in engineering. With some advanced planning, the student can usually arrange to attend one of the overseas campuses.

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, Electrical Engineering, Materials Science and Engineering, Mechanical Engineering, Operations Research, Applied Physics, Biological Sciences, Chemistry, Computer Science, Mathematics, Physics, Statistics, and the School of Earth Sciences, and (b) all upper-division undergraduate courses in Biological Sciences, Computer Science (108 and above), Mathematics, Physics, and Statistics. (2) Undergraduate courses in chemical engineering excluding 110, 120, 130, 180A,B may be included as part of the 45-unit master's program. Departures must be approved by petition of the student to the chairman of the Department of Chemical Engineering. Credit toward the M.S. degree will not be given for Chemical Engineering Special Topics courses numbered 270-278, or for the colloquium, 300. Note, however, that the student must register for 300
and attend the colloquia. Students wishing to obtain research experience should choose a research advisor and enroll in Chemical Engineering Research 290, for which up to 6 units may count toward the 45-unit requirement; 290, however, may not be substituted for any of the required four lecture courses in the Chemical Engineering 200-series. A written report describing the results of this research must be submitted to and approved by the research advisor.

To insure that an appropriately balanced program is being taken by all M.S. candidates, the student's program must be approved by the departmentally appointed graduate advisor, and a tentative program for the entire academic year should be worked out by the student and advisor at their first meeting of the academic year.

**Minimum Grade Requirement**—All courses taken to satisfy the M.S. degree requirements must be taken for letter grades, if offered, with the minimum average letter-grade equivalent 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 equivalent 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 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-series. A written report describing the results of this research must be submitted to and approved by the research advisor.

**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 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-series. A written report describing the results of this research must be submitted to and approved by the research advisor.

**Teaching Requirement**—All prospective Ph.D. candidates, regardless of the source of their financial support, are required to gain teaching experience as an integral part of their graduate training in the Department of Chemical Engineering.

**Qualifying Examination**—To be advanced to candidacy for the Ph.D. degree, the student must pass a preliminary qualifying examination. First-year students will be asked to present orally and defend a critical review of a published paper before the faculty at the beginning of the Spring Quarter. This examination shall be used as the basis for deciding whether or not these students will be allowed to choose research advisors and begin their thesis research in the Spring Quarter of their first year. Failure of this examination will lead to termination of the student's study with an M.S. degree and precludes financial aid beyond that already promised. Students passing the examination described
above will take a qualifying examination consisting of an oral defense of their research work before the faculty early in the Autumn Quarter of their second year.

Thesis Requirement—A dissertation based on a successful investigation of a fundamental problem in chemical engineering is required, and the student enrolls in Chemical Engineering 290 during the course of this research. It is expected that normally in 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 thesis, which has already been approved by his or her research advisor, to the Reading Committee. No sooner than four weeks after this date, the student’s University Oral Examination will be scheduled. This exam, based on the candidate’s thesis research, is in the form of a public seminar followed by private questioning by an examining faculty committee. 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, electro- and photochemical energy conversion, applied thermodynamics and chemical kinetics, polymer physics, surface and interface science, kinetics and catalysis, membrane separation processes, bioengineering, and chemical instabilities. 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) MWF 10

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. Separations Processes—Application of the equilibrium-stage concept to design of mass-transfer devices; phase relationships; countercurrent multistage extraction and distillation processes, simplified graphical and computer design methods; chromatographic separations, thermal diffusion, flow field fractionation. Prerequisite: 110 or equivalent.
3 units, Spr (Gast) MWF 10

130. Principles of Design of Chemical Reactions and Reactors—Design of chain and catalytic reactions from elementary steps with the help of transition state theory, the quasi-steady state approximation, and the concept of rate determining step and most abundant reaction intermediates. Elementary design of reaction networks for optimum selectivity, and of reactors of typical morphology defined by their thermal characteristics, mass transfer limitations, and residence time distributions. Introduction to catalyst design. Prerequisites: 110, 140, 150, Chemistry 171, 173.
3 units, Win (Staff) TTh 1:15-2:30

140. Fluid Mechanics—the flow of isothermal fluids from a momentum transport viewpoint. Continuum hypothesis; scalar fields; fluid statics; deformation of continuous media; non-Newtonian fluids; the equations of motion; creeping flow; potential flow; boundary layer theory; turbulence; 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 (Homsy) MWF 9

150. Energy and Mass Transport—A basic course in the transport of energy and mass in solid and fluid continua. Fourier’s law, heat transfer in solids, laminar flow, forced and free convection, boundary-layer heat transfer, natural convection with application to geophysical flows, energy transport by radiation, Fick’s Law, binary diffusion, the equation of convective diffusion, mass transfer with chemical reaction, transport in turbulent flows, heat and mass transfer analogies. Prerequisite: 140 or equivalent.
3 units, Win (Acrivos) MWF 9

155. Process Analysis and Control—Analysis of plant units for control design with emphasis on stability. Dynamics of first-, second- and higher-order physical systems, as well as instruments and controllers. Practical examples relat-

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

160. Chemical Engineering Plant Design—Application of chemical engineering principles to design of practical plants for chemical manufacture. Topics include: equipment design for distillation, chemical reactions, heat transfer, pumping, and compression; estimation of capital expenditures and production costs; plant construction. Open to seniors in chemical engineering or by advance consent of instructor.

3 units, Spr (Schwaar) TTh 3:15-5:05

180. Chemical Engineering Laboratory—Investigation of a number of experimental aspects of chemical engineering science with a strong emphasis on 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

199. Chemical Engineering Management—Participation by students in a simulated engineering corporation solving open-ended technical and business problems facing management in areas involving chemical processing, the environment, and energy. Emphasis on problem synthesis, creative and strategic thinking, and communication skills. Provides an understanding of what is expected of a new engineer in industry, the viewpoint of management, and skills needed for success. Management representatives from industry and academia will participate to add authenticity to problems and case histories and to increase students' skills in dealing with management. Prerequisite: Completion of undergraduate chemical engineering courses; other engineering majors may elect to enroll upon consent of instructor.

1 unit, Aut (Grossberg) T 12

CHEMICAL ENGINEERING 119

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, Spr (Fuller, Homsy) TTh 9:30-10:45


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

222. Transport Phenomena II—Continuation of 221 with emphasis on 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) alternate years, given 1987-88

3 units, Aut (Fuller) MWF 2:15-3:30 not given 1987-88


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


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

232. Interfacial Macromolecular Chemistry—Introduction to colloidal and interfacial phenomena with emphasis on macromolecular systems; electrostatic interactions, solvent effects and micellar solutions. Applications to biological systems with emphasis on proteins: proteins at interfaces, proteins as osmotic agents in physiological fluids, proteins as biocatalysts, separation and purification of proteins. Immobilization of enzymes and whole cells; cell cultures with approaches to reactor analysis; analysis of protein delivery systems.

3 units, Spr (Robertson, Gast) TTh 1:15-3:30

233. Polymer Physics—Emphasis on statistical analysis of the molecular structure of high polymers. Topics include: spatial configuration of the isolated polymer chain, statistical thermodynamics of polymer solutions, and amorphous state, morphology of semicrystalline polymers.

3 units, Win (Frank) MWF 11-12:15 alternate years, given 1987-88

234. Polymer Chemistry—Examines the principal methods of polymer synthesis, with emphasis on polymerization mechanisms and reaction kinetics, and their role in influencing polymer composition, structure, and ultimate properties. Topics include 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) (M)WF 2:15-3:30 not given 1987-88

270-277. Special Topics in Chemical Engineering—Discussion of recent developments and current research in specialized fields. Open to qualified students with consent of instructor; units by arrangement.

Aut, Win, Spr (Staff) by arrangement

270A,B,C. Fluid Mechanics.
(Acrivos)

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

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

273A,B,C. Bioengineering.
(Robertson)

274A,B,C. Microrheology.
(Fuller)

275A,B,C. Surface and Interface Science.
(Madix)

276A,B,C. Polymer Physics.
(Frank)

(Homsy)

(Gast)

290. Graduate Research in Chemical Engineering—Laboratory and theoretical work for graduate students on chemical engineering problems leading to partial fulfillment of requirements for an advanced degree. Credit is not given until the student has satisfied the specific report or dissertation requirement.

(Staff) by arrangement

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

300. Colloquium—Students 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

Chairman: Haresh C. Shah
Associate Chairmen: James M. Gere, Paul V. Roberts


Associate Professors: Anne S. Kiremidjian (on leave Spring Quarter), Raymond E. Levitt, Clyde B. Tatum

Assistant Professors: David L. Freyberg (on leave Autumn Quarter), Dunja Grbić-Galić, Henry C. Howard, Jeffrey R. Koseff, Stephen G. Monismith, Peter M. Pinsky, Raymond B. Seed, Lyna L. Wiggins

Professor (Research): C. Allin Cornell
Professor (Teaching): Gilbert M. Masters (on leave Winter and Spring Quarters)

Associate Professor (Research): Martin Reinhart

Visiting Professor: Britton Harris


Consulting Associate Professor: Angelos N. Finkidakis, Hasan Kamil, Martin W. McCann, Christopher Rojahn

Consulting Assistant Professors: Paolo F. Ricci, Douglas M. Mackay, Benjamin R. Roberts, Steven R. Winterstein

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, geotechnical engineering, structures, or a great variety of other branches. Laboratory facilities are available to students in construction, fluid mechanics, environmental engineering and science, soil mechanics, 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 Engineering (including elements of hydraulics, hydrology, and environmental fluid mechanics)

Resources Planning
- Energy and Environmental Planning
- Land Use Planning
- Water Resources Planning

Structural and Geotechnical Engineering
- Earthquake Engineering
- Foundation Engineering
- Reliability and Risk Analysis
- Soil Mechanics
- 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 soil 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.
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. 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. In the field of knowledge-based expert systems, faculty from all parts of civil engineering are cooperating in the development of new courses and programs. Students are encouraged to specialize in these rapidly developing fields.

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 PhD. 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 Engineering and Management Center.

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

ENVIRONMENTAL AND WATER STUDIES

This program covers a broad spectrum of specialities, including environmental engineering and science, water resources engineering 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 engineering.

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 Engineering program is directed toward an integrated understanding of the quantitative aspects of the movement of water in streams, reservoirs, and estuaries, over land and beneath the ground. Those with strong specific interests develop coherent programs by
combining water resources with, e.g., environmental engineering and science courses, or for
hydrology, courses from the School of Earth Sciences and the Department of Statistics, or
for a fluid mechanics focus, courses from the Department of Mechanical Engineering, etc.

The programs are kept flexible to foster interaction among students and to encourage the development of individual programs suitable for a broad range of engineering and science backgrounds and career goals. Modern laboratories for water quality control, hydraulics and environmental fluid mechanics are well-equipped and instrumented for advanced research and instruction.

RESOURCES PLANNING

This program prepares the engineer as a planner and manager of life-support and public facility systems which are necessary for the development of cities and regions. These systems, include water resources and water quality projects, energy facilities, land use controls, urban forms, and hazardous waste disposal facilities. The planning and management of these facilities and systems requires the integration of a variety of technical, social, economic, institutional and environmental considerations, all of which are incorporated into the curriculum of the Resources Planning Program.

The program includes graduate curricula in three speciality areas: water resources planning, energy and environmental planning, and land use planning. Within these frameworks each student is encouraged, with the assistance of his or her faculty advisor, to design a course sequence meeting his or her interest. Students who did not major in Civil Engineering as undergraduates are eligible for admission, provided they have completed at least one year of calculus.

Faculty members in the Resources Planning Program maintain very close ties with the undergraduate Urban Studies Program; civil engineering students are encouraged to use appropriate Urban Studies courses as part of their graduate programs.

STRUCTURAL AND GEOTECHNICAL ENGINEERING

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

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.

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 is designed to encourage highly qualified students to undertake a more intensive study of civil engineering than is required for the normal major, with course and research work of high distinction.

The Honors Program involves an in-depth research study in an area proposed to and agreed to by a Civil Engineering Department faculty advisor and completion of a thesis of high quality. A written proposal for the research to be undertaken must be submitted and approved in the fourth quarter prior to graduation. At the time of application the student must have an average grade of at least 3.5 for course-work at Stanford, and this grade record must be maintained to graduation. The thesis will be supervised by a Civil Engineering Department faculty advisor, and must involve input from the School of Engineering Writing Program via Engineering 102S or equivalent. Students are encouraged to present their results in a seminar for faculty and other students. Up to ten (10)
units of CE 199, Directed Reading and Special Studies in Civil Engineering, may be taken to support the research and writing (not to duplicate Engineering 102S). These units are beyond the normal civil engineering program requirements.

**GRADUATE PROGRAMS**

**MASTER OF SCIENCE**

Basic University requirements governing degrees of Master of Science, Engineer, and Doctor of Philosophy are described in the "Degrees" section of this bulletin.

Programs are available leading to the degree of M.S. in Civil Engineering with special designation on the diploma as follows: Computational Mechanics, Artificial Intelligence and Expert Systems, Construction Engineering and Management, Earthquake Engineering, Energy and Environmental Planning, Environmental Engineering, Environmental Engineering and Science, Geotechnical Engineering, Industrial Construction, Land Use Planning, Soil Mechanics and Foundations, Structural Engineering, Structural Mechanics, Water Resources Engineering, and Water Resources Planning. Detailed statements of the requirements for all master's degrees and the specific course requirements for a degree with special designation may be secured by request to the Civil Engineering Department.

Students admitted to graduate study with a Bachelor's Degree in Civil Engineering (or its equivalent) from an accredited curriculum can satisfy the requirements for the degree of Master of Science in Civil Engineering by completing a minimum of three quarters of full-time residence and a minimum of 45 units of study beyond the Bachelor's Degree. At least 36 of these units must be taken at Stanford. A minimum 2.7 letter grade indicator (LGI) is required for candidates to be recommended for the M.S. Degree. No thesis is required.

The program of study must be approved by the faculty of the department and should include at least 40 units of courses in engineering, mathematics, science and related fields unless it can be shown that other work is pertinent to the student's objectives.

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 average (3.0 LGI) 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. Dissertation research in absentia is not permitted.

The program of study will be arranged by the prospective candidate at the beginning of the second year with the advice of a faculty committee whose members are nearest in the field of interest to that of the student. The chairman of the committee will serve as the student's pro tem advisor until such time as a member of the 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 Univer-
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 $18,000. 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 also are available. Engineer and Ph.D. candidates may be able to use research results as a basis for the thesis or dissertation. Assistantships and other basic support may be supplemented by fellowship and scholarship awards or loans. Continued support is generally provided for further study toward the Engineer or Doctor of Philosophy degree subject to performance of the student, availability of research funds, and requisite staffing of current projects. Detailed information may be obtained by writing to the Department of Civil Engineering.

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 (Gere) TTh 10 and W 2:15

125. Computers in Civil Engineering—Examines changing role of microcomputers and large computers in civil practice. Applications of computers in several fields of civil engineering. Tandem use of microcomputers to do pre- and post-processing and mainframes to do extensive computational tasks. Comparative analysis of alternative equation solving procedures and how they are applied in a civil engineering context. Software programs studied include spreadsheets, equation solvers and linear programming routines. Prerequisite: Computer Science 106A or equivalent. Enrollment limited with priority given to seniors in civil engineering.
4 units, Spr (Staff) 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, Aut (Staff) MWF 1:15
alternative years, given 1987-88

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 1
lab TTh 1:15-5:30

144. Construction Engineering and Management—Introduces techniques for coordinating decisions and actions of the various participants involved in the design and construction of civil engineering projects. Covers legal, contractual and behavioral determinants of company and
project organization structures; markets for key construction resources and products; and techniques used in estimating, planning, coordinating and controlling time, cost, quality and scope. Limited to juniors, seniors, and graduate students. This is an appropriate course for GSB or other non-CE majors who wish to become "informed buyers" of construction services.

3 units, Win (Levitt) MWF 10

145. Construction Equipment and Methods—Construction engineering fundamentals; equipment economics; selection and efficient application of equipment; analysis of production output and costs. Prerequisites: Engineering 10 and 60.

3 units, Spr (Paulson) MWF 9; one or more field trips by arrangement.


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

160. Water-Resources Engineering—Hydrologic measurements, runoff relations, groundwater, water law, reservoir design, frequency analysis, hydraulic structures, planning of water-resources projects. Prerequisites: Engineering 21, 60.

4 units, Aut, (Staff) MWF 9 and W 2:15-4:05

170. Environmental Science and Technology—(Same as VTTS 182.) An introduction to the causes, effects and methods of controlling environmental degradation. Stress placed on problems associated with water resource development and water pollution; air pollution; population; and environmental effects of energy consumption. (Intended 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. (Graduate students register for 228.)

3 units, Win (Ortolano) TTh 1:15-2:30 alternate years, not given 1987-88

173. Energy and Society—(Enroll in Engineering 176.)

174. Noise Pollution—(Enroll in Aeronautics and Astronautics 138.)

176. Small Scale Energy Systems—Theoretical and practical considerations involved in the design of small scale energy systems suitable for a single dwelling or small cluster of buildings. Emphasis on solar water heating and passive and active solar space heating. Photovoltaics and wind-electric systems are also considered. Open to all students. (Graduate students register for 236.) (DR:8)

3 units, Win (Staff) 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. Prerequisite: 176 and computer experience. Enrollment is limited.

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. Prerequisites: Engineering 11.

4 units, Aut (Kiremidjian) MWF 10 and W 2:15-4:05

181. Design of Steel and Reinforced Concrete Structures—General discussion of methods of design, types of loading and structural systems. Properties of structural steel, concrete and reinforcing steel. Design and analysis of structural elements: connections, tension and compression members, beams, beam-columns, walls and footings. Strength and serviceability requirements. Design of simple structural building systems. Prerequisites: 114 and 180 or equivalent.

5 units, Win (Krawinkler) TTh 9-11 and W 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. Course includes laboratory projects. Prerequisite: Engineering 11.

4 units, Aut (Staff) 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

201. The Creation and Solution of Environmental Models—Focus on mathematical and numerical models for simple physical systems in the environmental and water studies context. Governing equations plus appropriate boundary and/or initial conditions derived from physical principles. Application of ordinary and partial differential equation theory, Fourier series, numerical integration and finite difference techniques, and introduction to method of characteristics. Prerequisites: Mathematics 43, Computer Science 106A and 103, or equivalent experience and consent of instructor.

3 units, Aut (Staff) MWF 11

202. Numerical Solution of Environmental Models—Focus on numerical models for simple physical systems in water studies context. Designed to acquaint students in water resources engineering with numerical methods for solving partial differential equations. Methods for model equations of parabolic and hyperbolic type. The convergence consistency, and stability properties of these methods. Also briefly quadrature and errors and error propagation in calculations. Prerequisites: Knowledge of FORTRAN, some experience with partial differential equations and 201.

3 units, Win (Koseff) MWF 10

203. Statistical Models in Civil Engineering—Applications of probability and statistical analysis to civil engineering; model construction from probability theory; descriptive statistics; estimation with small samples; recognition of variation including professional elements; models for reliability studies of civil engineering designs; construction of complex models. Prerequisite: Graduate standing, Mathematics 43.

4 units, Aut (Shah) TTh 9-11

204. Structural Reliability—Probability models for loads and resistance; definition of failure events of structural components and systems; statistical uncertainties; derivation of minimal cut set systems; solution techniques for complex systems, load combination and capacity deterioration; application to structural codes. Prerequisite: 203 or equivalent.

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

205. Stochastic Processes and Decision Statistics for Civil Engineers — Description of stochastic processes; application of Poisson and Markov processes to civil engineering problems; representatives of structural loads and response; introduction to statistical decision theory, Bayes theorem; prior and pre-posterior analysis; posterior analysis; utility functions; applications to civil engineering problems. Prerequisite: 203 or equivalent.

4 units, Spr (Kiremidjian) MWF 1:15 given 1987-88

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

1 unit, Aut (Staff) M 3:15-5:05

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

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

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

1 unit, Aut (Ortolano) 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 (Komer) MWF 11

224. Microcomputers in Resources Planning—An introduction to microcomputer based
spreadsheet and graphics applications in resources planning. Also covers the use of word processing and communications software to transfer information between microcomputers and mainframes.

1 unit, Aut (Staff) T 10-12

225. Microcomputers in Urban and Environmental Planning—(Same as Urban Studies 185 with additional assignments for students who desire graduate credit.) Examines current applications of microcomputer technology in the design professions and other business and agencies concerned with the built environment and urban services. Software programs studies include decision analysis, spreadsheets, Land Management Systems (LMS), and statistical mapping as they pertain to architecture, construction, urban design, environmental planning and urban planning. Coursework considers organizational changes which may occur in response to technological innovations as well as future directions in the field. Prerequisite: Computer Science 105A or consent of instructor.

4 units, Spr (Wiggins) alternate years, given 1987-88

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.

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

232. Computers in the Third World—Planning and policy for computer use in the third world: a research seminar with lectures, discussions, and student project reports. Topics include: computer applications; the "appropriateness" of the technology; dependency; economic advantages and disadvantages; cultural, institutional, and technical problems.

3 units, Win (Harris) MTh 3:15-4:30

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. Initial part of the course consists of a survey of current practices, their origin and evolution, and an examination of the relation between land use planning and environmental protection. Emphasis is placed on the regulatory and permitting process with examples of actual projects in both urban and suburban/rural settings. Guest speakers from public, private and conservative organizations bring different perspectives to in-class discussions. Students will carry out case studies or investigations commensurate with standing.

3 units, Aut (Staff) by arrangement

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

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

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—Emphasis on site selection procedures for facilities which are difficult and controversial to locate because of their social and environmental externalities; particular facilities studied will include landfills, hazardous waste sites, conventional power plants, and alternative energy systems. Review of siting techniques including constraint mapping, optimization procedures and decision analysis. Review of new planning strategies, including environmental dispute resolution. Prerequisite: 234 or consent of instructor.

3 units, Spr (Wiggins) TTh 11-12:30

240. Analysis and Design of Construction Operations—Primary focus is on understanding, analyzing, designing and improving work at the site. Develop skills in data acquisition, analysis, simulation, modeling and design. Emphasis is 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. Provides concepts of networking tech-
niques including treatment of uncertainty, sub-networks, resource allocation and leveling, time/cost tradeoffs and specification requirements. Also covers basic techniques for scope determination, cost engineering, materials management and quality control.

4 units, Aut (Fondahl, Tatum)  
MW 9, F 9-10:50

242. Managing Construction Projects and Companies—Integration and application of techniques for managing individual construction projects and construction companies. Provides a capstone of case studies for application of techniques covered in the prerequisite courses. Introduces techniques for strategic planning in construction companies. Requires individual and group efforts on problems and case studies. Prerequisites: 240, 241 or instructor's permission.

4 units, Spr (Tatum) MW 10-12

243. Computer Applications in Construction—Emphasis on analysis, design, development and implementation of computer-based systems for construction engineering and management. Supporting topics cover computer hardware and software technology. This is a seminar-laboratory course requiring individual and group projects building upon construction knowledge and experience. Prerequisites: 240 and a computer course equivalent to Engineering 70A. Corequisite: 259. Enrollment limited to 20, with priority given to students in graduate construction program.

4 units, Win (Paulson) MW 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.

3 units, Win (Barrie) TTh 1:15-3:15

245A. Computer-Aided Civil Engineering—Introduction to the use of computer hardware and software tools in Civil Engineering practice and research. Introduces fundamentals and illustrates applications to Civil Engineering. Topics include data structures, database management systems, computer graphics, geometric modeling, algorithms, programming languages, user interfaces, software engineering, large scale integrated systems, alternate computer architectures and artificial intelligence. Prerequisite: A course in structured programming techniques.

3 units, Win (Staff) MWF 11

245B. Expert Systems in Civil Engineering—Intended as a first course for graduate students interested in applications of Artificial Intelligence to Civil Engineering problems. Introduction to relevant concepts from Artificial Intelligence and Expert Systems, and illustrations of these concepts through discussion of previous development efforts. Students will be introduced to several microcomputer expert system toolkits and alone or in small teams will use one of them to develop a working expert system based upon knowledge in some part of the civil engineering domain. Instructor will guide and critique the applications at all stages of development. Class size is limited to 20; priority is given to civil engineering graduate students. Advanced undergraduates may be admitted to the course by permission of the instructor. Prerequisite: Familiarity with microcomputers. Recommended: Knowledge of a programming language.

3 units, Spr (Levitt) TTh 9, plus one hour by arrangement


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

248. Construction Financing in Real Estate and Land Development—Study of the inter-relationships between all of the variables that make up a successful real estate project; places heavy emphasis on the financial aspects involved in land acquisition, land development, construction, permanent lending, and project management. In addition, various aspects of joint venturing, including the control of functions and equity financing are discussed. Enrollment limited to 20, with priority given to students in the graduate construction program. Prerequisite: Engineering 60, Industrial Engineering 133 or equivalent.

3 units, Spr (Medearis) TTh 8, plus one hour by arrangement

250. Managing Human Resources in Construction—A study of human behavior in individuals, in small groups, and in project and company organizations. Develops integrated theories of perception, motivation and learning with examples drawn from construction. Provides both independent and supervised exercises in group problem solving, using selected
Credit registration is restricted to students in the graduate construction program. Construction graduate students each quarter for the required construction graduate courses, taking three quarters. Because lecture content builds upon the industry and government. Normally taken by students 258A, B, C.

Seminar in Construction Engineering — Special topics with speakers from industry and government. Subject relates construction organization structure to key characteristics of the tasks to be performed, available technologies for production and administration, skills and motivation of the workforce, and the degree of uncertainty in the task environment. Considerable attention is devoted to issues in the structuring of matrix organizations for design tasks, and project organizations for construction tasks. Some consideration of matrix organizations in industrial research and development settings. Students will work in teams of four to develop written solutions to case problems.

Enrollment limited to 40 students, with priority given to those from the graduate construction program.

2 units, Aut (Oglesby) group meeting TTh 8 plus group meeting by arrangement

251. Construction Project and Company Organizations — Provides a theoretical framework to analyze and design appropriate organization structures for projects and firms in the construction industry. Subject relates construction organization structure to key characteristics of the tasks to be performed, available technologies for production and administration, skills and motivation of the workforce, and the degree of uncertainty in the task environment. Considerable attention is devoted to issues in the structuring of matrix organizations for design tasks, and project organizations for construction tasks. Some consideration of matrix organizations in industrial research and development settings. Students will work in teams of four to develop written solutions to case problems.

3 units, Aut (Levitt) T 10, Th 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 rock excavation, tunneling, pile driving, conveyors, and temporary facilities. Estimating topics include site investigation, quantity take-off, work analysis, costing and bid preparation. Prerequisites: 145 and 255. Also includes estimates and costs for construction of large buildings.

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

255. Concrete Construction — Includes technical and management aspects of the methods and operations involved in concrete construction. Covers concrete production, formwork, field operations and special techniques. Requires student group preparation of a plan for a concrete construction project.

3 or 4 units, Win (Tatum) MW 1:15-3:15

255A, 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.

255A. 1 unit, Aut (Staff) by arrangement
255B. 1 unit, Win (Staff) by arrangement
255C. 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 are expected to consult specialists from the construction industry as well as make use of University facilities. Prerequisites: Graduate standing in construction and consent of instructor. See 299 for alternative for individual studies.

259A. 1–3 units, Aut (Staff) by arrangement
259B. 1–3 units, Win (Staff) by arrangement
259C. 1–3 units, Spr (Staff) by arrangement

261. Watershed Hydrology — Techniques and models for the analysis of watershed hydrology, with a focus 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. Prerequisites: 201, 160, 262 or equivalents.

3 units, Spr (Freyberg) MW 10

262. Open Channel Flow — A study of steady and unsteady flow in prismatic and non-prismatic channels. Part I: definitions and general derivations of mass, momentum and energy equations. The energy and momentum principles are reviewed. Part II: Focus on non-uniform flow, and unsteady flow. The Saint-Venant equations, method of characteristics and simple wave problem are treated. Flood wave routing in dendritic river systems and the dam-break problem will be studied using numerical methods. Prerequisite: Introductory fluid mechanics; knowledge of FORTRAN.

3 units, Aut (Koseff) MW 10

265. Water Resources Planning — Environmental, social and economic impact of water projects; methods of public involvement in water planning. Water conservation and relationships between water and energy. Planning and project evaluation in the face of multiple objectives. Course uses a group discussion format. Short written assignments and oral presentations are used to further develop students’ communication skills. Enrollment will be limited to 12 students. Prerequisite: 260 or consent of instructor.

3 units, Aut (Ortolano) T 3:15-5:05

266. Computers in Resources Planning — Examines changing role of microcomputers and large computers in resources planning with examples from the water resources area and illustrations involving land use and electric power systems planning. Provides a survey of spreadsheets, optimization software, graphics,
communications, remote data acquisition, data base management systems, and knowledge-based expert systems. Prerequisites: Computer Science 106A or equivalent. Recommended: A first course in Operations Research. Enrollment limited to 15 with preference given to students in the Resources Planning Program.

4 units, Win (Ortolano) 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, Win (Staff) T 4:15-5:30

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. 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.

3 units, Win (McCarty) MWF 11

271C. Water Quality Control III—Analysis of advanced or specialized wastewater treatment flowsheets, including municipal wastewater and processing of treatment residuals. Emphasis on physical and chemical processes in treatment of hazardous wastes. 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: 271A and concurrent registration in 271B.

3 units, Spr (Roberts) MWF 10

272. Environmental Health Risk Assessment—(Enroll in Industrial Engineering 244.) Principles of quantitative health risk assessment applicable to routine as well as catastrophic pollution problems. Three parts: dispersion models (air and water), dose-response analysis (epidemiological and animal studies) and two complete illustrative cases. 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, Ricci) Th 11

273. Aquatic Chemistry—(Same as Applied Earth Sciences 224.) A systematic presentation of chemical principles and application of those principles to the analysis and solution of problems in aqueous geochemistry (temperatures near 25°C and atmospheric pressure). Particular attention is given to the analysis of natural water systems and to the understanding and solution of specific chemical problems in water purification technology and water pollution control. Thermodynamics is used for prediction of direction and extent of chemical processes such as precipitation/dissolution, hydrolysis, complex formation and oxidation—reduction. Prerequisite: Chemistry 31 and 33 or equivalent.

3 units, Aut (Leckie) TTh 11 plus F 2:15

273A. Water Chemistry Laboratory—Laboratory application of techniques for the analysis of natural waters and wastewaters; special emphasis on instrumental techniques. Limited enrollment. Prerequisite: Consent of instructor.

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

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 (Grbic-Galic) TTh 10

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

2 units, Aut (Grbic-Galic) Th 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) M 2:15-5:05 and Th 1:15-5:05

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


1 unit, Spr (Leckie, Grbic-Galic) 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) WF 11-12:30

M 2:15-4:05, computer problems session

281. Finite Elements for Structural Analysis — Introductory theory of the finite element method applied to problems in structural mechanics. Basic concepts developed for model problems in one dimension. Generalization for finite element solutions in two-dimensional linear elasticity including plane stress, plane strain and axisymmetric problems; three-dimensional linear elasticity. Basic element families; isoparametric elements and numerical integration. Finite elements for structural analysis including beams, plates and shells. Transient analysis. Introduction to programming procedures used in finite element programs. Prerequisite: 280 or equivalent.

4 units, Win (Pinsky) WF 11-12:30

M 2:15-4:05, 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 (Gere) MWF 9

282B. Earthquake Engineering II—Earthquake motions and their engineering interpretations; strong ground motion studies; design spectrum and design earthquake; importance of dynamic analysis of structures; geologic and soil engineering problems; design of structures to minimize earthquake damage; risk analysis; earthquake codes. Prerequisite: 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.

3 units, Win (Gere) MWF 9

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 11 and W 2:15-4:05


4 units, Spr (Staff) TTh 9-10:50

290. Advanced Soil Mechanics — Examination of the fundamentals of soil behavior. Classification of soils; soil mineralogy; stress-strain and strength behavior of soils; introduction to stress path and critical state soil mechanics; soil characterization and property evaluation; site exploration; in-situ testing. Prerequisite: 190 or equivalent.

4 units, Win (Staff) TTh 12:15-2:05

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 (R. B. Seed) 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. Prerequisites: 290, 291 and 295.

4 units, Spr (R. B. Seed) TTH 12:15-2:05

293. Experimental Soil Mechanics — Laboratory investigations of soil behavior. Tests include monotonic triaxial testing under undrained and drained conditions, undrained cyclic triaxial testing, consolidation and swell testing, minimum and maximum density tests and soil classification tests. The class is structured within the framework of a hypothetical geotechnical consulting project and requires weekly reporting of group laboratory work, analyses, and a final project report. Prerequisites: 290, 291 and 292 (may be taken concurrently.)

3 units, Spr (Staff) M 11-12:15

lab by arrangement

294. Soil and Site Improvement — Improvement of soil properties and development of marginal sites. Soil compaction; deep densification; dynamic consolidation; lime, cement, asphaltic chemical admixture stabilization; consolidation theory and analyses, preloading and drains; electro-osmosis; thermal stabilization; grouting; earth reinforcement. Prerequisite: 190 or equivalent.

4 units, Aut (R. B. Seed) TTh 1:15-3:05

295. Advanced Geotechnical Analyses — Application of finite element methods to analysis of stresses and deformations of earth masses; soil liquefaction and evaluation of seismic pore pressure generation behavior of level sites and nonlevel embankments; one-dimensional site response analyses by shear wave propagation. Involves extensive use of microcomputers; group analysis projects. Prerequisite: Graduate geotechnical major or consent of instructor.

2 units, Aut (Seed) M 12:15-2:05
given alternate years, 1987-88

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 (Staff) MWF 2:15-4:05

given 1987-88

296B. Structural Dynamics II—An 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 (Staff) TTh 2:15-3:40

297. Structural Stability—Buckling of columns; elastic and inelastic behavior; design of columns; approximate and exact methods of analysis; beam-columns; buckling of frames; torsional buckling; lateral buckling of beams; buckling of plates. Prerequisites: Civil Engineering 114, 180.

3 units, Spr (Gere) MWF 10, given 1987-88

298. Structural and Geotechnical Engineering Seminar—Lectures on topics of current interest. Recommended for all graduate students.

1 unit, Win, Spr (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 (Gere) W 4:15

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, Aut (Freyberg) MWF 9 and W 2:15-4:05, given 1987-88

361. Soil Moisture and Groundwater—Advanced study of the flow of water in saturated and unsaturated porous media. Review of governing equations and their underlying assumptions. Solutions for such problems as infiltration and redistribution of soil water, evapotranspiration from soils, hillslope hydrology, regional aquifer flow, artificial recharge, well hydraulics. Impacts of spatial variability of
362. Environmental Fluid Mechanics—Introduction to turbulence concepts and models. Introduction to basic concepts of computer modeling of turbulence. Application of various models to open channel, estuary, lake and reservoir simulations. Use of state-of-the-art computer models for simulation of reservoir dynamics, of stream water quality, and of ocean outfall hydraulics. Consideration of dimensional/scale analysis and physical models as a means to understand flow dynamics. Prerequisites: 201, Engineering 21, Computer Science 103 or 106, or equivalents and consent of instructor.
4 units, Win (Koseff) MTWF 1:15

372. Mass Transfer in Aqueous Systems—Basic concepts of diffusion and interphase mass transfer. Applications to water treatment and transport in natural aqueous systems, with emphasis on organic contaminants. Prerequisites: Engineering 21 or equivalent and concurrent registration in 270.
2 units, Aut (Roberts) TTh 1:15 alternate years, given 1987-88

373. Hydrogeochemical Cycles—A study of the processes and mechanisms responsible for the natural circulation of major, minor, and trace elements through the hydrosphere, atmosphere, lithosphere, and biosphere. Emphasis is on a mechanistic interpretation of global cycling of elements and man’s influence on accelerating or intercepting the normal processes. Consideration of chemical weathering processes, biotransformations of elements, residence times in various environmental compartments, and fluxes between environmental compartments. Prerequisites: 273 and 274.
2 units, Spr (Leckie) by arrangement alternate years, given 1987-88

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 will be sought; the role of degradative plasmids and genetic manipulation in decomposition of pollutants. Explanations of the phenomena of biodegradability and recalcitrance, detoxification and production of more toxic compounds, activation and biomagnification; the use of microorganisms in detecting mutagenic and carcinogenic compounds, as well as comparisons of metabolic pathways of hazardous organics in microorganisms and man, estimations of biodegradation potential of xenobiotic compounds and predictive models of their decomposition.
3 units, Spr (Grbić-Galić) TTh 9 F 1:15

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

390. Advanced Topics in Geotechnical Engineering—A graduate geotechnical seminar, topics and course content selected on the basis of current student and faculty interests, and expertise of visiting lecturers selected for distinguished experience in private practice. Prerequisite: 190 or equivalent.
1 unit, Win (Staff) M 12:30-2:05

397. Random Vibrations—Concept of random vibrations; description of the vibratory motion of probabilistic summary; concept of stationarity, ergodicity; correlation and autocorrelation; Fourier Analysis; spectral density function; input/output relationship for linear systems; transmission of random vibrations. Prerequisites: Post-M.S. standing.
2 units, Win (Staff) MW 11, given 1987-88

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
Emeriti: (Professors) George B. Dantzig, John G. Herriot, (Professor, Research) Arthur Samuel
Chairman: Nils J. Nilsson
Associate Chairman: Lester Earnest
Assistant Chairman for Education: Stuart T. Reges


Associate Professors: Michael Genesereth, Joseph E. Oliger, Terry Winograd

Assistant Professors: David Cheriton, Manolis G. H. Katevenis, Keith A. Lantz, Ernst Mayr, Paul Rosenbloom

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

Associate Professor (Research): Gio Wiederhold

Associate Professor (Teaching): Charles A. Bigelow

Courtesy Professor: Michael J. Flynn

Courtesy Associate Professors: John T. Gill, III (Electrical Engineering), Susan S. Owicki (Electrical Engineering), Edward H. Shortliffe (Medicine), Fouad A. Tobagi (Electrical Engineering)

Courtesy Assistant Professors: Mark A. Horowitz (Electrical Engineering), Mark A. Linton (Electrical Engineering), Brian K. Reid (Electrical Engineering), David M. Unger (Electrical Engineering)

Affiliated Professor (Research): David Luckham (Electrical Engineering)

Visiting Professor: Ehud Shapiro

Consulting Professors: Forest Baskett, Patrick J. Hayes, Jay M. Tenenbaum, Richard Waldinger

Consulting Associate Professors: Richard P. Gabriel, Barbara J. Grosz, Stanley J. Rosenstock

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

Industrial Lectureships: Gregory Nelson, Robert Smith, Ray Strong

OFFERINGS AND FACILITIES

A variety of computer systems are available to Stanford students. There are five large systems available to all students in the University. Most courses, including courses given by the Computer Science Department, use the four systems available at the Low Overhead Timesharing System (LOTS) computer facility. A few courses and some sponsored research projects use the Information Technology Systems (ITS) facility.

There are four large systems available to students of Computer Science: Score, SAIL, Sushi, and SUMEX. Each of these systems is a host on the nation-wide ARPAnet computer research network; each is also a host on the experimental ethernet (SUNet) operated by the department.

Score is a DECsystem-2060 running the TOPS-20 operating system. It includes 2048K 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 timesharing operating system. SAIL supports 64 local display consoles, plus other local and remote terminals. The SAIL facility includes two central processors, 2304K words of main memory, and 1.6 billion bytes of disk storage.

Sushi is a DECsystem-2060 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 national resource, funded by the National Institutes of Health, for core research on knowledge-based systems and applications of artificial intelligences to biomedicine. SUMEX operates a large DECSYSTEM 2060, a 2020, a VAX 11/780, and more than fifteen personal Lisp machines. Students doing research in appropriate areas may be granted access to SUMEX.

The VAX 11/780 called Navajo is used for research in large-scale numerical problems and for some general departmental use. There are 11 other VAX computers running UNIX associated with specific research projects.

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

UNDERGRADUATE PROGRAMS

The department offers a degree in Computer Science, 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 CS 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 (MSCS) and the M.S. in Computer Science: Artificial Intelligence (MSAI). The MSAI program differs from the standard MSCS program (in particular from Specialization 5—Symbolic and Heuristic Computation) in that it is a two-year 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.

A candidate is required to complete a program of 42 units. At least 36 of these must be graded units, passed with a 3.0 (B) average or better. The 42 units may include no more than 18 units of courses from courses listed in Requirements 1 and 2. Thus, students needing to take more than six of the courses listed in Requirements 1 and 2 will actually complete more than 42 units of course work in this program. Students hoping to complete the program with 42 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: CS 22 (for specialization 5 only), CS 106A, CS 106B, CS 106C, CS112, CS 140, CS 143A, Math 109 or Math 120, Phil. 160A.

2. The following core courses or their equivalents must be completed: CS 212, CS 223, CS 237A, CS 240A, CS 240B, CS 242, CS 243, CS 254 or CS 257A, CS 261. 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 MSCS degree.

3. At least 3 quarters of the seminars such as those listed below must be attended, but no more than 6 units may be counted toward the MSCS degree. CS 500, CS 510, CS 520, CS 522, CS 527, CS 540, CS 545.

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. CS 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: CS 237B, CS 237C.
2. Systems
   a) At least four of the following courses: CS 211, CS 244, CS 245, CS 312, EE 271, EE 482.
   b) At least 9 units selected from the remainder of the previous group and the following courses: CS 246, CS 247, CS 248A, CS 248B, CS 265, CS 318, CS 340, CS 342, CS 343, CS 344, CS 345, EE 183, EE 272A, EE 272B, EE 281, EE 312, EE 374, EE 486, EE 487.

3. Software Theory
   b) At least 9 units from the following courses: CS 244, CS 245, CS 263, CS 340, CS 342, CS 343, CS 345.

4. Theoretical Computer Science
   a) The following courses: CS 254, CS 257A, CS 260.
   b) At least two of the following courses: CS 257B, CS 262, CS 263.
   c) At least 9 units from the remainder of the previous group and the following courses: CS 345, CS 350, CS 353, CS 357, CS 360, CS 363A, CS 363B, CS 365, CS 366, CS 367A, CS 367B, CS 368, OR 340A.

5. Symbolic and Heuristic Computation
   a) The following courses: CS 254, CS 257A, CS 257B, CS 323.
   b) At least 12 units from the following courses: CS 225A, CS 225B, CS 275, CS 276, CS 306, CS 326, CS 327A, CS 327B, CS 327C, CS 329; no more than one of CS 328A, CS 328B, CS 328C.

6. Database
   a) The following courses: CS 245, CS 345, CS 393.
   b) At least two of the following courses: CS 225A, CS 244, CS 262, CS 265, CS 347.
   c) At least one of the following courses: EES 221, EES 231, EES 241, OR 240, Stat. 376.

MASTER OF SCIENCE IN
COMPUTER SCIENCE
ARTIFICIAL INTELLIGENCE

The degree of "Master of Science in Computer Science: Artificial Intelligence" may be conferred upon students who wish to develop a competence in the design of substantial knowledge based AI applications. The degree will be administered by the Committee for Applied Artificial Intelligence, composed of faculty and research staff of the Computer Science Department. Present members include Thomas Binford, Bruce Buchanan (Chairman), William Clancey, Edward Feigenbaum, Michael Genesereth, and Paul Rosenbloom.

The CSAI 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 applying for admission. (Coterminal applications from Stanford undergraduates are discouraged, because of the two-year research training required.) Admission to the CSAI 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 CSAI 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) One of CS 222 or CS 223.
   b) One of CS 225 or CS 271.
   c) At least one of CS 275, CS 276, CS 326, CS 327A, B, C or CS 520.

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

3. Theoretical computer science (3 units), choose one course from: CS 257A or CS 306.

4. Practicum (27 units) CS 393. A substantial AI system is implemented and documented in the second year. This is an application that makes significant use of AI concepts and methods in a working program, demonstrating the student's understanding of the field.
5. Additional units must be in courses relevant to the project. Acceptable courses will be determined by the project supervisor, depending upon the application area of the project. Examples of courses to take outside 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 MS program in Computer Science Department, a 3.00 grade point average must be maintained in these courses. Students in this program must also demonstrate satisfactory quarterly progress on an AI research project.

CSAI 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 CSAI Committee on an individual basis. In particular, students are not expected to take courses when they have had the equivalent subject matter previously. The student should submit a written statement of individual objectives and how the program and previous preparation meet these objectives.

A successful experience in this program is likely to require an undergraduate education in the sciences, with at least a moderate exposure to computing concepts and practice. Familiarity with LISP is strongly advised.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.), are discussed in the section "Degrees" in this bulletin. The following are departmental requirements:

1. A student should plan and successfully complete a coherent program of study covering the basic areas of computer science and related disciplines. The student's advisor has primary responsibility for the adequacy of the program which is subject to review by the Graduate Study Committee of the department.

2. Each student, to remain in the Ph.D. program, must pass a comprehensive exam covering introductory level graduate material in major areas of computer science. 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 Administrative Assistant for Academic Affairs 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 200 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 200 and 299.

In addition, research equivalent to that normally performed by research assistants is required during one or more quarters.

4. The most important requirement for the Ph.D. degree is the dissertation. After passing the qualifying examination each student must secure the agreement of a member of the department faculty to act as the dissertation advisor. (In some cases the dissertation advisor may be in another department.) The department is currently conducting research in analysis of algorithms, artificial intelligence, complexity theory, computational geometry, databases and knowledge bases, data structures, distributed processing, graph theory, heuristic programming, measurement and performance evaluation, natural language understanding, networks, numerical linear algebra, operating systems, optimization, parallel processing, partial differential equations, program verification, programming languages and systems, reliability of computer systems, robotics, spline functions, and vision and perception. An oral or written dissertation proposal may be required.

5. Each student must pass a University oral examination in the form of a defense of his or her dissertation. It will usually be held after all or a substantial portion of the dissertation research has been completed.

6. The student is expected to demonstrate the ability to present scholarly material orally, both in the dissertation defense and by a lecture in a departmental seminar.

7. The dissertation must be accepted by a reading committee, composed of the principal dissertation advisor, a second member from within the department, and a third member chosen from within the university. The principal advisor and at least one of the other committee members must be Academic Council members.

Ph.D. MINOR IN
COMPUTER SCIENCE

For a minor in Computer Science a candidate is required to demonstrate a suitable
level of competence in the departmental comprehensive examination. There are no specific course requirements. For further information see the Administrative Assistant for Academic Affairs.

TEACHING AND RESEARCH ASSISTANTSHIPS

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 $8,010 for the nine-month year. Some may work full time in the summer for approximately $1,780 per month.

Duties in the academic year involve 20 hours of work per week. Teaching assistants help an instructor teach a course by meeting discussion sections, consulting with students, grading examinations, etc. Research assistants help senior staff members with research in computer science. Approximately two hours of the work week are spent in attendance at Computer Science Department colloquia and seminars. Nearly all teaching and research assistantships are held by Ph.D. students in the Computer Science Department. 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 CSAI program) should not plan on being appointed to an assistantship.

Students with NSF fellowships and trainee ships 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 CS 106X, then CS 108A, B, C. CS 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. CS 108A, B, C is 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 CS 106X for students who have less previous experience or who wish to take more time to study the fundamentals of programming. Such students should take CS 106A or CS 106H, then CS 106B. Students in CS 106A are not expected to have any prior experience in computer programming, but are expected to have a reasonable degree of mathematical ability. Students in CS 106H are expected to have a good working knowledge of calculus.

Students in engineering and science disciplines who expect to make limited use of computers in their fields should take CS 106A or CS 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 CS 105A. This course covers a certain amount of the material in CS 106A, but without a technical orientation.

Students in non-technical disciplines who would like to learn about computers and how they are used, but who do not want to become proficient at programming, should take CS 105A and choose the project options instead of the programming options on the various assignments.

Students who would like to learn about issues involving the computer and its relation to society should take CS 101.

To summarize the options for introductory Computer Science courses:


For significant use—CS 106A or CS 106H, CS 106B.

For scientific/technical use—CS 106A or CS 106H.

For nontechnical use—CS 105A.

For exposure—CS 1.

For appreciation—CS 101.
UNDERGRADUATE

1. Using Computers—A practical course in the use of specific computer systems. This Pass/No Credit course introduces students to the basic functions of a computer system: text editor, communications facilities, software packages, etc. Students spend 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-20 timesharing system available at the LOTS Computing Center. Section B examines the DEC Professional 350 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 will be offered when appropriate staff are available to teach them, as listed in the Time Schedule.

1 unit

3. Programming in FORTRAN—An introduction to FORTRAN for students with experience in programming in a high-level programming language other than BASIC. Prerequisite: 106A, or equivalent.

2 units, Aut, Spr (Staff) MWF 12

first 8 weeks only


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

22. Programming in LISP—An introduction to the LISP language and the techniques of manipulating symbolic data, e.g., 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.

3 or 4 units, given when staff available

75. Computers and Language—(Same as Linguistics 35L.) 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 will not be assumed to have prior computer background. Enrollment limited. (DR:4) or (DR:8)

5 units, Spr (Winograd) MWF 10

UNDERGRADUATE AND GRADUATE

101. Computers: Their Nature, Use, and Impact—Intended to introduce students from all departments to the computer revolution. Designed for nonspecialists to survey a variety of concepts and issues relating to computers. Topics include: basic concepts and vocabulary of computers and information processing; current applications of computers in education, business, music, art, medicine, science, 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 in this course. Alternatives 105A, 106A. (DR:8; student must also have completed CS 106 as taught before 9/1/85.)

3 units, Win (Feigenbaum) not given 1986-87

105A. Introduction to Computers—A course designed for non-technical majors to develop a working knowledge of computers as they are utilized in our society. Differs from 101 as it requires considerable interaction between student and computer. 105A is both a programming course and an issues course, taught to be comprehensible by students without a strong math and/or technical background. Pascal programming language is used for concepts of structured programming. Non-programming topics include: basic terminology, overview of different computer systems, overview of common software packages, privacy, security, human factors. Students in technical fields are encouraged to take 106A. Prerequisite: Mathematics 3 or equivalent. (DR:8)

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

Win (Staff) MWF 1:15

Spr (Staff) MWF 10

Sum (Staff) MTWTh 10

106A,B. Introduction to Software Engineering—This two-quarter sequence gives a broad overview of the engineering of computer applications. Four general areas: general programming, software engineering, computer science, and applications. The Pascal programming language is used to teach general structured programming techniques. In the software engineering portion of the course students will examine the process of specification, implementation and verification; information hiding, procedural abstraction; data abstraction; mod-
ules; object oriented design; and writing adaptable code. In the computer science portion students examine recursion and analysis techniques that predict memory and time usage of algorithms. In the applications portion students examine different applications of computers such as graphics, simulation, and data bases. 106A covers the bulk of the programming and about half of the software engineering principles. 106B has a balance of software engineering, computer science, and applications. Alternatives: 106H, 106X. Prerequisite for 106A: Mathematics 3 or equivalent; recommended: CS1-A. Prerequisite for 106B: old 106 or 106A or 106H.

106A. (DR:8)
*5 units, Aut, Win, Spr (Staff)
MWF 9, 2:15
Sum (Staff) MTWTh 9, 11

106B. *5 units, Aut, Win, Spr (Staff)
MWF 2:15
Sum (Staff) MTWTh 2:15

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 42 or 22.

*5 units, Aut (Floyd) MWF 2:15

106X. Introduction to Software Engineering (Accelerated)—Covers the programming and software engineering concepts of 106A,B in one quarter. Intended as preparation for 108A, 108B, 108C, 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, Win, Spr (Staff) MWF 9


108A. Inside a computer: Instructions, simple machine and assembly languages. Data models: propositional and predicate logic, graph theory, sets, trees, etc. Program translation: the compilation process, automata, regular expressions, lexical analysis, grammars, parsers, generation of assembly code. Semantics of programs: simple languages, object-oriented languages, production systems, pure Lisp. Corequisite: Math 103 (old 113S) or Math 113. (DR:6)
5 units, Aut, Win, Spr (Staff)

5 units, Aut, Win, Spr (Staff)

5 units, Aut, Win, Spr (Staff)

tman microcomputer cluster. Prerequisite: 106B or equivalent.
3 units, given when staff available

112. 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: 108C or 168 or assembly language programming experience.
3 units, Aut, Win (Staff) MWF 11

123. Cognitive Introduction to Artificial Intelligence—(Same as Psychology 166/266.) Introduction to the core concepts of artificial intelligence, including 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. Prerequisites: 105A or equivalent.
3 units, Win (Rosenbloom) TTh 1:15-2:30

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 is given to 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: 237A,B. Prerequisites: Knowledge of FORTRAN; Mathematics 113 and 130; or equivalents.

3 units, Win (Staff) MWF 10
Sum (Staff)

140. Introduction to Systems Programming—Introduction to software systems and the programming thereof, including operating systems and compilers. Principles of concurrent programming, including processes, mutual exclusion and synchronization, message-passing and monitors. Principles of storage management as used by large programs. Overview of performance, reliability, and user interface issues. Emphasis is on principles and algorithms, rather than on implementation. Typically, 140L should be taken at the same time. Prerequisite: 108C or 111 and 106X or 106B.

3 units, Aut, Win, Spr (Staff)

140L. Systems Programming Laboratory—A laboratory to supplement 140. It may be taken separately by those desiring an introduction to C and UNIX. Prerequisite: 106X or 106B, or equivalent programming experience.

1 unit, Aut, Win, Spr (Staff)

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 will be assigned. Prerequisite: 108C.

4 units, Win (Linton)

143B. Compiler Project—Implementation of the phases of a compiler using current tools and techniques. Intended to give students 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, Aut, Win, Spr (Staff)

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)

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. Examine and analyze 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, Win (Gorin) TTh 11-12:15
alternate years, given 1987-88

191. Senior Project—Students complete 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) will be given for volunteer computer programming work of public benefit and educational value. Restricted to Computer Science students. 1-3 units, any quarter (Staff) by arrangement

198C. Teaching of Computer Science—Students learn how to consult at the LOTS computing center or the Terman Microcomputer Cluster. Attend biweekly lectures on system software and work as the on-duty consultant. Interested students should talk to the Student Coordinator at LOTS, or the Terman Microcomputer Cluster. Prerequisite: 1A or equivalent.

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

198H. Teaching of Computer Science—Students learn 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 Margaret Jacks Hall for an application. Prerequisite: 106B or 108A.

3 units, Aut, Win, Spr (Reges) by arrangement
211. Logic Design—(Enroll in Electrical Engineering 381.) Principles and techniques of logic design. Topics include 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 both fundamental and pulse mode circuits, design for testability techniques. Prerequisite: 112 or equivalent.

3 units, Aut, Win

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 with respect to the design of instruction sets. Prerequisite: 112.

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

223. Fundamentals of Artificial Intelligence—A rigorous introduction to the issues and ideas of Artificial Intelligence. Topics include knowledge representation, automated deduction, search control, machine learning, and meta-level architecture. Prerequisite: Familiarity with mathematical reasoning and computer programming.

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

225A. AI Programming Methodology—An introduction to the technology of expert systems and the associated programming methodology. Special emphasis on logic programming (using various interpreters) and partial programming (e.g., condition-action rules). Some discussion of knowledge acquisition and validation techniques. The course work includes programming exercises and a single large project. All course work is done in teams. Prerequisites: 22 (or equivalent) and 223.

2 or 3 units, Spr (Genesereth) TTh 9:30-10:45

225B. AI Programming Laboratory—Companion project course for 225A. Prerequisite:

225A.

3 units, given when staff available

237A,B,C. Numerical Analysis—Three-quarter sequence designed to acquaint students of the mathematical and physical sciences with the derivation and analysis of methods for solving mathematical problems on digital computers. Organized so that students can take the first quarter and then either the second or third according to their interests. Fundamental concepts of numerical computation are introduced in 237A. Topics include linear systems of equations, interpolation, numerical differentiation and integration, and the solution of nonlinear equations. Material related to the analysis of structures and data is discussed in 237B. Topics include the approximation of functions, the matrix eigenvalue problem, least squares approximation and statistical computations. The simulation of systems governed by ordinary and partial differential equations is discussed in 237C. Topics include methods for the solution of both initial and boundary value problems. Finite difference, finite element and collocation methods are included. These courses include analysis of convergence and estimation of truncation and round-off errors. Assigned work includes both 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; Mathematics 113 (C.S. 237C has the additional prerequisite of Mathematics 130); or equivalents.

237A. 3 units, Aut (Staff) MWF 2:15
237B. 3 units, Win (Golub) MWF 2:15
237C. 3 units, Spr (Oliger) MWF 2:15

240A,B. Operating Systems—Two-quarter sequence in operating systems design and implementation. 240A teaches the basic techniques necessary to construct a rudimentary operating system, motivations, functions, and evolution; basic structure, multiprogramming, processes and scheduling; imlementation 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 provides 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 only). Prerequisite for 240B: 240A.

240A. 3 units, Aut, Win (Staff)
240B. 3 units, Win, Spr (Staff)

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, Aut, Win (Staff)

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, etc. 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: 108C.

3 units, Aut, Spr (Staff)

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, Spr (Staff)

244. Computer Networks: Architecture and Implementation—(Same as Electrical Engineering 384.) 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 will be cited throughout the course for point-to-point, satellite, packet radio, and local networks. Prerequisite: 240A or equivalent; may be taken as corequisite.

3 units, Aut (Cheriton) TTh 2:45-4
Win (Staff) (Enroll in Electrical Engineering 384.)


3 units, Win (Wiederhold) MWF 11

246. Operating Systems Project—A project course for students wanting experience in a large-scale, team project in operating systems or distributed systems. Students will be 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, Win, Spr (Staff)

248A. Computer Graphics—Introductory computer graphics with emphasis on raster techniques. Topics covered include: 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 as well as those of hidden-surface elimination, shading, color, and other image synthesis methods. The architecture of raster graphics systems is discussed and the use of specialized instructions for raster manipulation illustrated. Presupposes knowledge of linear algebra and data-structures, and will require programming assignments that make use of raster display system. Prerequisites: 108C and Math 113. Recommended: 261.

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


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


3 units, Win (Staff)
Spr (Floyd) MWF 10

257A. Logical Basis for Computer Programming—Introduction to the logical foundations of computer programming. An elementary exposition, from a computational point of view, of propositional logic, predicate logic, and theories with equality and induction, including integers, strings, lists, trees, sets, bags. Proofs of properties of programs.

3 units, Aut (Staff) TTh 11-12:15
261. Introduction to Data Structures and Algorithms — Basic data structures: list structures, trees, balanced trees, hash tables, partially ordered trees. Storage management: garbage collection, allocation strategies. Techniques for asymptotic and exact analysis of programs, and criteria for data structure and algorithm selection. Methods for the design of efficient algorithms: divide-and-conquer, dynamic programming, greedy algorithms. The theory of intractable problems: NP-completeness, examples of intractable problems. Prerequisites: 108C or equivalent. Students are expected to have familiarity with Turing machines and nondeterminism, as taught in 254.

3 units, Aut (Knuth) MWF 1:15


3 units, Win (Staff) MWF 3:15


3 units, Spr (Pratt) MWF 3:15 alternate years, given 1987-88

264. Introduction to Combinatorial Theory — Intended as an elementary first course in combinatorics. Topics include 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 alternate years, given 1987-88

265. Basic Tools in Computer Systems Modeling — (Enroll in Electrical Engineering 284.) 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; queuing theory; networks of markovian queues; elements of graph theory; graph algorithms. Examples will be drawn from the computer systems area. Prerequisite: Statistics 116.

3 units, Win (Staff)

270. Computer Applications in Medicine — (Same as Medical Information Sciences 210.) Provides an overview of medical computer science activities in both research and applied environments. Topics include 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, Cooper, Wiederhold) TTh 12:15

271A. Computer-Based Medical Decision Making — (Same as Medical Information Sciences 211A.) Introduction to medical decision making techniques and to methods for their implementation in decision support systems. Bayesian statistics, decision analysis, expert systems.

3 units, Win (Cooper) TTh 12:15

271B. Computer-Based Medical Decision Making — (Same as Medical Information Sciences 211B.) Intended for students who have completed 271A and wish to implement some of those ideas in a computer project. Computer
programming will be required in most projects. Prerequisite: 271A.
3 units, Spr (Fagan, Cooper, 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 semiological issues. Course consists primarily of visual exercises.
3 units, Spr (Pagan, Cooper, Buchanan) TTh

3 or 4 units, Win (Winograd) alternate years, given 1987-88

276. Computational Models for the Semantics of Natural Language—(Same as Linguistics 235.) 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 alternate years, not given 1987-88

3 or 4 units, Spr (Staff)

PRIMARILY FOR GRADUATE STUDENTS

300. Departmental Lecture Series—Weekly presentations by members of the department faculty, each describing informally his or her current research interests and views of computer science as a whole. Recommended for first-year Computer Science graduate students.
1 unit, Aut (Staff) Th 2:45-4

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 Ph.D. degree candidates in computer science, and recommended for students beginning such a degree program.
3 units, Win (Knuth) TTh 11-12:15

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: Either 106B, 108B, or equivalent ability to program.
3 units, Aut, (McCarthy) TTh 1:15-2:30

309. Industrial Lectureships in Computer Science—Each quarter the department invites one outstanding computer scientist from the local industry to give a course in his or her specialty. These courses (309A,B,C) are ordinarily given only once. Lecturers and topics change from year to year, hence courses with this number may be taken repeatedly.

309A. Methods for Program Verification—An introduction to practical methods for writing difficult programs without errors. Starting with axiomatic semantics, the predicate calculus, and E. W. Dijkstra's theory of predicate transformers, the course will lead into a series of example programs that will be derived using the methods. Additional topics, to be covered if time permits, include mechanical theorem proving techniques, constraint languages, and compiler correctness.
3 units, Aut (Nelson) by arrangement

309B. Fault Tolerant Distributed Systems—Requirements and solutions to problems arising in the context of distributed systems that must tolerate faults. Special emphasis: atomic broadcast and clock synchronization. Design decisions for a prototype distributed system that reaches, maintains, and recovers from failure to maintain agreement. Course organized around a series of problems of varying difficulty that students are challenged to solve, including some problems that are still open.
3 units, Aut (Strong) by arrangement

309C. Computer Assisted Instruction—The role of computers in education, history, techniques and future prospects. Special emphasis on software issues, development languages and tools, and applications of artificial intelligence to education. Prerequisites: LISP, and some artificial intelligence and programming language background.
3 units, Spr (Smith) by arrangement

312. ALU Design—(Enroll in Electrical Engineering 382.) Data representation, integers, floating point and residue representation.
Bounds on arithmetic speed, algorithms for high speed addition, multiplication and division. Pipelined arithmetic. Implementation and control issues using PLA's and microprogramming control. Prerequisites: 112 (Electrical Engineering 182) or equivalent.

3 units, Win (Flynn)


3 units, Spr (McCloskey) alternate years, given 1987-88


3 units, Spr (McCloskey)

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 that are 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; and distributed artificial intelligence. Prerequisite: 223 or equivalent.

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

325. Cognitive Architecture—(Same as Psychology 223.) An examination of the issues involved in designing a cognitive architecture. Topics include 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 123, 223, Psychology 106, or equivalent experience.

3 units, Spr (Rosenbloom) TTh 11-12:15 alternate years, not given 1987-88

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 will be assumed.

3 units, Win (McCarthy) TTh 1:15-2:30 alternate years, not given 1987-88

327A. An Introduction to Robotic Manipulations—(Enroll in Mechanical Engineering 219A.) An introduction to the basics of robot manipulations and a review of current applications. The following topics will be discussed in detail: kinematic structure, coordinate transformations, manipulator solutions, workspace, path selection, control, dynamics, and programming. Knowledge of matrix algebra and some familiarity with basic control theory and rigid body mechanics suggested.

3 units, Aut (Roth) MWF 1:15-2:05

327B. Introduction to Computer Vision (Robotics)—An introduction to 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. Advanced Robotics—The emerging field of intelligent robot control systems will be introduced. Robot programming systems, geometric modeling, off-line simulators, integration with CAD databases, geometric reasoning, assembly planning, sensory integration, collision avoidance, grasping, mobile robots, force strategies, uncertainty analysis, representations for spatial reasoning. Prerequisite: 327A and 327B, or 223 and 225A.

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

328A. Computational Models of Cognition—(Enroll in Psychology 187.) Computational models of information processing, covering relevant current research in both Artificial Intelligence and Cognitive Psychology. Use of
computer simulations to test psychological theories. Applications of psychological research to building Artificial Intelligence systems. Topics will include, but not be limited to, knowledge representation, machine learning, natural language understanding, and parallel processing models. Students will be expected to 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, Aut (Pavel) alternate years, given 1987-88

328B. Applying Cognitive Psychology to Computer Systems—(Enroll in Psychology 286.) Surveys 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. Covers methodology including model building and testing. The computer-related topics include model-based approaches to design, computer-user interfaces, software psychology, and knowledge representation. Prerequisite: Consent of the instructor.

1-3 units, Win (Pavel) W 1:15-3:05

328C. Advanced Seminar in Perception, Cognition, and Human Performance—(Enroll in Psychology 289A.) 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 unit, Spr (Pavel) W 1:15-3

329. Topics in Artificial Intelligence—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics that are currently being offered.

by arrangement

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 (Johnstone) TTh 11-12:15

337A. Advanced Numerical Analysis—Approximate methods for initial value problems and initial boundary value problems for partial differential equations. Convergence and stability theory; analysis of methods; finite difference and finite element methods. Particular attention will be paid to the implementation of methods and to realistic applications. Prerequisites: 237A and 237C.

3 units, Aut (Oliger) alternate years, given 1987-88

337B. Advanced Numerical Analysis—Solution of linear problems: linear equations, linear programming; linear least squares problems; linearization of nonlinear problems. Prerequisites: 237A and 237B.

3 units, Win (Staff) alternate years, given 1987-88

337C. Advanced Numerical Analysis—Solution of boundary value problems for ordinary differential equations, and elliptic partial differential equations by finite difference and finite element methods. Emphasis on the implementation of methods and to realistic applications. Prerequisites: 237A and 237C.

3 units, Spr (Staff) alternate years, given 1987-88

338A. Advanced Topics in Numerical Analysis—Numerical solution of initial value problems for ordinary differential equations: convergence and stability theory; multistep methods; methods for stiff equations. Prerequisites: 237A and 237C.

3 units, Aut (Staff) MWF 11 alternate years, not given 1987-88

338B. Advanced Topics in Numerical Analysis—Iterative methods: numerical methods are developed, described, and analyzed for solving large sparse systems of linear equations and eigenvalue problems. Prerequisites: 237A and 237B.

3 units, Win (Staff) MWF 11 alternate years, not given 1987-88

338C. Advanced Topics in Numerical Analysis—Numerical approximation of functions and data, approximation theory and its applications to standard numerical analysis problems such as quadrature and the solution of differential equations. Prerequisites: 237A and 237B.

3 units, Spr (Staff) MWF 11 alternate years, not given 1987-88

339. Topics in Numerical Analysis—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics that are currently being offered.

by arrangement
340. Distributed Systems—An 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 (Staff)

342. Programming Language Design — Exposure to the problems of programming language design and their known solutions will be undertaken. Topics may include formal semantics, implementation considerations, extensibility, very high level languages, evaluation of language designs, and other timely topics. The innovative features of a variety of modern programming languages will be discussed. Prerequisites: 242, 243, 343.

3-6 units, Aut (Staff) not given 1986-87

343. Advanced Compilers — Lectures and discussions explore implementation issues in depth. Major focus on optimization techniques and advanced code generation. A significant project will be included. Prerequisite: 243.

3-6 units, Spr (Hennessy)

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 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. Prerequisites: 244, 265.

3 units, Spr (Staff)

345. Database System Theory—Overview of database systems; the entity-relationship model of the real world; the network data model and the DBTG proposal; the hierarchical model; the relational model; relational algebra and calculus; query languages based on algebra and calculus, such as ISBL, QUEL, SQL, and Query-by-Example; functional dependencies and their influence on database design; multivalued dependencies; query optimization; logical databases; closed-world assumption; optimization of logically-defined queries. Prerequisites: A familiarity with file organization, as in 245, and with predicate calculus, as in 257A, or Philosophy 160A, will be assumed.

3 units, Spr (Ullman) MWF 11


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 that are currently being offered.

by arrangement


3 units, Win (McCarthy) MWF 1:15 alternate years, 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, Pspace). Complexity of decision procedures for first-order logics like Presburger Arithmetic or finitely generated commutative semigroups.

3 units, Aut (Staff)

353. Formal Methods for Description and Reasoning—Algebraic methods: universal algebra, word algebras, categories. Logical theo-
ries: propositional, modal, equational, and first-order theories. Language fragments: their proof systems, decision methods, and combinations. Applications: program verification, program optimization, automatic theorem proving. Prerequisites: 261, Mathematics 160B or equivalents.

3 units, Aut (Pratt) TTh 9:30-10:45

356. Reasoning About Knowledge—Knowledge plays a crucial role in such diverse areas as distributed systems, cryptography, and artificial intelligence. Examines attempts at formalizing reasoning about knowledge and the extent they are applicable to the areas mentioned above. Issues: the internal vs. external views of knowledge, applying knowledge to analyzing distributed systems, attainable states of knowledge, and modelling resource-bounded reasoning. Prerequisites: Mathematical maturity and an acquaintance with propositional logic.

3 units, Win (Halpern)


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


3 units, Aut (Floyd)

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 that are currently being offered.

by arrangement

360. Analysis of Algorithms — An advanced course primarily for students who will be doing specialized work in the analysis of algorithms. The intent is to present each of the important paradigms used to analyze algorithms 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)

alternate years, given 1987-88

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) TTh 11-12:15

alternate years, not given 1987-88

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 (Staff)

alternate years, given 1986-87


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


3 units, Spr (Staff)

alternate years, given 1987-88


3 units, Aut (Staff)

alternate years, given 1987-88

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

3 units, Spr (Mayr) MWF 10

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 such as convexity, intersection and range query problems, point location in subdivisions, and sweep-line methods are always covered. Additional topics may vary from year to year and include visibility and decomposition problems, collision avoidance and shortest path questions, the use of geometric duality, etc. Prerequisite: 261.

3 units, Spr (Guibas) Th 1:45-4:15

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 that are currently being offered.

by arrangement

371. Medical Decision Analysis—(Same as Engineering Economic Systems 235, Medical Information Sciences 235.) Introduction to the use of decision analysis in medical practice. Student teams will analyze specific clinical decision problems as a term project. Individual analyses will be generalized by outlining a computer-based clinical decision tool for cases similar to the one analyzed. Also covers 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. Prerequisites: Engineering Economics Systems 231 or equivalent. No formal medical background is required.

3 units, Spr (Holtzman) MF 3:15-4:30

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 that are currently being offered.

by arrangement

409. Topics in Knowledge-Based Software Environments—Knowledge-based environments for the production and evolution of software will be considered. Topics include wide-spectrum and very-high-level languages, formal specifications, correctness-preserving transformation rules, strategies for designing algorithms, data and control structure refinement, program optimization and finite differencing, knowledge-based support for project management, synthesis of concurrent programs and architectures. Individual projects included. Prerequisites: 22, 257A, 243, 261.

3 units, (Green, Smith) any quarter (Staff) by arrangement

441. Topics in Ada Programming—The Ada language are 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: Overview of 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. Prerequisites: 140 or 242/Electrical Engineering 285 or equivalent.

Spr (Luckham) TTh 1:15-2:30
442. Concurrent Prolog Programming Techniques—Concurrent Prolog is a logic programming language designed for concurrent programming and parallel execution. It is a process oriented language, which embodies dataflow synchronization and guarded-command indeterminacy as the basic control mechanisms. Basic concepts of logic programming; outlines the definition of the Concurrent Prolog; surveys general concurrent programming techniques, and programming techniques idiosyncratic to Concurrent Prolog; review of language applications to date; provides some details of its implementation techniques on a uni- and multi-processor; the design of Logix, its programming environment and operating system developed at the Weizmann Institute. The course requirements include programming assignments and a programming project, which will be carried out using the Logix system. Prerequisite: 108C. Recommended: Knowledge of concurrent programming concepts and of sequential Prolog.

3 units, Aut (Shapiro) TTh 9:30-10:45

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

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 is placed 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. The topics covered will vary from year to year. Examples of current research topics are 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. Prerequisites: 223 or equivalent.

1 unit, Spr (Nilsson) T 11


1-3 units, any quarter (Staff) 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 A.I. qualifying exam. Prerequisites: 223, 225A, and consent of instructor.

3 units, Win (Staff)

524. Seminar on Rule-Based Expert Systems — (Same as Medical Information Science 229.) Graduate seminar for students wishing to gain an historical perspective, as well as 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.

2 units, Spr (Buchanan, Shortliffe) not given 1986-87

527. Robotics Seminar — Recent research in the areas of computer vision, manipulation and mobility; geometric modeling and CAD/CAM. Invited speakers present recent results and summaries of articles from the current literature.

1 unit, Aut, Win, Spr (Binford) M 4:15


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

540. Seminar on Computer Systems—(Enroll in Electrical Engineering 380.) Discussion of current research in the design, implementation, analysis, and 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 innovation. Strong emphasis on discussion and evaluation. Topics of special interest include database models, high performance algorithms, and application of artificial intelligence techniques to large and distributed databases.

1-3 units, Aut, Win, Spr, Sum (Wiederhold) F 3:15

548. Distributed Systems Research Seminar — Recent research in the areas of distributed operating systems, computer communicatons, 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
OFFERINGS IN OTHER DEPARTMENTS
The following departments offer courses that may be of special interest to students of computer science:

Business—Data processing in business problems, science in management and operations research.

Economics—Statistical Methods of Econometrics.

Electrical Engineering—Information and communication theory, theory and design of systems and adaptive design, VLSI design.

Industrial Engineering—Management.

Linguistics—Syntax, semantics, language theory.

Mathematics—Mathematical logic, recursion theory.

Mechanical Engineering—Computational geometry, man-machine systems.

Operations Research—Mathematical programming.

Philosophy—Mathematical logic.

Psychology—Cognitive Psychology.

Statistics—Probability, combinatorics.

ELECTRICAL ENGINEERING


Chairman: Robert L. White

Associate Chairmen: James B. Angell, 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

Assistant Professors: Stephen P. Boyd, John M. Cioffi, Mark Horowitz, Mark Linton, Brian Reid, David Ungar


Courtesay Professors: Malcolm R. Beasley, William Brody, Gene H. Golub, Donald E. Knuth, John McCarthy, Jeff Ullman

Courtesay Associate Professors: Gior C.M. Wiederhold, Lambertus Hesselink (Research)

Courtesay Assistant Professors: David Cheriton, Keith Lantz


Consulting Assistant Professor: Norman F. Jouppi

*On leave one or more quarters

UNDERGRADUATE PROGRAMS

Students desiring to specialize in Electrical Engineering during their undergraduate period may do so by following the depth sequence given earlier in the general discussion of the School of Engineering.

Majors must receive at least a “C” in the courses in the E.E. depth sequence and an overall average 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).
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.

MASTER OF SCIENCE

University regulations governing the degree of Master of Science are described in the "Degrees" section in this bulletin; note that this department has waived the thesis requirement. Applications for admission with graduate standing in Electrical Engineering are made to the Director of Admissions of the University and are reviewed by this department. Inquiries may be addressed to the Associate Chairman, Admissions, Department of Electrical Engineering.

Modern electrical engineering is a broad and diverse field, and graduate education in this department may satisfy a great variety of objectives. Students with undergraduate degrees in physics, mathematics, or related sciences, as well as in various branches of engineering, are invited to apply for admission. Such students will ordinarily be able to complete the master's degree in one calendar year. Students with undergraduate degrees in other fields may also be admitted for graduate study (see below).

The master's degree program may provide advanced preparation for professional practice or for teaching on the junior college level, or it may serve as the first step in graduate work leading to the degree of Engineer or Doctor of Philosophy. The faculty does not prescribe specific courses to be taken. Each student with the help of a program advisor prepares an individual program and submits it to the faculty for approval. This should be done as soon as possible and must be done before completion of the first 12 units of graduate study (modifications may be made later). 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 GPA 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 item 1, to provide breadth.

3. Enough additional units of electrical engineering courses so that items 1 through 3 total at least 21 units of graded electrical engineering courses numbered above 200, including at least 9 units of such courses numbered 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 201, 200 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, and 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 GPA of at least 3.0 is required.

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.

FINANCIAL ASSISTANCE

The department annually awards fellowships, teaching and research assistantships to graduate students. The fellowships are usually awarded only to first-year graduate students. Most of the awards to Engineer and Ph.D. candidates are research assistantships. These research assistants 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 discussion in "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.

**SPACE PHYSICS AND RADIOSCIENCE**

Computer Simulation of Wave-Particle Interactions
Electromagnetic Waves and Plasmas
Electron Beam Experiments in Space
Ionoospheric 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
Space Data Management
Search for Extraterrestrial Intelligence
Telephone and Data Networks
Voice Signal Processing
Underwater Communications

**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

**INTEGRATED CIRCUITS**

Bipolar, MOS and Other Silicon Devices
Biomedical Applications of Custom Integrated Circuits

**ELECTRICAL ENGINEERING**

Circuits, Biomedical Systems
Computer-Aided Analysis and Design
Integrated Sensors and Transducers
Linear, Digital, and Optoelectronic Integrated Circuits
Micropower Electronics
Process, Device and Circuit Modeling
VLSI Device Structures and Physics
VLSI Fabrication Technology
VLSI Systems in Silicon

**PLASMAS**

Active Plasma Experiments in Space
Magnetohydrodynamics
Plasma transport

**LASERS AND QUANTUM ELECTRONICS**

Coherent UV and X-Ray Sources
Fiber Optics
Laser Applications in Physics, Chemistry, Biology, Aeronautics and Electronics
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

**INFORMATION SYSTEMS**

Adaptive Control
Adaptive Signal Processing
Biomedical Signal Analysis
Cryptography and Data Security
Data Compression and Communication
Estimation Theory and Applications
Fourier and Statistical Optics
Information and Coding Theory
Multivariable Control
Medical Imaging
Pattern Recognition and Complexity
Real-Time Computer Applications
Signal Processing Algorithms and Architectures
Speech and Image Coding

**COMPUTER SYSTEMS**

Compilers
Computer Architecture
Computer Networks
Computer Organization
Computer Reliability
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

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. Prerequisites: One year of college engineering, mathematics or physics.

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. Introduction to integrated circuit fabrication techniques. Small signal models of MOS transistors. Prerequisite: Engineering 40. 112: 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 pn junction diodes and transistors. Prerequisite: 111. 113: 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 (Gibbons) TTh 9:30-10:45
Win (da Rosa) MWF 11

112. 3 units, Win (Gibbons) TTh 9:30-10:45
Spr (da Rosa) MWF 11

113. 3 units, Aut (da Rosa) MWF 11
Spr (Staff) TTh 9:30-10:45

121. Digital Design Laboratory—Introduction to digital circuits and their application. Topics include measurement technique, logic families, switching speed, Boolean algebra, state machines, digital data transmission, analog and digital converters, and digital displays. Prerequisite: Engineering 40. Co-requisite: Engineering 102E.

3 units, Win, Spr (Staff) T 1:15 plus 3-hour lab weekly by arrangement

122. Analog Laboratory—Design and testing of analog circuits. Transistor amplifier with feedback; discrete components differential amplifier; op-amps and their applications; active filters and oscillators; regulated power supplies; class AB power amplifier; AM and FM communications. Corequisite: 113.

3 units, Aut (da Rosa) TTh 9:30-10:20 plus 3-hour lab weekly by arrangement

139. Design Project—A laboratory course in which individuals or small teams design, build and test special circuits or simple systems. Projects are proposed by students or the professor. Ideally two students would make a team and propose a project. The requirements include a report giving the details of the project and the test results, a presentation to the class of the design features, and the constructed (and hopefully, working) project. Those primarily interested in digital circuits or microprocessors should take 183 or 281. Class will be strictly limited to 15 students. Prerequisite: 122.

3 units, Win, Spr (McWhorter) Th 1:15 plus lab by arrangement


3 units, Aut (Waterman) MWF 2:15
Win (Inan) MWF 2:15


3 units, Spr (Inan) MWF 2:15

150A,B,C. Fundamentals of Computer Science — (Enroll in Computer Science 108-A,B,C.)

181. Introduction to Computer Organization, Machine and Assembly Languages—(Enroll in Computer Science 111.)

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: Computer Science 108C or Computer Science 168 or assembly-language programming experience.

3 units, Aut, Win (Staff) 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. Prerequisites: 182 and 121 or equivalent.

3 units, Aut (Flynn) 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 experimen-
tation, 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 a written 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—Seminars associated with and supplementing various courses are offered when there is sufficient interest. See the Time Schedule and bulletins in the department office.

UNDERGRADUATE AND GRADUATE

200A,B,C. Seminar—Special section of 201A,B,C (see description below) open to students holding assistantships and registering under limited tuition grants. Given for Pass/No-credit only.

200A. 0 units, Aut (Pantell) Th 11
200B. 0 units, Win (Meindl, Rets) 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 (Pantell) Th 11
201B. 1 unit, Win (Staff) Th 11
201C. 1 unit, Spr (Staff) Th 11

202. Medical Electronics—Primarily biological in nature. Purpose is to introduce electrical engineers to the physiological and anatomic aspects of medical monitoring and imaging. In addition to the biological content, transducers, electronic systems, the socio-economic impact, and the constraints unique to medicine will be discussed. Course presumes no biological background, but some familiarity with circuits and electrical instrumentation techniques (e.g., 113) will make it more meaningful.

3 units, Aut (Thompson) TTh 4:15-5:30

204. Thoracic and Abdominal Anatomy and Physiology—(Enroll in Physiology 211.)

205. The Entrepreneurial Engineer—A seminar to further the knowledge base of prospective entrepreneurs with an engineering background. Major part of the content will include contributions made to the business world by engineering graduates. Speakers will include Stanford (and other) engineering and MBA graduates who have founded large and small companies in nearby communities. Contributions from faculty members and other departments, such as law, business and industrial engineering will also be made.

1 unit, Win (Melen) T 11

208. Biological Information Processing—Acquaint the student with the basic signal processing elements occurring in biological systems, and how these elements can be assembled to execute fairly complex signal processing. The physiological basis of the signal processing is investigated so that a good sense of the signal magnitudes, propagation delays, etc. can be obtained. The signal processing capabilities of various neural networks are examined and compared to naturally occurring systems. Examples are taken from both lower animal and human systems. Peripheral signal processing, such as occurs in auditory and optical sensory systems, is discussed, as well as regulatory systems and the central nervous system.

3 units, Spr (White) MWF 9

209. Nerve and Muscle—An in-depth introduction to the processes underlying the excitation and propagation of electrical impulses in nerves and the development of contractile force in muscle. Introduction to bioelectric phenomena; physical forces on charged particles; introductory neuroanatomy; structure and function in unit membranes; ionic channels; Hodgkin-Huxley action potential model; neuro-muscular synaptic, quantal hypothesis, noise analysis of molecular events; excitatory and inhibitory synapses; action potentials in cardiac muscle membranes; coupling; excitation-contraction coupling; general features of motile systems; muscle ultrastructure—skeletal, heart, smooth; contraction biochemistry; contractile dynamics; muscle energetics and thermodynamics; theories of contraction; cardiac muscle and chamber dynamics.

3 units, Spr (Ingels) MWF 12

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

216. Principles and Models of Semiconductor Devices—Fundamentals of carrier generation, transport, recombination and storage in semiconductors. Physical principles of operation of
221. Linear Active Circuits — Analysis and design of discrete and integrated circuits. Properties of common building blocks at low and high frequencies. Design of dc amplifiers to minimize drift, etc. Circuits, such as active filters, using operational amplifiers. Filter functions for high, low, and bandpass filters. Introduction to noise limitations in amplifiers. Prerequisites: 113 and Engineering 102.

3 units, Win (Pease) MWF 10

228. Basic Physics for Solid State Electronics — Course 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

229. Integrated and Fiber Optics — Propagation of waves in dielectric thin films and cylindrical guides. Bit limitation rate due to material dispersion and multimoding. Step index and graded index fibers. Switching and modulation of solids from a fundamental point of view. Introduction to band theory, surface states, dielectric and ferroelectric materials, magnetic materials, ferromagnetism, and superconductivity. Emphasis on physical understanding. A large amount of material is systematized using the twin concepts of extended wave functions (trans- port, band theory, etc.) and more localized wave functions, ferroelectricity, ferromagnetism, etc.

3 units, Win (Siegman) 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 (Siegman) MWF 8

235. Electrical and Magnetic Properties of Solids — Electrical and magnetic properties of solids from a fundamental point of view. Introduction to band theory, surface states, dielectric and ferroelectric materials, magnetic materials, ferromagnetism, and superconductivity. Emphasis on physical understanding. A large amount of material is systematized using the twin concepts of extended wave functions (transport, band theory, etc.) and more localized wave functions, ferroelectricity, ferromagnetism, etc.

3 units, Win (Siegman) MWF 9
by integrated optics techniques. Prerequisite: 241.

3 units, Win (Pantell) MWF 1

244A. Communication Engineering Telephony—Current design problems in telephone transmission systems, including transmission of analog and digital voice and data on wire, cable, and fiber optics. New design problems for Integrated Services Data Networks (ISDN) are analyzed. Reviews telephone traffic theory, circuit capacity and network planning. International standards and signaling protocols are considered. Rotary and cross-bar telephone switches are reviewed, and new digital switch architectures are introduced.

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. Also reviews performance of FM, AM, SSB common digital schemes and spread-spectrum modulation, time frequency and code multiplexing. Emphasis is on link performance, capacity, total system design and cost optimization. The course introduces current industry design problems and research results. Prerequisite: Senior or graduate standing in Electrical Engineering or permission of instructor.

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

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, Systems Engineering. Prerequisite: Permission of the instructor.

3 units, Spr (Lusignan) TTh 1:15-2:30

245. Wave Measurement Techniques—Combined lecture and laboratory course 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, acoustic-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 is placed on MIC structures (microstrip, coplanar waveguide, slotline, finline, and imageline) capable of transmitting millimeter wave analogue signals and picosecond pulses; but modal properties (TEM, quasi-TEM, TE, TM) of general waveguides are also reviewed. 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 will be given of IC circuit structures, and computer-aided design principles will be introduced. A background in transmission lines and waveguides corresponding to 142, or equivalent, is desirable.

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. Prerequisite: Familiarity with electromagnetics at the level of Physics 53 and senior or graduate standing.

3 units, Aut (Bracewell) MWF 1:15

250. Communications Design Seminar—A seminar covering recent developments in telecommunication research, including satellite applications, mobile radio, telephone networks, digital switches, voice and data modulation. Speakers are drawn 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 as an example. Radar equation and systems parameters, components of radar systems, radar cross-section and target characteristics, signal detection in noise, ambiguity function with applications to measurement precision, resolution, clutter rejection and waveform design; pulse compression waveforms, synthetic aperture radar, tracking and scanning radars, HF(OTH) radar, radar remote sensing, radar astronomy. Prerequisites: Senior undergraduate or graduate student standing.

3 units, Win, alternate years, given 1987-88

256. Elementary Plasma Physics—A broad-based elementary and interdisciplinary course presenting basic theoretical concepts, experimental evidence, and applications to astrophysics, space physics, and thermonuclear fusion. The subjects treated 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 Physics 121 or EE 141.

3 units, Spr (Storey) MWF 3:15

261. The Fourier Transform and Its Applications—The Fourier transform as a tool for solving physical problems. Convolutions and correlations, the Dirac delta function, Fourier transform theorems, measures of time duration and bandwidth, the uncertainty relation, and the central limit theorem. Additional topics include analysis of linear systems, sampling theorems, the discrete Fourier and Hartley transforms, and two-dimensional Fourier analysis. Prerequisite: Previous exposure to Fourier series at the level of 102.

3 units, Aut (Goodman) MWF 10 or Spr (Macovski) 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 8-9:15
Win (Staff) 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; 263, 104, or consent of instructor. 261 is recommended.

3 units, Win (Widrow) MWF 10

268. Introduction to Modern Optics—(Enroll in Engineering 170.)

271. Introduction to VLSI Systems—An introduction to 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. Course is intended for EE and CS students with background in computers, signal processing, or programming. Background in IC fabrication or physics is not required. Prerequisites: Familiarity with the basic notions of circuits, logic, and digital systems; and programming.

3 units, Aut (Horowitz) TTh 9:30-10:45
Win (Staff) TTh 2:45-4

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. Lecture topics include: design tools and techniques, including 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 who take 272A are expected to take 272B for at least one unit as well. Prerequisites: 271, experience with timesharing facilities.

4 units, Win (Horowitz) T 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 func-
tationally 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 (Horowitz) T 1:15-2:30
plus lab by arrangement

278. Introduction to Statistical Signal Processing—Review and elaboration of elementary probability theory: expectation, characteristic functions (transforms), limit theorems. Introduction to random processes: definitions and properties, covariance and spectral density, time average, stationarity, ergodicity, and linear system relations. Selected applications in noise analysis, communication systems, estimation theory. Prerequisite: Elementary linear systems, transforms, and probability. 102 or 261 and Statistics 116E or equivalent.

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

279. Information 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; phase tracking; timing and carrier recovery. Prerequisite: 278.

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

280A,B. Computer Applications and Signal Processing—Real-time applications of minicomputers and microcomputers in signal processing and control. Experimental research projects are developed in cooperation with faculty of Electrical Engineering, the Medical School, and other research laboratories. Previous topics include interference cancelling in fetal electrocardiography and blood pressure control based on a real-time model of an animal's reaction to a pressure-elevating drug. Should be taken for two consecutive quarters. Prerequisite: Mini- or microcomputer programming experience.

3 units, Win, Spr (Widrow) not given 1986-87

281. Microcomputer Laboratory—Introduction to a specific microprocessor, for example, the Zilog Z-80. Lectures covering the programming and design of a microcomputer system are accompanied by laboratory exercises. A final laboratory project is required. Prerequisites: 182 or equivalent, and some hands-on experience with TTL logic, such as 121 or 183.

3 units, Aut (Staff) TTh 2:45-4
plus lab by arrangement
Win (Staff) TTh 9:30-10:45 plus lab by arrangement

282. Computer Architecture and Organization—Structure of systems using processors, memories, input/output (I/O) devices, and I/O interfaces as building blocks. Computer system instruction set design and implementation, including memory hierarchies and pipelining. Issues and tradeoffs involved in the design of computer system architectures, in particular with respect to the design of instruction sets. Prerequisite: 182.

3 units, Aut (Staff) 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; queuing theory; network of markovian queues; elements of graph theory; graph algorithms. Examples will be drawn from the computer systems area. Prerequisite: Statistics 116.

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

292. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. These courses are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule and bulletins in the department office.


3 units, Aut (da Rosa) MWF 3:15


3 units, Win (da Rosa) MWF 3:15

305. Seminar on Electronics in Medicine—Weekly seminars on the application of electronics technology to problems of medical practice or research, featuring speakers from educational institutions or industry.

1 unit, Aut, Win (White) W 4:15
310. Integrated Circuits Technology and Design Seminar—In-depth treatment of technology and circuit design problems in integrated circuits. Content is designed to complement topics in 312 (Aut), 313 (Aut), 314 (Win) and 315 (Spr).

1 unit, Aut (Plummer) T 4:15
Win (Wooley) T 4:15
Spr (Saraswat) T 4:15

311. Characterization and Computer Modeling of Semiconductor Devices—Computer simulation techniques for IC process and device modeling. Use of SUPREM for process modeling and SEDAN for device analysis to characterize effects such as bipolar current gain and MOS threshold voltage. Model parameter extraction for SPICE. Prerequisite: 216.

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

312. Integrated Circuit Fabrication Processes—Fundamental principles of silicon integrated circuit fabrication processes. Technological limitations on integrated circuit design. Physical and chemical models of bulk and epitaxial crystal growth, oxidation, diffusion, ion implantation and photoengraving. Geometrical layout of bipolar and MOS devices and integrated circuits. This course is designed to be taken Autumn Quarter by students who will be using the laboratory facilities for doctoral research, since it is a prerequisite for 410. 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 (Meindl) TTh 1:15-2:30
3 units, Spr (Plummer) TTh 9:30-10:45


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

314. Bipolar Analog Integrated Circuits—Discussion, analysis and design of analog IC’s, with emphasis on quantitative study of circuit performance, its figures of merit, its limitations, and recent techniques for its optimization. Topics include linear IC’s, such as operational amplifiers, wide-band, high frequency and low-noise amplifiers, quasi-linear circuits for signal processing, such as multipliers and translinear circuits, plus phase-locked loops, A-to-D and D-to-A converters. Prerequisites: 216 or equivalent and 221.

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

315. Analog MOS Integrated Circuits—Fundamentals of analog MOS integrated circuit design. Small-signal device and circuit models. Design of amplifiers, analog switches, sample and hold circuits, comparators and voltage references. Analog subsystems, including A/D and D/A converters and switched capacitor filters. Prerequisite: 313 or consent of instructor.

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

316. VLSI Devices and Technology—In modern VLSI technologies, MOS and Bipolar device electrical characteristics are very sensitive to structural details and hence to fabrication techniques. This course concentrates on how VLSI devices and circuits are fabricated and on what future changes are likely. Emphasis is on the implications for device electrical performance caused by fabrication techniques and 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. This includes 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 will be a "hands-on" computer simulation of the exposure and development of patterns in resist.

3 units, Win (Pease) MWF 8 alternate years, not given 1987-88

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 (Doniach, Geballe, Spicer) Th 4:15

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. These include 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. Emphasis will be placed on understanding the relationship between the formalism (Hilbert space representation) and the measurement process. Both the Schrödinger
wave function approach and the matrix formulation of quantum mechanics will be given. The equivalence of the two schemes will be discussed though the emphasis will be given to the former. Three exactly soluble problems; constant potential, harmonic oscillator, and the hydrogen atom will be discussed in detail and the use of these to approximate the behavior of some real systems. An introduction to the quantum theory of angular momentum will be presented. Prerequisites: Introductory atomic physics, differential equations. Recommended: Linear algebra, classical mechanics.

3 units, Aut (Bates) TTh 9:30-10:45

322B. Basic Quantum Mechanics—Deals with the various approximation schemes for determining the energy levels and other properties of real systems. Including 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 will be presented. Also given will be a generalized treatment of angular momentum including definition in terms of infinitesimal rotations, choice of representations, eigen values and eigenstates, matrix representations and addition of angular momenta, including the Clebsch-Gordon or vector-coupling coefficients. Prerequisite: 322A.

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

324. Applications of Quantum Theory—A unified approach involving the density matrix to lasers, field quantization, and multiple quanta effects. Emphasis on the techniques for obtaining the appropriate equations of motion, rather than on detailed investigation of specific devices. Topics included are rate equations, spontaneous emission, laser action, infrared absorption, multiple photon absorption, relativistic quantum effects, and free-electron lasers. Prerequisite: 322A or Physics 231.

3 units, Aut (Lindau) TTh 8-9:15

325. Analog Signal Processing—Introduction to analog filters with emphasis on acoustic surface waves and related optical and semiconductor devices. Topics covered include 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 will be discussed. Prerequisites: 142 and 261.

3 units, Aut (Kino) MWF 1:15

327A. Acoustic Waves in Solids—(Enroll in Applied Physics 252.)

328A. Physics of Semiconductor Devices—Introduction to the physical principles underlying semiconductor device operation and the application of these principles to specific devices. Emphasis is on understanding device operation, rather than circuit properties. 328A 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. 328B considers the p-n junction and MOS capacitor in detail, followed by a careful treatment of bipolar and MOS transistors. Prerequisites: 216, 228 and 328A (for 328B) required; 238 recommended but not required.

3 units, Win, Spr (Swanson) MWF 3:15

329. The Electronic Structure of Surfaces and Interfaces—Deals with the basic physical concepts and phenomena for various surface science techniques to probe the electronic structure of surfaces and interfaces. Microscopic and atomic models are becoming increasingly important in understanding microstructures and have many technologically important applications, e.g., within semiconductor device technology and catalysis. Lectures will cover 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, energy-loss spectroscopy, electron/photon stimulated ion desorption, inelastic tunneling spectroscopy, and experimental aspects of surface science techniques. Prerequisites: Physics 57 or equivalent; 238 or consent of instructor.

3 units, Aut (Lindau) TTh 8-9:15

331. The Science of Semiconductor Interfaces—Recent 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, both practical and scientific, will be covered in a systematic way. Semiconductor-metal, -oxide, -semiconductor, and -insulator interfaces are included and correlations made between them. 3-5 and other compound semiconductors will be emphasized. Key concepts will be identified and the course developed around them to give unity and allow the student to follow easily new developments as they arise. Prerequisite: 238 or equivalent and consent of instructor.

3 units, Spr (Spicer) TTh 1:15-2:30

alternate years, not given 1987-88
332. Optical Properties of Solids—Basic theory with emphasis on the relationship between electronic structure and optical properties of solids. Representative semiconductors, insulators, and metals will be discussed. Impurities and defects in solids. Surface states. Photoemission, luminescence, applications. Prerequisite: 322A or equivalent.

3 units, Spr, alternate years, given 1985-86

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. Primary emphasis on fabrication procedures and techniques based on a planar direct ion implantation process in semi-insulating GaAs directed toward digital IC’s. Course similar to 312. Prerequisites: 228, 229.

3 units, Win (Sigmon) MW 11-12:15

334. Superconducting Electronics—Introduction to superconducting electronics and applications. Course proceeds from a brief introduction to the phenomena of superconductivity through a discussion of Josephson junctions and superconducting quantum devices and finally to an analysis of some promising applications in computer logic and memory, magnetometry, and low noise electromagnetic detectors and mixers in the millimeter and submillimeter wave region. Recommended: An exposure to quantum mechanics and a good grounding in electromagnetic theory.

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

338A. Quantum Theory of Energy States in Solids—(Enroll in Materials Science and Engineering 233.)

338B. Electronic Transport in Solids—(Enroll in Materials Science and Engineering 234.)

338C. Photoelectronic Properties of Solids—(Enroll in Materials Science and Engineering 235.)

344. High Frequency Laboratory—A combination lecture/laboratory course with emphasis on the lab. Class covers techniques in the 1MHz-1GHz range useful in designing and measuring oscillators, amplifiers, and mixers. Basic high frequency measurement techniques including s-parameter measurements are included. Lectures will be given by the professor and experts from Hewlett Packard. (Two lectures, one lab per week.) Prerequisites: A good understanding of transmission lines, Smith charts. Class limited to 15 students.

3 units, Aut (McWhorter) WF 3:15-4:30 plus lab by arrangement

346. Introduction to Nonlinear Optics—Wave propagation in anisotropic, non-linear, and time-varying media. Microscopic and macroscopic description of electric dipole susceptibilities. Free and forced waves—phasematching; slowly varying envelope approximation—dispersion, diffraction, space-time analogy; harmonic generation; frequency conversion; parametric amplification and oscillation; and electro-optic light modulation. Prerequisites: 241, 242, 322A or equivalent.

3 units, Spr (S. Harris) MWF 2:15

347. Optical Methods in Engineering Science—(Enroll in Aeronautics and Astronautics 220.)

348. Ionospheric and Magnetospheric Processes—The role of solar ionizing radiation; production, loss and diffusion processes in the makeup of the ionosphere; thermal behavior of the ionospheric plasma; temperature and electron density profiles. The earth’s magnetic field and plasma environment. Coupling processes between the upper atmosphere, ionosphere and the magnetosphere, with emphasis on mass, energy and electric transfer. Global current system. Space plasma electrodynamics. Substorms and other geomagnetic disturbances. Prerequisite: 142 or 241, or Physics 121 or equivalent.

3 units, Spr, alternate years, given 1987-88

350. STAR Laboratory Seminar in Radioscience—Seminars by internal and external speakers primarily in the following subject areas: planetary exploration, magnetospheric and ionospheric physics, space plasma physics, radar and radio remote sensing of the environment and information systems with space applications. Student-faculty discussions follow the seminar.

1 unit, Aut, Win, Spr (Vesecky) M 4:15

352. Electromagnetic Waves in the Ionosphere and Magnetosphere—Magnetooionic theory in multi-component media; signal dispersion; group ray velocity; wave polarization; refractive index surfaces; ray tracing; absorption; boundary effects; interpretation of natural phenomena (e.g., whistlers and VLF emissions); remote sensing in plasmas; communication; theory of wave-particle interactions in the magnetosphere. Prerequisite: 142 or equivalent.

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

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, alternate years, given 1987-88

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, magnetoionic propagation and dispersion. Sheath and probe theory, magnetic confinement, pinches, mirrors, magnetogasdynamics; computer simulation of plasmas. Prerequisite: 141 or equivalent.

3 units, Aut (Buneman) MWF 2:15

358A,B. Quantum Electronics Laboratory I, II—(Enroll in Applied Physics 358A,B.)

359. Remote Sensory 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 prerequisites: 106, 142, 241, basic thermodynamics and classical mechanics.

3 units, Spr (Staff) TTh 8-9:15 alternate years, not given 1987-88

363. Introduction to Linear System Theory—Analysis of finite-dimensional linear systems. State space realizations and canonical forms. Controllability, observability, and minimality. Relations to transfer function descriptions. Design of controllers and observers; linear quadratic regulator. Prerequisite: 102 or Engineering 104, Mathematics 113S or equivalent.

3 units, Aut (Boyd) MWF 9 Spr (Staff) TTh 8-9:15


3 units, Win (Boyd) MWF 9


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


3 units, Win (Goodman) MWF 10

367. Statistical Optics—Applications of statistical tools to a variety of problems in modern optics. First-order statistical properties of thermal and laser light, effects of partial polarization, basic definitions of coherence, propagation of mutual coherence functions, the Van Cittert-Zernike theorem, imaging with partially coherent light, imaging through randomly inhomogeneous media, and statistics of optical detection processes. Prerequisites: 278, 366.

3 units, Spr (Goodman) MWF 10

368. Digital Image Processing—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 are given throughout. Prerequisites: 261, Mathematics 113S or 363.

3 units, Spr (Hesselink) MWF 9

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. Prerequisites: Fourier transforms: 366 recommended.

3 units, Spr (Macovski) TTh 11-12:15
370. Information Systems Seminar—Lectures and discussion of topics and research areas in information systems; sample topics are computational and statistical complexity, rate distortion theory, algebraic systems theory, simultaneous communications, signal processing, and telecommunication policy.

1 unit, Aut, Win, Spr (Staff) Th 4:15


3 units, Spr (Staff) MWF 11

374. Introduction to Digital Telecommunications—Introduction to and comparison of analog and digital telecommunications; voice digitization—PCM, DPCM, and DM techniques; low bit rate coding of speech; segment conforming laws in PCM; time division multiplexing-framing, synchronization and pulse stuffing; transmission of digital signals-baseband and carrier techniques; introduction to digital switching. Prerequisite: 261 or equivalent, and 278 or equivalent.

3 units, Win (Staff) MWF 9


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

376B. Information Theory—Jointly typical sequences. Capacity theorems for multiple user channels: broadcast channels, multiple access channels, two-way channels, Gaussian channel, channels with feedback. Multiple user data compression: rate distortion theory; Slepian Wolf theorem; data compression with side information. Kolmogorov complexity. Prerequisite: 376A.

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


3 units, Spr, alternate years, given 1987-88


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

378B. Fast Algorithms for Signal Processing—Levinson-Schur algorithms and lattice filters for stationary processes. Parallel and modular implementations. Processes with low displacement rank: generalized constant gain lattice filters; adaptive lattice and transversal filters. High resolution spectral estimation techniques for autoregressive and sinusoidal signals in noise. Applications in speech, communications, sonar, etc. Prerequisite: 278 or 378A.

3 units, Spr (Kailath) TTh 1:15-2:30

379. Communication Channels—Digital modulation and coding; detection of signals in Gaussian noise; channel capacity and channel reliability functions; applications to signal selection, input and output quantization, error-correcting codes; equalization, partial-response signals, trellis coding. Prerequisite: 278.

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

380. Seminar on Computer Systems—Discussion of current research in the design, implementation, analysis, and use of computer systems ranging from integrated circuits to operating systems and programming languages.

1 unit, Aut, Win, Spr (Staff) W 4:15

381. Logic Design—Principles and techniques of logic design. Topics include combinational circuit analysis including hazard detection, combinational 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 both fundamental and pulse mode circuits, design for testability techniques. Prerequisite: 182 or equivalent.

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

382. ALU Design—Data representation, integers, floating point and residue representation. Bounds on arithmetic speed, algorithms
for high speed addition, multiplication and division. Pipelined arithmetic. Implementation and control issues using PLA's and microprogramming control. Prerequisite: 182 or equivalent.

3 units, Win (Flynn) MWF 9

384. Computer Networks: Architectures and Protocols—(Same as Computer Science 244.) 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 will be cited throughout the course for point-to-point, satellite, packet radio, and local area networks.

3 units, Aut (Enroll in Computer Science 244) Win (Staff) TTh 2:45-4

385. Special Seminars in Computer Systems — Seminars on current research topics in computer systems are given from time to time 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 is placed 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 courses are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule and bulletins in the department office.

395. Electrical Engineering Instruction: Practice Teaching—Open to a limited number of advanced graduate students in Electrical Engineering who plan to make teaching their career. Qualified students conduct a small section of an established course taught in parallel by an experienced instructor.

(McWhorter) by arrangement

400. Thesis and Thesis Research—Limited to students who have established candidacy for the degree of Engineer or Ph.D. A grade of P indicates satisfactory work; no letter grade is assigned.

by arrangement

410. Integrated Circuit Fabrication Laboratory—Laboratory fabrication of silicon gate NMOS integrated circuits. The emphasis is 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 is given to students pursuing doctoral research programs in which the facilities of the IC lab will be used. Registration by consent of instructor. Prerequisite: 312.

3 units, Win (Plummer) 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 per-
formance. May be repeated for additional credit. Prerequisites: 312, 410, and consent of instructor.

3 units, Spr (Meindl) TTh 1:15-2:30

413. Ion Implantation and Beam Processing Techniques—Theory of application of ion beams for modification and analysis of solid-state materials. Course describes physics of the interaction of ion beams with solids for use in doping or analysis of solid materials. Discussion of the development, present applications, and problems of using ion-implantation in semiconductor device fabrication is presented. A review of the present status of the use of laser beams for semiconductor device fabrication is also presented. Prerequisite: Consent of instructor and some familiarity with programming.

1-3 units, Spr (Sigmom) T 1:15
alternate years, not given 1987-88

414. Physical Limits in VLSI—Hierarchy of physical performance limits on very large scale integration (VLSI) including fundamental law of physics, properties of materials, device characteristics, fabrication processes, circuit topologies and system architecture. Minimum energy operation of bipolar transistors, MOS transistors and charge transfer devices in amplifiers, oscillators, multipliers, delay lines, logic elements and memory cells without compromising speed, gain, bandwidth, stability margins, etc. Prerequisites: 216, 312, 313 and (or concurrently) 314 or equivalents.

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

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 is 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 will be studied in detail. The fundamentals for creating new devices based upon quantum size effects, tunneling and ballistic electron transport will be examined. Prerequisites: 328A and B, and Physics 230 or equivalent.

3 units, Win, Spr (J. Harris) MWF 9

430. Surface and Interface Seminar—A better fundamental understanding of the electronic structure of surfaces and interfaces is becoming increasingly important for many practical applications, e.g., semiconductor devices and metal catalysts. This seminar concentrates on electron spectroscopic methods and basic theoretical approaches for studying surfaces and interfaces. Connection is made with electrical measurements, device and IC performance. Faculty members and advanced graduate students, as well as invited speakers from outside the University, present material for discussion.

1 unit, Aut, Win (Spicer) W 2:15-4:15
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. Prerequisites: Quantum theory to the level of 322B or Physics 231. A course in lasers, such as 231-232 is not a prerequisite, but background reading from this course material may be necessary.

3 units, Spr, alternate years, given 1987-88


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.

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

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.

3 units, Spr (Staff) 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 and 382.

3 units, Spr (Lundstrom) MWF 11

484. Computer Networks: Modeling and Analysis—Review of network functions, architectures and protocols; computer traffic characterization; resource sharing; packet-switched-store-and-forward networks such as the ARPA NET: delay analysis, network design and optimization including capacity assignment, routing and topological design; analysis of 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. Knowledge of 384 is also highly recommended.

3 units, Spr (Staff) 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 and 382.

3 units, Spr, alternate years, given 1987-88

487. Digital Signal Processing Architecture and Circuits—The architecture, system design and hardware implementation of real time signal processors and digital filters. Signal processing operations including the Discrete Fourier Transform, Discrete Convolution, Cosine transform, Hadamard transform and the estimation of power spectra. Design of Finite Impulse Response and Infinite Impulse Response implementations of low pass, high pass, bandpass and all-pass filters. Applications in speech processing, image processing, communication, sonar and radar signal processing. Possibilities for LSI implementation of signal processing and digital filter computation structures are investigated. Prerequisites: 381, 382. Recommended: 263.

3 units, Spr (Peterson) MWF 10

488. Testing Aspects of Computer Systems—Fundamental principles of testing computer systems and designing for testability. Failure and fault models. Deterministic and probabilistic techniques of test generation and testing. Techniques for testing memories and microprocessors. Design for testability. Prerequisite: 381.

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


3 units, Spr, alternate years, given 1987-88

492. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. These courses 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.
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.

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; (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 letter grade average; (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.

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 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 EES are funded by the National Science Foundation, Electric Power Research Institute, the Center for Economic Policy Research, and the Department of Energy as well as our Industrial Affiliates.

BUSINESS SYSTEMS

The business systems program is a department-wide program that responds to the fact that more Engineering-Economic Systems graduates now enter business firms directly, work for consulting firms on projects in the private sector, or do continuing research and teaching on business problems. The program emphasizes strategic, financial, and entrepreneurial aspects of business systems taking a fundamental quantitative approach. Research projects described under several of the programs outlined below have a business systems orientation. The decision analysis, systems economics, and organizational economics 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, 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.

SYSTEMS ECONOMICS
(Luenberger, Stacchetti)

Systems economics is an emerging discipline that combines advanced theories of economics (in finance, general equilibrium theory, and decision theory) with the problem-solving viewpoint and techniques of systems analysis. The field is a response to the growing magnitude and complexity of economic decision problems in both the private and public sectors. Its orientation reflects the conviction that solution methods for these problems must simultaneously be solidly based on theoretical principles and capture the structural complexity inherent in actual situations. The theoretical basis is found mainly in economics, while the techniques for handling complex structure are found mainly in systems analysis.

The program sponsors student internships outside the university, conducts internal applications projects, and conducts Ph.D. dissertation research. Some current theoretical research topics include: (1) development of efficient algorithms, based on fixed-point theory, for calculating equilibrium prices, (2) development of the “descriptor variable” approach to representation and analysis of complex dynamic phenomena, (3) development of “implicit mathematical programming,” a theory combining control theory and mathematical programming to analyze dynamic investment problems, (4) a study of equilibrium investment, to explain the storage policies for commodities such as wheat, and (5) a study of futures markets using the concept of “rational expectations.”

ORGANIZATIONAL ECONOMICS
(Chiu, Dunn, Stacchetti, Tse)

Organizational economics is the study of incentives and information in organizations and interorganizational systems. The incentives of interest are those created by rules governing such activities as information sharing, cost allocation, and transfer pricing within an organization. Information in organizations is obtained from a variety of different sources, combined, and used in decision making. The best method of combining and using information in decision making is dependent upon a variety of factors and is a subject of current research. Of special interest are problems involved in decision making and planning in groups of organizational units with differing objectives.

Current areas of research include: (1) power pooling and long-term planning in the electric utility industry; (2) management of the frequency spectrum; (3) pricing shared services and facilities in interorganizational networks with multiple owners; and (4) incentives for innovation in systems with interconnected and interrelated components.

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
(Dunn, Shachter, Tse)

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 effects of consumer information on innovation, (2) economic analysis of alternative approaches to spectrum management, (3) the economics of electronic publishing, and, (4) 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.

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.

**COURSES**

There are four types of courses in the department, as follows:

**Core Courses:**

**Project Courses:**
208, 214B, 234, 235, 236, 283 (4 units).

**Lecture Courses:**

**Other Courses:**
290, 292, 293, 294, 400 series.

Course descriptions, organized by general subject area, are listed below.

**SYSTEMS**


3 units, Aut, Sum (Staff)  
T 11-12:15, Th 10-11:50

201A. Dynamic Systems—An introduction with about equal emphasis given to development of general dynamic system theory and to exploration of classical models from social, physical, and life systems. Goal is to develop ability to recognize and analyze dynamic phenomena in diverse situations. Concepts covered include: formulation and analysis of difference and differential equations; state-space formulation: linear systems, fundamental solution sets, equilibria, dynamic diagrams; eigenvector analysis of linear systems, the concept of stability. Systems with positive variables: Frobenius-Perron theory, stability, existence of positive equilibria, comparative statics. Markov Chains: finite and infinite Markov Chains, limiting distributions, transient state analysis, state statistics. Applications discussed 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) TTh 1:15-2:30

201B. Dynamic Systems—Transforms, concepts of control, and feedback, controllability, observability, and canonical forms. Nonlinear system analysis; stability, Lyapunov 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

208. The Art of Mathematical Modeling—Construction of realistic mathematical models is essential to the successful application of quantitative analysis to new and unexplored problem areas. Modeling is an art and should be taught as art. Students develop skills in modeling the way an artist’s studio encourages an artist. Students will become acquainted with and discuss the difficulties in the modeling process. Modeling exercises will be imbedded within practical problems. There will be no one “correct” model; ingenuity and creativity will be encouraged, and no particular set of mathematical skills will be assumed. Problems focus on issues that underly the modeling process; complexity versus simplicity, design of experiments, validation, degrees of freedom, simulation, and uncertainty. Previous problems include planning of public parks, predicting Golden Gate Bridge suicides, optimal traffic light timing, and design of a market research plan to evaluate a new service. Prerequisite: Calculus and some knowledge of probability.

3 units, Spr (Smallwood, Morris)  
W 3:15-5:30

209. Quantitative Methods in Transportation and Urban Service Systems—Quantitative techniques of engineering, management and systems sciences with emphasis on 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. Implementen 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

ECONOMICS

155. Economics of Natural Resources—(Enroll in Economics 155.)
5 units, Spr (Wolack)

212A,B. Economic Analysis—Presents the basic principles for analysis of economic problems arising in industry, individual or institutional decision making, and government. Provides a foundation of concepts suitable for direct application, for further theoretical work in economics, and for further courses in related specialized topics in planning, management, investment, and policy. Specific theoretical topics in the first quarter include (1) production: production functions, cost functions, duality; (2) the behavior of the firm: pure competition, monopoly, oligopoly, pricing policy; (3) individual preferences: Pareto efficiency, welfare theorems. Emphasis is on the translation of theory into both qualitative understanding and concrete procedures for analysis and implementation. Examples illustrate theory, its application, and its relation to further study in economics of industry, financial theory, public policy analysis, marketing, and strategic planning. The theoretical topics of the second quarter 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. Prerequisite: 241 or equivalent is highly recommended.

212A. 3 units, Win (Luenberger)
TTh 9:30-10:45

212B. 3 units, Spr (Luenberger)
TTh 9:30-10:45

214A,B. Public Policy Analysis—An approach to public policy analysis drawing on law, economics, and system analysis in developing a conceptual framework for policy formulation and evaluation. Neoclassical welfare economics used as reference point 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. Economic incentives for competition and cooperation among firms in relation to rulemaking and the effects of intra and inter-industry cooperation on the national economy are studied. 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—Discussion of the systems aspects of economic problems, with particular emphasis on principles and techniques for dealing with complex investment opportunities. The general objective is to relate economics, finance, and systems concepts to complex investment problems. The course, which is partly tutorial and partly research-oriented, consists of presentations by faculty, guests, and students. Topics include: 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 both theoretically sound and suited to application. Appropriate either as a terminal course or as a foundation for further graduate work in applied areas. Theory presented axiomatically with emphasis on outcome space representation for both discrete and continuous random variables. Discussion of basic concepts, description of random variables, changes of variable, transform techniques, named distributions, and computer simulation. Most enrolling students have had previous probability courses, but they share a desire to learn how to apply probability concepts to problems of uncertainty. The course objective is to provide students with the same understanding and competence in analysis of probabilistic problems that they already
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 people to convert the opaque decision situations that confuse them 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 range over every major field of application and provide the philosophical concepts and practical techniques necessary to achieve mastery in decision-making in a complex, dynamic, and uncertain world. (DR:8)

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

231. Decision Analysis—Development of a normative rationale for individual and group action in the face of uncertainty, complexity, and dynamism. Presentation of the procedures necessary to reduce the rationale to practice. Encoding of information and preferences. Discussion of utility measures of risk preference and discounting measures of time preference. Analysis of problems using decision trees that include risk and time preference. Determination of the economic value of perfect and imperfect information on one or several variables in a decision problem. Design of economic information-gathering experiments. Presentation of examples that range over the fields of business, engineering, law, and medicine. Applications drawn from private and public sectors of the economy. Prerequisite: Knowledge of basic probability (221 or equivalent).

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

232. Advanced Decision Analysis—Extension of decision analysis beyond the basic paradigm. Emphasis on determining and extending the boundaries of logical analysis of decisions. Discussion of such representative topics as creation of alternatives; the encoding of subjective information without bias; foundations of inference; invariance and exchangeability principles; relationship of decision analysis to classical inference and data analysis procedures; analysis of complex preference structures; normative preference principles; repetitive, iterative, and decentralized decision systems; value of information in special contexts; use of experts; competitive and social decision analysis; sensitivity and approximation; and decision analysis in dynamical processes. Content will vary with current research interests. Prerequisite: 231.

4 units, Spr (Howard) Th 2:45-5:15

234. Artificial Intelligence for Decision Analysis—Investigates the relationship between decision analysis and artificial intelligence in building expert systems for decision making in complex domains. Major topic areas include fundamentals of artificial intelligence (production systems, search, logic programming) and design of intelligent decision systems based on decision analysis (use of formal methods in decision making, representation and solution of decision problems, reasoning under uncertainty). Also covers Lisp programming for students not familiar with the language. Course requirements include a substantial project based on the concepts developed in the course. Prerequisite: 231, or equivalent.

4 units, Aut (Holtzman) MF 3:15-4:30

235. Medical Decision Analysis—(Same as Medical Information Sciences 235, Computer Science 371). Introduction to the use of decision analysis in medical practice. Student teams will analyze specific clinical decision problems as a term project. Individual analyses will be generalized by outlining a computer-based clinical decision tool for cases similar to the one analyzed. Also covers advanced topics in decision analysis of particular relevance to medical decision, including influence diagram formulation, probability encoding, risk attitude assessment, value model development, and computer-based decision system design. Prerequisites: 31, 231, or equivalent. No formal medical background is required.

3 units, Spr (Holtzman) MF 3:15-4:30

236. Decision Analysis Practice—Provides an opportunity for students trained in the theory of decision analysis to apply that knowledge in practice, and also to extend the domain of rational analysis. Teams of students each analyze a current decision problem faced by an actual decision maker. They must carry out the technical procedures of modeling, information assessment, and value encoding by communicating with individuals who are usually not trained in logical analysis. Problems chosen by students have covered every level of decision-making from the university to the community of nations, and many fields of human endeavor. Project evaluations are based solely on the professional quality of analysis and presentation. Prerequisite: 231.

4 units, Spr (Matheson) TTh 11-12:15

238. The Ethical Analyst—The professional analyst who uses his or her technical knowledge
in support of any individual, organization, or government is ethically responsible for the consequences of his or her acts. This course sensitizes the individual to ethical issues, provides him or her with the means to form ethical judgments. Especially questions the desirability of physical coercion and deception as a means to reach any end. An exploration of human action and relation in society will be conducted in the light of previous thought and used to provoke additional research on the desired form of social interactions. Students are encouraged to explore attitudes toward ethical dilemmas by creating an explicit personal code. Selected issues from the full range of human affairs will be presented and explored to test the student's framework for ethical judgment.

1-3 units, Spr (Howard) T 1:15-3:45

OPTIMIZATION


4 units, Aut (Tse) MW 9:30-10:45


4 units, Spr (Staff) MW 9:30-10:45

253. Optimal Dynamic Systems—Development of optimal control theory and its applications to social, economic, and life systems. Pontryagin maximum principle is 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 that are discussed in detail include: management of renewable resources, dynamic theory of the firm, control of predator-prey systems, and optimal economic growth. Prerequisite: 201B.

3 units, Aut (Tse) MW 9:30-10:45

256. Convex Analysis—Introduction to convex analysis, conjugate duality and variational inequalities. A common theory underlying many concepts from economics, mathematical programming, optimal control, calculus of variations, game theory, and stochastic programming is presented. Topics include: properties of convex sets and functions, conjugacy, conjugate duality, multifunctions, monotone operators, and generalized equations. Applications include: duality in economics (Hotelling's lemma, and Shephard's lemma), first order necessary and sufficient conditions for nonlinear programming, duality in linear and quadratic programming, Von Neumann's saddle-point theorem, computation of and existence theorems for equilibria (e.g., Nash, Arrow-Debreu models). Also a general Newton type algorithm to solve generalized equations. Prerequisites: Multivariate calculus and linear algebra; exposure to at least one of the application areas mentioned above is assumed.

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

263. Principles of Optimization—The objective is to demonstrate that a rather large segment of the field of optimization can be effectively unified by a few geometric principles of linear vector space theory. Introduction to functional analysis; linear vector spaces, normed spaces, Banach space, Hilbert space. Projection theorem in Hilbert spaces with applications to least-square estimation and minimum norm control. Dual spaces and linear functionals, the Hahn-Banach theorem. Convex optimization, duality theory, Kuhn-Tucker theorem with applications to production planning, resource extraction. Prerequisite: 201B or Mathematics 113, Mathematics 115.

3 units, Aut (Tse) MW 9:30-10:45 alternate years, given 1987-88

APPLICATIONS AND RESEARCH

253. Energy Policy Models—Design and application of formal models in the study of strategic public and private sector energy planning problems. The course addresses policy problems involving issues of individual choice, social welfare, technology tradeoffs, resource management, and uncertainty in a national or international setting. Emphasis on the integrated utilization of modeling tools drawn from diverse methodologies and the requirements for suc-
cessful application in a policy-making context. Focus on 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

286. Decision Systems—Focuses on the integration of Artificial Intelligence, Decision Sciences and Systems Modeling to design and implement intelligent decision support systems that can enhance decision making capability. Topics discussed include: 1) decision process models with recognition of bounded rationality; 2) knowledge representation and use of knowledge in reasoning and analysis; 3) expert systems and development of expert rules; and 4) distributed environments involving many individuals directly or indirectly influencing the decision process. Course requirements include development of a decision system for a specific domain application.

3 units, Win (Tse) Th 3:30-5:15

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 in which people pursue ends on a voluntary basis. The fundamental axiom explored is: "Peaceful, honest people have the right to be left alone." Each term in the axiom is carefully defined, various bases for the axiom are discussed, and the consequences of the axiom are derived. Topics addressed include: efficacy and ethics; property rights and homesteading, "cocoon" model, and 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, including help for the needy, victimless crimes, and environmental protection; transition strategies to a voluntary society.

1-3 units, Win (Howard) TTh 2:45-4

288. Environmental Health Risk Assessment—(Enroll in Industrial Engineering 244.) Principles of quantitative health risk assessment applicable to routine as well as 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

292. Directed Reading and Research in Engineering-Economic Systems—Directed study and research on subject of mutual interest to student and staff member.

1 or more units, any quarter (Staff) by arrangement

293. Seminar in Engineering-Economic Systems—Lectures on research problems and recent results in engineering-economic systems by faculty, students, and visiting specialists.

1 unit, Win, Spr (Staff) 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 as well as areas of applications. Topics will be announced on a quarterly basis.

1 or more units, Aut, Win, Spr (Staff) by arrangement

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT

Emeriti: (Professors) Eugene L. Grant, W. Grant Ireson, Robert V. Oakford, David A. Thompson
Chairman: Warren H. Hausman
Associate Professors: Hau L. Lee, Robert H. Keeley, Elisabeth Paté-Cornell
Assistant Professors: Paul S. Adler, Margaret L. Brandeau, Kathleen M. Eisenhardt, James E. Hodder, Robert I. Sutton
Professor (Teaching): Robert McGinn
Courtesy Professor: Steven C. Wheelwright
Affiliated Faculty Professors: Frederick S. Hillier, Charles A. Holloway, Douglass J. Wilde, Richard S. Shevell, Arthur F. Veinott
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.) It should be considered a terminal degree and not a step toward a second advanced
degree. The Ph.D. is not offered in Engineering Management. Those students who expect eventually to pursue an M.B.A. degree should not apply. Students interested in management of construction or Civil Engineering Infrastructure should apply to the Civil Engineering Department at Stanford.

The Degree of Master of Science in Engineering with a concentration in Engineering Management requires 30 units of specified courses in the Engineering Management area and a coherent package of 15 additional units of coursework typically in the student's technical area (beyond the previous degree level). A sample program outlining detailed requirements for the degree is available from the Department of Industrial Engineering and Engineering Management. This program should be of particular interest to Honors Cooperative students.

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.

Manufacturing Systems Engineering is a joint effort of the departments of mechanical engineering and industrial engineering and engineering management. The program seeks high-quality students with strong educational backgrounds in engineering and provides a demanding curriculum strong in both hardware and engineering management.

The hardware and engineering-design aspects of the program include:

- Computer-Aided Design
- Engineering Design
- Introduction to Robotics and Manipulation
- Manufacturing Engineering
- Microprocessor Applications
- Visual Thinking

The engineering management subjects include:

- Analysis of Production Systems
- Engineering Economy
- Industrial Accounting
- Manufacturing Strategy
- Organizational Behavior and Management
- Quality Assurance and Control

The purpose of the thesis is to prove the professional competence of the candidate and not necessarily to make an original contribution to knowledge.

DOCTOR OF PHILOSOPHY

The Doctor of Philosophy in Industrial Engineering is for students who desire careers in teaching or in research, rather than in professional practice.

The degree of Doctor of Philosophy is offered under the general regulations of the University. The program requires a minimum of three years (nine quarters) of graduate study, at least 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 Commit-
tee of three, appointed by the department head and having as chairman the faculty member who will direct the thesis work. The final program must be approved by the department.

ASSISTANTSHIPS AND SCHOLARSHIPS

A limited number of fellowships and assistantships up to $17,000 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 February 1 preceding the start of the academic year for which the award is to be made.

COURSES

UNDERGRADUATE

60. Engineering Economics—(Enroll in Engineering 60.)

100. Organizations: Theory and Management
—A survey of classical and modern organization theory; concepts and functions of management; and 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 instead.

4 units, Spr (Eisenhardt) TTh 10-11:50

107. Work and Society — (Enroll in Values, Technology, Science and Society 170.) Historical and contemporary perspectives on work, particularly as conditioned by technology and transformed by technological change. Topics include work in the pre-industrial world; the impact of the industrial revolution on work, leisure, and community; philosophies of work and work-society relations; the labor movement in Europe and America; key 20th-century work legislation and court cases in America; recent innovations in work theory and practice in Sweden, Italy, Japan, and the U.S.; and work and technology in the future.

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

121. Quality Assurance and Control—Concepts and statistical methods employed in the assurance of product conformance to specifications in the industrial environment. Emphasis is placed on acceptance sampling, process control, reliability engineering management, and the economic design of control methods. Prerequisites: Statistics 110, 116.

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. Both the history of work design and modern approaches will be covered. Prerequisites: 100, 121.

4 units, Spr (Staff) TTh 8:30-9:45

133. Industrial Accounting—Introduction to basic accounting concepts and operating characteristics of accounting systems. Principles of financial and cost accounting, design of accounting systems, techniques of analysis and cost control. Course is designed for the user of accounting information and not as a first course for those preparing for careers as professional accountants. Interpretation and use of accounting information for decision making is stressed. Students who have taken or are taking another University course in elementary accounting should not enroll. Videotapes are used in a number of class sessions.

3 units, Aut (Riggs) MWF 8 and 1:15

144. Simulation—The design, creation, and analysis of simulations. The use of simulation for estimation, comparison of policies, and optimization. Emphasis is primarily on applications in the areas of production and management. Prerequisites: 121, Computer Science 106B and Operations Research 153 or their equivalents.

4 units, Spr (Staff) MWF 9

180. Senior Project: Organizations — Each student will participate in a major project as a member of a group of four students. Special attention will be given to problem identification and definition, and emphasis will be put on synthesizing feasible solutions to real problems. Restricted to 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 — Each student will participate in a major project as a member of a group of four students. Special attention will be given to problem identification and definition, and emphasis will be put on synthesizing feasible solutions to real problems. Restricted to 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 (Hodder, Pate-Cornell, Staff) TTh 11-12:15
186. Senior Project: Production—Each student will participate in a major project as a member of a group of four students. Special attention will be given to problem identification and definition. Students will be expected to apply analytic methodology obtained from previous course work, when appropriate; but the emphasis will be on synthesizing feasible solutions to real problems. Restricted to I.E. majors in their senior year not enrolled in either 180 or 183. Not open to graduate students. Prerequisites: 100, 121, 125, 133, 144, 235, 260, Engineering 40, Operations Research 152, 153. 4 units, Win (Carlson, Hausman, Lee, 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.) An investigation of problem solving with particular emphasis on problem definition, creativity, and interpersonal and organizational factors that influence thinking. Common blocks to problem solving will be explored and methods of dealing with them will be presented. The advantages of integrating various problem solving strategies will be stressed through use of reading, abstracted problem situations, and projects. Open to undergraduates and graduates in any field. 3 units, Aut (Jucker) TTh 11-12:50

203. Organizational Behavior and Management—Organization theory; concepts and functions of management; behavior of the individual, the work group, and the organization. Substantial emphasis on case and related discussion. Enrollment limited and restricted to graduate students. 3 units, Aut (Jucker) TTh 11-12:50

204. Organizational Transitions — Course offers 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. The first portion of the course uses the life cycle metaphor to consider the organizational transitions of birth, growth, stagnation, decline, and death. The second portion considers other transitions that can occur at almost any point in the life cycle. These include executive succession, strikes, and efforts to turn around stagnating, declining, or dying organizations. Finally, since many organizational transitions are threatening to participants, the course also explores the general literature on the behavior of individuals, groups, and organizations during crises. Prerequisites: 203 or equivalent. For graduate students only. given 1987-88

206. Management of Conflict—Conflict is inherent in organizational change. Power, negotiation, and persuasion are means by which the decision maker might deal with such conflict. Focus is on assessing the individual’s power among interest groups within and outside the organization, understanding the process of bargaining, developing negotiating skills, and exploring the practical and ethical consequences of managerial power. Students will explore different techniques for handling intergroup and interpersonal conflict by participating in a series of simulated managerial situations. Individualized and video taped feedback, maximizes their effectiveness as decision makers and implementers of change, and develops styles for dealing with conflicting relationships. Enrollment limited to 20 students. 3 units, Aut (Greenhalgh) M 1:15-3:45

234. Research and Development Management—The economics and functions of R&D in the business enterprise, including planning, forecasting and budgeting. The practical problems of project evaluation, project selection, integration of R&D with marketing production, and financial management; selection and retention of scientists and engineers; establishment of research priorities; financial controls of R&D operations; R&D evaluation and technological forecasting. Prerequisite: Operations Research 152 or equivalent; graduate standing or consent of instructor. not given 1986-87

235. Introduction to Financial Decisions—(Same as Economics 112.) This course focuses on the models and techniques in financial decision-making under uncertainty. Topics covered include risk measurement, expected utility theory, decision trees, and portfolio and capital market theories. The effects of taxation and inflation are also discussed. Prerequisites: 133, Engineering 60, Operations Research 152, and Statistics 116. Enrollment limited and at discretion of instructor. 3 units, Aut (Hodder) MWF 9 Win (Keeley) MWF 9

237. The Firm in the International Economy —The response of firms to international economic forces. Exposure to exchange rate movements, trade barriers, and international taxa-
tion. Implications for accounting, financial and production practices. Prerequisites: 235 (required) and Economics 165 (recommended). Enrollment limited and at discretion of instructor (preference given to students with recommended prerequisite).

3 units, Spr (Hodder) TTh 8:30-9:45

240. Engineering Risk-Benefit Analysis—Techniques of analysis of engineering projects involving a trade-off between risks (technical, human, environmental, etc.) and benefits. The course has 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 (such as safety of nuclear power plants, liquefied natural gas terminals, and dams) are designed to be of interest to the students of several engineering departments. The emphasis is put 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

242. Financial and Organizational Control—Introduction to the design and implementation of control systems. Control systems are viewed as both information and motivation devices. Topics include: development of cost behavior, extensions of C-V-P and variance analysis, cost issues in pricing, financial control structures in different types of organizations, and implementation. Prerequisites: 133; 100, or 203 recommended. Open to seniors and graduate students only. Enrollment is at the discretion of instructor.

not given 1986-87

244. Environmental Health Risk Assessment—Principles of quantitative health risk assessment applicable to routine as well as catastrophic pollution problems. The course has three parts: dispersion models (air and water), dose-response analysis (epidemiological and animal studies) and two complete illustrative cases. 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

260. Analysis of Production and Operating Systems—Introduction to the design, operation, and control of production systems using mathematical, computational, and other modern analytical techniques. Areas investigated will include determination of optimal facility location, determination of production lot sizes,
interactions between functions, such as those between R&D and marketing, R&D and manufacturing, and marketing and manufacturing. 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 353.) Offered for students interested in starting a new business and/or participating in the management of a small, ongoing business during its formative stages. Emphasis is on the development and evaluation of realistic, action-oriented business plans to launch new enterprises. Legal, financial and related considerations that are peculiar to new ventures are also discussed. Students, working alone or in small groups, are required to develop a detailed business plan for a specific, proposed new venture. Enrollment limited and at discretion of instructor based upon previous management training and particular new venture being proposed.

4 units, Spr (Keeley) TTh 10-11:45

272. Automation and Work—(Same as VTSS 172.) The reciprocal effects of advanced technologies and changes in work. Topics include human resource management in technology-intensive environments, implementing advanced technologies (numerical control, word processing, CAD, etc.), new versus old skills, technology and industrial relations, Taylorism, knowledge in production, learning and productivity, technology and employment. Emphasis is placed on current issues, but students will be encouraged to explore historical background. Open to graduates and senior students only. Enrollment limited and at discretion of instructor.

3 units, Win (Adler) MW 11-12:15

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 will develop a new product and a business plan; recommendations for products are available. All functional areas of new ventures will be studied. Enrollment is 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 per quarter covering a wide range of aspects of risk analysis techniques and applications; assessment problems as well as valuation questions; technical, political, economic, and psychological aspects of risk-benefit decision making presented by speakers from universities as well as industry. No letter grades will be given. Attendance required. Previous exposure to probabilistic methods recommended.

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 from year to year with faculty and student research interest. Open to doctoral students interested in research problems and issues in the fields of organizational design, behavior and control. not given 1986-87

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.

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

360. Doctoral Research Seminar in Production—Topics from current published literature and working papers. Content will vary from year to year. Open to doctoral students interested in research problems and issues in the production-inventory area. Prerequisites: 260 and at least one of 261, 262 or equivalent.

3 units, Win (Brandeu) MW 1:15-2:30

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.

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

363. Advanced Models for Service Systems—A study of advanced models for operations plan-
ning and management in the service sector. Emphasis will be on extending quantitative models typically used in manufacturing production to problems in service operations. Topics will include forecasting, scheduling, inventory control, product flow, capacity planning, facility location, logistics, and financial decision models. Application areas examined will include health care, public emergency services, transportation, financial services, and retail sales. Prerequisites: 260 or equivalent, Operations Research 153 or equivalent.

3 units, Spr (Brandau) MW 2:45-4

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 is on operating characteristics, performance measures, and optimal operating and control policies. Prerequisites: 260 and 261 or equivalent.

not given 1986-87

370. Management of Technology Doctoral Research Seminar — Intensive review of the academic literature in the management of technology field. Topics covered will include technological forecasting, R&D management, theories and models of technological revolutions, and the classic academic studies of technological innovation. Topics may vary from year to year. Prerequisites: 269 and 270 or equivalent. Enrollment limited and at discretion of instructor.

3 units, Win (Adler) M 2:45-3:15

390. Doctoral Research Seminar—Course provides an overview of topics in Industrial Engineering and Engineering Management. In the fall quarter, faculty members in the department present examples of ongoing research. The winter quarter features presentations from speakers outside the department, as does the spring quarter. 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 will be given.

Aut, Win, Spr (Staff) T 4:15-5:30

MATERIALS SCIENCE AND ENGINEERING

Emeritus: (Professor) G. Marshall Pound, O. Cutler Shepard
Chairman: Richard H. Bube
Associate Chairman: William D. Nix
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. Jaffe, David Redfield, Arden Sher, John Stringer, Henry Wise
Consulting Associate Professor: Jeffrey Wadsworth

OFFERINGS

Materials Science and Engineering is concerned with the relation between the structure and properties of materials, factors which control the internal structure of solids, and processes for altering the structure and properties of solids. It brings together in a unified discipline the developments in physical metallurgy, ceramics, and the physics and chemistry of solids. The undergraduate program of the department, described under the School of Engineering, provides training for the physical metallurgist or materials engineer and also preparatory training for graduate work in materials science. Capable students are encouraged to take at least one year graduate study to extend their coursework and to obtain training in research. Coterminal degree programs are encouraged both for undergraduate majors in Materials Science and Engineering and for undergraduate majors in related disciplines. Graduate programs lead to the degrees of Master of Science, Engineer, and Doctor of Philosophy.

FACILITIES FOR INSTRUCTION AND RESEARCH

The department occupies an area of 30,000 square feet in the Thomas F. Peterson 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 Physics, Chemistry, and Applied Physics, participates in an interdisciplinary Center for Materials Research. The center provides equipment, service facilities, and funds for faculty and student research. In addition the center provides 35,000 square feet of space for materials research in the McCullough Building. Opportunities are also available for research at the Stanford Synchrotron Radiation Project (SSRP). Located at the Stanford Linear Accelerator, SSRP utilizes the extremely intense x-ray and ultraviolet synchrotron radiation produced in the electron-positron storage ring for a large variety of studies of solids, liquids and gases. For more information, see the section describing SSRP in this bulletin.

UNDERGRADUATE PROGRAM

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 grade average of B for course work.

The department offers a variety of programs of study leading to the Master of Science degree. The majority of students take a general program in materials science; however, programs are available that specialize in various technological areas of materials engineering. The requirements for the M.S. degree programs are 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. 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 applied to materials technology. These programs are terminal M.S. programs. A minimum of 24 units in materials science and engineering, 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 in a coherent program directed toward the educational goals of the student, approved by the student's advisor and the Advanced Degree Committee. Course sequences listed below are illustrative and for the guidance of the student; program-oriented substitutions and changes are possible with approval.

MECHANICS OF MATERIALS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S.&amp;E. 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 203</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
</tbody>
</table>
M.S.&E. 205. Mechanics of Materials 3
M.S.&E. 238. Fracture of Solids 3
M.S.&E. 249. Time-dependent Plasticity 3
Mech. Engr. 200A,B. Math. Methods (or equivalent) 6
Electives 18
Total ........................................ 45

ELECTRICAL, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS
Course No. Subject Units
M.S.&E. 188. Electrical, Optical, and Magnetic Properties of Materials 4
M.S.&E. 210. Semiconductor Materials Processing 3
M.S.&E. 222. Statistical Thermodynamics 3
Elec. Engr. 322A,B. Quantum Mechanics 6
M.S.&E. 234. Electronic Transport in Solids 3
M.S.&E. 235. Photoelectronic Properties of Solids 3
Elec. Engr. 332. Optical Properties of Solids 3
Electives 14
Total ........................................ 45

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.
4. Maintain a grade average of B for all course work taken as a graduate student at Stanford.
5. A candidate must present the results of his or her dissertation at a departmental seminar prior to his University oral examination.

COURSES
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. Materials Engineering of Microelectronic Devices—(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 (Braum) MTThF 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 (Nix) MWF 9 Th 4:15
158. Electrical, Optical and Magnetic Properties of Materials—(For undergraduates, see 188 for description.)
5 units, Win (Bube) TTh 9:30-11:15 M 4

160, 161, 162. Experimental Methods in Materials Science—(For undergraduates, see 202 A, B, C for description.) 160 equivalent to 202B; 161 equivalent to 202A; 162 equivalent to 202C.
160. 2 units, Aut (Staff) T 1:15
161. 2 units, Win (Bravman) W 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) MTThF 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 (Nix) 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—Main emphasis is on qualitative and semi-quantitative understanding with a broad look at the important phenomena involved in the growth and perfection of crystalline solids from the melt, solution, vapor, electrodeposition, etc. 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
given 1987-88

201B. The Science of Crystallization: Applications—Main emphasis is 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, etc., bulk single crystal formation via the Czochralski and Bridgman techniques, fiber growth, edge defined growth, flux growth, chemical crystalizers, 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
given 1987-88

202A,B,C. Experimental Methods in Materials Science—Laboratory course involving experimental techniques in different areas of materials science. Typical experiments are listed below: 202A: Structural characterization by optical microscopy and scanning electron microscopy; experiments on thermodynamics and kinetics of materials. 202B: X-ray diffraction and transmission electron microscopy. 202C: Experiments on the mechanical, electrical, optical and magnetic properties of solids. Prerequisites: Previous concurrent registration in the Materials Science and Engineering 180 series or their equivalent.
2 units, Aut (Staff) T 1:15
Win (Bravman) W 2:15
Spr (Bates, Staff) M 4:15

203. Mechanics of Materials—Elementary continuum mechanics, kinematics of stress and strain, Hooke’s law for isotropic and anisotropic solids, simple stress states, phenomenological plasticity, single crystal plasticity, elementary treatment of dislocation stress fields and their
use in discussing theories of plastic deformation and fracture in solids. Prerequisite: 185.

3 units, Spr (Barnett) MWF 9, given 1987-88

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 1987-88

205. Strength and Microstructure—Mechanical properties of solids as viewed by the materials scientist or physical metallurgist. Basic aspects of dislocation theory and the role of dislocations and other defects on mechanical behavior of solids. The elastic, anelastic, and plastic properties of solids, stressing the relation between the internal structure of solids and the corresponding mechanical properties. Methods of hardening materials and mechanisms of hardening. Specific mechanical properties such as fracture, fatigue, and creep. Application of the concepts developed will be made to materials useful in technology. The course is directed primarily toward non-materials science majors. Prerequisite: Upper division or graduate standing in Engineering or Science.

3 units, Aut (Sherby) MWF 8


3 units, Aut (Nix) MWF 9

207. Stress Analysis of Thin Films and Layered Composite Media—An 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. Prerequisite: 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


3 units, Aut (Barnett) MWF 10

210. Semiconductor Materials Processing—Main emphasis is on an atomistic understanding of the key processes involved in the synthesis of integrated circuits. The course is 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) MWF 10

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, will be developed. Recommended: First year graduate understanding of solid-state electronics.

3 units, Spr (Fahrenbruch) TTh 2:45-4, given 1987-88

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, Spr (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 (Sher) TTh 1:15-2:30

226. Electrochemistry and Corrosion—Development of electrochemical principles with application to corrosion, electrolytic processes, and galvanic cells. Prerequisites: Elementary thermodynamics.

3 units, 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.)

230. Materials Science Colloquium.
1 unit, Aut, Win, Spr (Huggins, Nix, Bube) 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) TTh 10-11:15

233. Quantum Theory of Energy States in Solids—Applications of wave mechanics and approximate methods of atomic systems, free electron model of metals, and energy bands in one and three dimensional crystals. Prerequisite: 188 or Electrical Engineering 322A.

3 units, Spr (Bates) TTh 1:15-2:30

234. Electronic Transport in Solids—Time dependent wave mechanics and wave packets. Electrical conductivity, mobility and scattering processes. Interpretation of the Boltzmann equation for galvanomagnetic, thermal, and thermoelectric processes in metals and semiconductors. Localized levels and Fermi level analysis of semiconductors. Prerequisite: 233 or Electrical Engineering 322B.

3 units, Aut (Bube) MWF 2:15

235. Photoelectric Properties of Solids—Selected topics in photophysical properties of solids, including photovoltaic, luminescence, photovoltaic effects, and methods of photoelectronic analysis of ordered and disordered materials. Prerequisite: 233 or Electrical Engineering 322B.

3 units, Spr (Bube) MWF 2:15

236. Modern Imaging Techniques in Materials Science—Currently important methods of directly examining the microstructure of materials are surveyed. Topics: optical microscopy, scanning electron microscopy, field-ion microscopy, transmission electron microscopy, x-ray topography and scanning transmission electron microscopy. Emphasis is on the electron-optical techniques. Prerequisite: 180.

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

238. Fracture of Solids—The stress fields about elastic cracks developed from both a conventional elastic and a dislocation 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 (Barnett) MWF 10
rupture. Various types of life prediction methodologies are covered, ranging 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

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

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.)

268. The Electronic Structure of Surfaces and Interfaces—(Enroll in Electrical Engineering 329.)

278. The Science of Semiconductor Surfaces—(Enroll in Electrical Engineering 331.)


3 units, 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 (Stevenson) by arrangement


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; 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 Mungal, Stephen J. Niksa, Sheri D. Sheppard, Juan Simo

Courtesy Professors: Robert A. Chase, Peter M. Finsky, Robert L. Street, George Springer

Courtesy Associate Professor: Leslie J. Dorfman

Courtesy Assistant Professor: John J. Csongradi

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


Acting Associate Professor: David M. Kelley

Consulting Professors: Floyd L. Culler, Chauncey Starr

Consulting Associate Professor: Harry T. Whitehouse

Teaching Specialist: Francis E. Rinehart

ORGANIZATION AND OBJECTIVES

The programs in the Department of Mechanical Engineering are designed to provide background for a wide variety of careers. The discipline of mechanical engineering is very broad, but is generally understood to emphasize an appropriate mix of energy science and technology, applied mechanics, and design. Graduates at all degree levels have traditionally entered into the energy industries, into the product manufacturing industries, into government laboratories and agencies dealing with these problems, and a variety of academic situations.

Since mechanical engineering is a broad discipline, many students use the undergraduate program as a springboard for graduate study in medicine, law, political science, and other professions where a good understanding of technology is often very important. The mechanical engineering undergraduate and graduate programs provide excellent technical background for persons who want to work in environmental pollution control, transportation, ocean engineering, and other multidisciplinary problems that concern our society. Throughout the various programs, considerable emphasis is placed on the development of systematic procedures for analysis, effective communication of one's work and ideas, practical and aesthetic aspects in design, and on the responsible use of technology. This can provide a student with an approach and a philosophy of great utility, irrespective of an ultimate career.

The department is organized into three divisions: Applied Mechanics, Design, and Thermosciences. Each division maintains its own laboratories, shops, and offices. The Applied Mechanics Division covers the areas of dynamics, mechanics of deformable solids, fluid dynamics and experimental and computational mechanics. The Design Division emphasizes the design process and is specifically concerned with manufacturing technology, automatic control, robotics, kinematics, fatigue and fracture mechanics, optimization, design aesthetics, human factors, biomechanics, computer-aided design, microcomputers in design, and design research. The Design Division also offers undergraduate and graduate programs in Product Design (jointly with the Art Department). The Thermosciences Division offers courses and specialized work in the areas of applied thermodynamics, energy systems, combustion, fluid mechanics, heat transfer, plasma sciences, nuclear energy and pollution control.

Many faculty members of the three divisions are involved in advanced mathematical analyses, and the department as a whole provides a number of basic and advanced courses in applied mathematics.

FACILITIES

All three divisions of the department maintain modern laboratories which are used for both undergraduate and graduate instruction and graduate research work.

Various research projects are conducted in the Applied Mechanics Division. Qualified students participate in these as research assistants engaged in thesis research in close working association with the faculty director and fellow students. The projects include original theoretical, computational, and experimental investigations in the strength and deformability of elastic and inelastic elements of machines and structures; fracture mechanics, vibrations, and nonlinear dynamics; analysis, synthesis, and control of systems; flow dynamics of liquids and gases, including geophysical and astrophysical applications; and biomechanics.

The 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 Hospital.
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 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 IRS-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 Rehabilitative 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 managed by members of the Design Division Faculty. Facilities include a VAX 11/780 and two PDP-11/34's dedicated to real-time experiment control, a wide variety of microcomputers, and IRIS 2400 real-time graphics workstations. A unique neural and muscular systems laboratory compliments campus facilities.

The Thermosciences Division has two major laboratories. The Thermosciences Laboratory is equipped with representative power, fluid handling, refrigeration and heat and mass transfer equipment, and extensive special facilities for advanced graduate research in convective heat transfer and fluid mechanics, turbulence, internal combustion engine research and other work relevant to energy systems, conducted by the Heat Transfer and Turbulence Mechanics (HTTM) group. 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, with normal and superconducting magnets, a shock tube, 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. A wide variety of instrumentation, extensive shop facilities, utilities, and research space are all available within and shared by these laboratories.

The Guidance and Control Laboratory, a joint activity with the Departments of Aeronautics and Astronautics and Mechanical Engineering, specializes in the construction of electromechanical systems and instrumentation, particularly where high precision is a factor. Work in this laboratory ranges from robotics for manufacturing to feedback control of carburators for automotive emission control. The faculty and staff of this laboratory work in close cooperation with both the Design and Thermosciences Divisions on device development projects of mutual interest.

A wide range of computation facilities are available to department students. Three of the department's laboratories are equipped with superminicomputers, three DEC VAXes and a Prime. Numerous smaller minicomputers and microcomputers are used in the research and teaching laboratories. A microcomputer applications development laboratory equipped with several development systems is also available. Free computation is available on the DEC-20 LOTS system while larger computations are possible on the IBM 3081 at Information Technology Services.

The Thermosciences Division includes a group that conducts research, in cooperation with the NASA-Ames Research Center, in computational fluid dynamics, with emphasis on turbulent flows. This group uses NASA's CRAY-XMP, CRAY-2, and CDC CYBER 205 computers, the two most powerful computer systems presently available.

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.
BACHELOR OF SCIENCE

Students desiring to specialize in mechanical engineering during their undergraduate period may do so by following the curriculum outlined earlier under School of Engineering. The University's basic requirements for the bachelor's degree are discussed in the "Degrees" section of this bulletin.

A program for Product Design is offered by the Design Division and leads to the degree of Bachelor of Science in General Engineering. It is recommended, however, that this should not be considered a terminal degree and that all students who elect this program continue on through the master's degree in this field. 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 set by the School of Engineering (2.0 in Engineering Fundamentals and Engineering Depth). Students completing their degrees under the old requirement must achieve a letter grade indicator 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 eleventh 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 grade average 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. Coterminial information and forms can be obtained from the Mechanical Engineering Department office.

GRADUATE PROGRAMS

MASTER OF SCIENCE

The master's program normally consists of three quarters of full-time course work; no thesis is required, although many students become involved in research projects during the master's year, particularly to explore their interests in working for the Ph.D. degree.

Admission and Registration—The basic University requirements for the master's degree are discussed in the "Degrees" section of this bulletin.

To be eligible for registration as a graduate student in the department a student must have received a B.S. degree in engineering, physics, or some comparable science program. The student's undergraduate record and personal recommendations must demonstrate capability of handling graduate level work and ability to complete the requirements for the M.S. degree. Students whose undergraduate backgrounds are entirely devoid of some of the major subject disciplines of engineering (for example, fluid mechanics, applied thermodynamics, applied mechanics, ordinary differential equations) may find it desirable to take some undergraduate courses to fill in obvious gaps and prepare themselves to take graduate courses in these areas. Such students may require more than three quarters to fulfill the master's degree requirements, as the make-up courses may not be used for other than the unrestricted electives (see item 4 below) in the M.S. degree program. However, it is not the policy to require fulfillment of mechanical engineering B.S. degree requirements in order to obtain an M.S. degree, and furthermore students who have already fulfilled certain categories of the M.S. degree requirements as a result of their undergraduate work may find they have sufficient time (see item "3" below) to obtain the M.S. degree in the normal three quarters.

Graduate Program—Mechanical Engineering is a varied profession, ranging from primarily aesthetic aspects of design to highly technical scientific research. The discipline areas of interest to mechanical engineers include rigid and elastic body mechanics, materials, fluid mechanics, thermodynamics, heat transfer, nuclear reactor engineering, magnetohydrodynamics, biomechanics, and systems engineering, to name a few. No mechanical engineer is expected to have a mastery of this entire spectrum.

The master's degree program requires 45 units of course work taken as a graduate student. At least 36 of these units must be taken at Stanford; any units transferred from other universities (up to 9 are allowed) must be graduate level courses taken while registered as a graduate student, and may not be applied toward fulfillment of item "2" below.
3. Approved electives, to bring the total number of graduate-level courses in Mechanical Engineering 290, 291, and 292.

The departmental requirements which must be met for the degree of Master of Science are:

1. Mathematical Competence in two of the following areas: partial differential equations, linear algebra, complex variables, or numerical analysis, as demonstrated by completion of two appropriate courses from the following list: Mechanical Engineering 200-208; Mathematics 106, 113, 131,132; Computer Science 137A,B. (Requirement—6 units.)

   Students who completed comparable graduate-level courses as undergraduates and who can demonstrate their competence to the satisfaction of the instructors of the Stanford courses may be exempted from this requirement by their advisors, and place the units in the approved elective category.

2. 18 units of graduate-level courses in 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 the other courses numbered M.E. 290-299 or other seminars. A student planning to go on for a Ph.D. degree should discuss with his or her faculty advisor the desirability of taking 291 or 292 during the master's year.

4. Unrestricted electives to bring the total number of units submitted for the M.S. degree to 45. Students are strongly encouraged to use these units outside of engineering, mathematics, or the sciences. Students should consult their advisors for recommendations on course loads and on ways to use the unrestricted electives to make a manageable program.

5. Within the courses satisfying the requirements above, there must be at least one graduate-level course dealing with laboratory studies. Courses which satisfy this requirement are Mechanical Engineering 210C, 218A,B,C, 226A, 248, 249, 254, 268. Mechanical Engineering 292 will satisfy this requirement if 3 units are taken for work involving laboratory experiments. A student who has had a substantial laboratory experience in an industrial or government research institute may be exempted from this requirement by his advisor.

Candidates for the degree of Master of Science will be expected to have the approval of the faculty, and a minimum letter grade equivalent of 2.75 in the 45 units presented in fulfillment of the degree requirements. All courses used in fulfillment of requirements 1, 2, 3, and 5 must be graded courses (excluding courses numbered Mechanical Engineering 290-299, seminars, and courses for which a Pass/No Credit grade is given to all students).

Students falling below a letter grade equivalent of 2.50 at the end of 20 units may be disqualified from further registration. Students failing to meet the complete degree requirements at the end of 60 units of graduate registration will be disqualified from further registration. An exception to the 60-unit rule will be units used to fill deficiencies arising from inadequate undergraduate preparation for mechanical engineering graduate work.

Computational Fluid Dynamics—A graduate program in Computational Fluid Dynamics (CFD) is operated jointly by the departments of Aeronautics and Astronautics and Mechanical Engineering. At the master's level this program is an option with the general structure of the master's requirements of each department. At this level, a student interested in a still greater emphasis on CFD may register for the M.S. in Engineering or Engineering Science and design a program, in consultation with the student's advisor, with a stronger component of CFD. Students intending to seek a Ph.D. degree with an emphasis on CFD should pre-
pare for the post-master's series in CFD (Mechanical Engineering 269 and/or Aeronautics and Astronautics 214A,B,C) by planning a M.S. program strong in mathematics and numerical analysis (Mechanical Engineering 200A, B, C or equivalents) and in advanced fluid mechanics (Mechanical Engineering 251A,B, or 258, 261, etc.). Choice of math courses, theoretical and experimental dynamics courses, and electives most suitable for the CFD program should be selected in consultation with the student's advisor.

ENGINEERING PRODUCT DESIGN

The following one-year graduate program leading to a Master of Science in Engineering (Product Design) is intended for students who have completed Stanford's undergraduate major in this field. Students with undergraduate engineering degrees from other schools usually spend an additional year taking prerequisite undergraduate 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>M.E. 211A,B,C</td>
<td>Product Design</td>
<td>12</td>
</tr>
<tr>
<td>Master's Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art 360</td>
<td>Master's Project</td>
<td>6</td>
</tr>
<tr>
<td>M.E. 214</td>
<td>Philosophy of Design</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 221</td>
<td>Human Factors</td>
<td>3</td>
</tr>
<tr>
<td>**Approved Electives</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Free Electives</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

*Taken jointly each quarter.

**Approved electives must be graduate-level courses.

Students are encouraged to follow one of the following graduate design options. These are recommended electives and may require enrollment approval by the instructor.

GRADUATE DESIGN OPTIONS

Biomedical Design
- M.E. 280. Biomechanics Seminar
- M.E. 281. Orthopedic Biomechanics
- M.E. 282. Neuromuscular Biomechanics
- M.E. 284. Dynamics of Viscous Fluids andSuspensions
- 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
- Indus. Engr. 133. Industrial Accounting
- Indus. Engr. 269. Industrial Marketing
- Indus. Engr. 272. Managing Small Technical Companies
- Indus. Engr. 271. New Enterprise Management

Design Philosophy
- M.E. 214. Philosophy of Design
- M.E. 215. Designer in Society
- M.E. 222. Kinematic Synthesis of Mechanisms

Engineering Design
- M.E. 210A,B,C. Engineering Design
- M.E. 214. Philosophy of Design
- M.E. 216. Optimal Design
- M.E. 217. Design for Manufacturability
- M.E. 223. Design and Analysis of Dynamic Systems

Visual Design
- Art 261. Advanced Graphics Design
- Art 268. Design Synthesis
- Art 269. Advanced Creative Studies

Admission requirements and grade point average graduation requirements are the same as for the mechanical engineering master's degree described above. If possible, applicants should also submit evidence of design ability (e.g., photos or slides of several design projects).

Students with non-engineering undergraduate degrees in design may apply to the Department of Art for a similar graduate design program taught jointly by art and engineering faculty. Graduates of this Joint Program receive a degree of Master of Arts. Students with non-engineering degrees who wish to earn the M.S. degree should talk with the program advisor.

**Engineering Design**—Additional programs in Process Design, Control Systems Design, Mechanics and Design, Machine Design, Production Design and Biomachanics, each leading to a Master of Science in Engineering, are available. Contact the Design Division for detailed descriptions.

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. 210ABC)
- Manufacturing and Design (M.E. 213)
- Computer-Aided Design (M.E. 212A)
- Microprocessor Applications (M.E. 218ABC)
- Introduction to Robotics and Manipulation (M.E. 219)
The engineering management subjects include:

- Engineering Economy (Engr. 060)
- Industrial Accounting (I.E. 133)
- Statistics and Quality Control (I.E. 121)
- Organization Behavior and Management (I.E. 203)
- Analysis of Production Systems (I.E. 260)
- Manufacturing Strategy (I.E. 268)

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 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 Mechanical Engineering 200-208 and 290-292. The petition must be accompanied by a statement explaining the objectives of the program, how it is coherent, contains depth, and fulfills a well-defined career objective. The grade requirements are the same as for the Master of Science in Mechanical Engineering.

POST-MASTER'S DEGREE PROGRAMS

The department offers two post-master's degrees: the Degree of Engineer and the Doctor of Philosophy. These programs are described below. It is very strongly urged that students anticipating working for a post-master's degree arrange to do some research work under M.E. 291 or 292 prior to attempting to make a supervision arrangement. Faculty members supervising post-master's research will generally require some such evidence that a student has research potential before committing themselves to supervision and a research assistantship. It is most efficient to carry out this preliminary research effort during the M.S. degree year.

At their first post-master's registration, students seeking post-master's degrees must report their status of faculty supervision to the department. A student who has not arranged for faculty supervision must petition for registration after completing 45 units of graduate work at Stanford.

ENGINEER

The basic University requirements for the degree of Engineer are discussed in the "Degrees" section in this bulletin.

This degree represents nominally an additional year of study beyond the Master of Science degree, and includes a research thesis. This program is designed for students who desire to do professional engineering work upon graduation, and who desire an opportunity to engage in more specialized study than is afforded by the master's degree alone.

The admission standards for this program are substantially the same as indicated under the master's degree. However, since thesis supervision is required, and the availability of thesis supervisors is strictly limited, the department cannot admit a student to 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 grade point average of 3.0 for all courses (exclusive of thesis credit) taken beyond those required for the master's degree.

Product Design—A special two-year program in the field of Product Design leads to the degree of Engineer in Mechanical Engineering. It is intended for students who wish to augment in-depth graduate engineering study with education in the aesthetic and human qualities essential in new product development.

A typical program represents course and thesis content equivalent to the Master of Science in Mechanical Engineering plus the Master of Science in Engineering (Product Design). Alternatively, a program of interdisciplinary graduate study may be devised according to guidelines described in the School of Engineering section of this bulletin (e.g., in Biomedical Design, Computer-Based Design, or Man-Machine Systems).

The total of 90 units can normally be completed in two academic years. Students deficient in prerequisite areas may take more time. Students who fulfill requirements for this program are awarded the M.S. in Engineering (Product Design) and Degree of Engineer in Mechanical Engineering (Product Design) simultaneously at its completion.

Admission to the program follows the same requirements as for the master's degree in Product Design.

DOCTOR OF PHILOSOPHY

The basic University requirements are discussed in the "Degrees" section of this bulletin. The Ph.D. degree is intended primarily for students who desire to pursue a career in research, advanced development, or teaching; for this type of work a broad background in mathematics and the engineering sciences, together with intensive study and research experience in a specialized area, are the necessary requisites.

The department 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.

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 equivalent of at least 3.25. Courses used in the letter grade equivalent evaluation will be the same as those that would be used to meet the M.S. grade average requirement. Students entering Stanford with an M.S. from another school must have a 3.25 grade point average in the M.S. program at the previous school to take the examination in their first quarter at Stanford. After the first quarter at Stanford, such a student must meet the grade point average 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: Mechanical Engineering 280, 290, 293, 294, 295, 296, 298, Aeronautics and Astronautics 296 or 297.

The Ph.D. thesis normally represents at least one full year of research work and must be a substantial contribution to knowledge. Students may register for course credit for thesis work (Mechanical Engineering 301) to help fulfill University residence requirements, but there is no minimum limit on registered thesis units. Candidates should note that University residence requirements (see section on "Degrees") are expressed in terms of equivalent full-time registration and not in terms of units per se; questions on this point should be addressed to the departmental administrative assistant.

The department has a breadth requirement for the Ph.D. degree. 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 of the first year, pass the qualifying examination by the fall of the second year, and complete course work, demonstrate feasibility of research methods and obtain approval of the thesis proposal by the end of the third year.

Ph.D. MINOR

Students who wish a Ph.D. minor in Mechanical Engineering should consult the department office for designation of a minor advisor. A minor in Mechanical Engineering may be obtained by completing 15 units of approved graduate level courses in Mechanical Engineering, or by completing 9 units of graduate level courses and passing the departmental qualifying oral examination in two appropriate areas identified by the minor advisor.

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 for all three forms of assistance may obtain the necessary application forms from the department office.

Research assistants can, and normally do, carry out their thesis research work and write their theses as an integral part of the commitments of their assistantships.

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

PRIMARILY FOR UNDERGRADUATES

Note: Laboratory sections in experimental engineering will be assigned in groups. Insofar as the laboratory schedule permits, students will be allowed, with due regard to priority of
application, to arrange their own sections and laboratory periods. Enrollment with the instructor concerned, on the day before instruction begins, or the first day of University instruction, is essential in order that the laboratory schedule may be prepared. Enrollment later than the first week will not be permitted under any circumstances.

30. Engineering Thermodynamics—(Enroll in Engineering 30.)

33. Introductory Fluids Engineering—Elements of fluid mechanics, introduction to the use of thermodynamics and the momentum principle in the solution of fluids engineering problems selected from but not restricted to flow metering, energy losses in pipe flow, drag on a body, jet engine thrust, operation and performance of turbines, compressors and pumps. Prerequisites: Engineering 10 and 30. Concurrent Engineering 12 suggested, but not required. Limited enrollment Spring Quarter. Students are encouraged to register for Winter section where possible.

- 4 units, Win (Johnston) MWF 10
- 4 units, Spr (Staff) MWF 11
  lab MTWTh 1:15-3:05 or 3:15-5:05, or one 2-hour lab by arrangement

75. Introduction to Small Computer Hardware and Interfacing—Lecture and laboratory course describing the hardware of modern small computer systems with emphasis on interfacing to the external world. Topics include basic computer architecture, typical hardware components, analog and digital interfacing, and simple control systems. Prerequisites: Engineering 40 and 70 or equivalents.

- 3 units, Aut (Eaton) TTh 3:15-4:30 plus lab


- 3 units, Aut (Paste, Boyle) lec and lab, Sec. 1
  MW 1:15-3:05, Sec. 2 MW 3:15-5:05
  Win (Curtis, Haygood)
  MTh 3:15-5:05

102. Design Communication—Fundamentals of the four basic methods of engineering design communication; (freehand sketching, technical drawing, verbal and written presentations) are offered in a coordinated and interactive manner. Includes brief introduction to computer-aided tools in the design process. To encourage innovative and relevant use of these engineering skills, class exercises and projects are based on instructor's professional experiences.

- 3 units, Spr (Della Bona, Scott) MWF 8-10

103. Manufacturing Technology—Fundamentals of machining, welding and casting introduced in lecture and supported by laboratory experience. Emphasis placed 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. Mechanical Engineering 103D is normally taken concurrently with 103 unless the student has previous experience doing engineering drawing.

- 4 units, Aut, Win (Beach) T 9 Th 9-11
  plus lab by arrangement

103D. Engineering Drawing—Fundamentals of engineering drawing are presented including orthographic projection, dimensioning, sectioning, exploded and auxiliary views and assembly drawings. Course designed to accompany 103. Homework drawings are of parts fabricated by the student in the shop. Major assignments in 103 supported by material in 103D and assignment dates sequenced on assumption that student is enrolled in both courses simultaneously. No prior knowledge of drafting required.

- 1 unit, Aut, Win (Milroy) one meeting per week by arrangement, Sec. 1 T 7:30-9:30 p.m., Sec. 2 W 3:30-5:30

104. Dynamic Response—(Enroll in Engineering 104.)

105. Control System Analysis and Design—(Enroll in Engineering 105.)

111. Stress, Strain and Strength—Review of free body diagram analysis and basic, elastic stress analysis. Static failure theories. Buckling (column, plate, local). Fatigue failure criteria and life prediction methods. Introduction to fracture mechanics. Corrosion, stress corrosion, corrosion-fatigue. Contact stresses and surface failures (fretting, pitting, wear). Discussion of design margins (safety factors) and product liability. Homework assignments will emphasize applications to mechanical design. Prerequisites: 103 and Engineering 10 and 11.

- 3 units, Aut (Nelson) MW 1:15-2:40

112. Mechanical Systems—Emphasizes quantitative aspects of the design process. Application of basic principles and empirical relationships in the evolution from conceptual design to the detailed specification of critical components. Individual term project will 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 both studied as a process and experienced by students as they work on a design project. Final project results are presented to a professional jury. Prerequisites: 101, 103, 111, and 112.

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

115A. Human Values in Design—Active encounter with human values in design. Lectures survey central philosophy of product design program, with emphasis upon the relation between technical and human values, the creative process, and design methodology. Laboratory exercises include the development of simple product concepts visualized in rapidly executed three-dimensional mockups. Prerequisite: 101.

3 units, Win (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. Students work in class under the guidance of instructors. Concurrent assignments in 115 and 116 series product design courses provide subject matter, but the class is open to anyone wishing to improve their freehand drawing skills.

1 unit, any quarter (Scott, Burnett) 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 also 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 (Staff) TTh 11-1:05

119. Precision Engineering—Offers lectures, laboratory experiences, field trips, individual design and fabrication projects, directed toward current topics of interest in manufacturing with an emphasis on precision engineering. How to accomplish micro-inch 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—A lecture/laboratory course covering 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 devoted to demonstration and experiments in the specific area of the lectures and cover basic experimental procedures, including measurement techniques, experiment design, data collection, processing, and evaluation. Prerequisites: Familiarity with basic principles of thermodynamics, and some elementary knowledge of fluid mechanics, equivalent to Engineering 30 and Mechanical Engineering 33. Mathematical background should include intermediate calculus and ordinary differential equations.

4 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 lecture hour and lab one afternoon by arrangement

131C. Thermosciences—Continuation of 131B.

5 units, Spr (Reynolds) MWF 10 plus lab one afternoon by arrangement

138. Noise Pollution—(Enroll in Aeronautics and Astronautics 138.)
161. Mechanical Vibrations—Modeling, analysis and measurement of small motions in mechanical systems. Topics include personance, damping, harmonic analysis force transmission and extensions to multiple degrees of freedom. One session per week will emphasize practical examples and demonstrations. Prerequisites: Engineering 12 or equivalent, Mathematics 43 or equivalent.

 4 units, Aut (Cutkosky) MWF 11-12

176. Nuclear Energy—(Enroll in Engineering 176.)

180. Energy and Society—Unified analysis of the production, distribution and consumption of energy in United States and world. Treatment includes: 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. Presentation of technical information will be in terms understandable to the non-engineering student. Prerequisites: High school physics, Mathematics 21, and junior standing or consent of instructor. (DR:8)

3 units, Aut (Connolly) MWF 1:15 alternate years, given 1987-88

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 (Wilde) MWF 9

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 (Niksa) MWF 9


3 units,Spr (Staff) MWF 9

201. Applications of Complex Variables—The theory of analytic functions, with applications to the evaluation of definite integrals by contour integration, the solution of physical problems by conformal mapping, and the solution of partial differential equations by means of integral transforms. A knowledge of the algebra of complex numbers and the derivative of a complex function is assumed.

3 units, Aut (Van Dyke) MWF 11

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 (Staff)

205B. Methods of Mathematical Physics—(Enroll in Mathematics 220B.) Continuation of 205A.

3 units, Win (Staff) MWF 2:15

205C. Methods of Mathematical Physics—(Enroll in Mathematics 220C.) Continuation of 205B.

3 units, Spr (Staff) MWF 2:15

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. Prerequisites: 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.

210A,B,C. Engineering Design—Experience in the formulation, design, and analysis of real engineering projects, offered by industry. Designs will be 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, Smart Project Design. Projects will be 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). In the first quarter, the student uses rational and intuitive problem-finding procedures to identify a design project within an unexplored area of need, presents a project proposal, and performs research. In the second quarter, the student prepares a design program, develops concepts, performs necessary experiments, and carries a project to the stage of a working prototype. In the third quarter, the student refines the design from the standpoint of cost, production and aesthetics. A demonstration model is built and presented to a professional jury. For Product Design 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

212A. Geometric Modeling — Principles of solid geometry and pictorial sketching pertinent to computer-aided design of mechanical

3 units, Spr (Wilde) MWF 1:15-2:05

212B. Advanced Geometric Modeling — Space curve and surface geometry pertinent to computer-aided design and manufacture of mechanical parts and packaging. Circle and conic section algorithms. Differential geometry: Serret-Frenet formulas; Gaussian curvature. Design of plane cubics: Hermite, Ferguson, Bezier, and B-splines. Composite surfaces: Coons patches; tensor products. Intersections of curves and surfaces: developable surfaces; numerically controlled cutter paths. Lecture demonstrations and lab assignments use microcomputers. Prerequisites: 200A, 212A. 200B and C and ability to program in a high-level language such as PASCAL recommended.

1 unit, any quarter (Wilde) T 10

213. Manufacturing and Design—Course offers experience which links design and fundamental manufacturing processes. Introductory labs provide hands-on experience with machining, and casting; lectures and field trips describe manufacturing processes with emphasis on current topics of interest; and the syllabus is structured to support the design and fabrication of prototype devices by each student. The combination of design and hands-on fabrication develops judgment and intuition which combines with other elements of an engineering education to produce graduates who are well equipped to form a link between product design and manufacturing.

3 units, Spr (Beach) MW 10

plus lab by arrangement

214. Philosophy of Design—Student encouraged to develop and clarify his/her personal design philosophy by reading design-related literature, writing, and experiencing projects structured to illuminate specific philosophical issues. Discussions and experiences with individual Design Division faculty will include personal creativity, design methodology, interpersonal relationships, ethics, goal-setting, aesthetics, human values in design, ecology, appropriate technology, and decision making. Prerequisite: Concurrent enrollment in 210A or 211A.

3 units, Aut (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. The emphasis is on assisting individuals in assessing their roles in modern society. Students are required to do readings on political, social, and humanistic thought related to technology and design. A term project will be required. Limited enrollment; open to graduate students of all disciplines.

3 units, Win (Roth) W 1:15-4:05


3 units, Win (Wilde) MWF 10

217. Design for Manufacturability—Examines the relationship between design and each aspect of manufacturing, from part layout, 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 course grade will be based upon individual projects in which each student will select 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, not given 1987-88

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. Specific content includes: digital logic, microprocessor organization, development system architecture, interactive high-level language programming (FORTH), as-
semology 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: 1) builds several microprocessor interface circuits; 2) writes microcomputer control programs for each interface; 3) creates a stand-alone product using a small target system; and 4) writes a laboratory report for each assignment. Computer Science 311/Electrical Engineering 181 or their equivalents are highly recommended. A laboratory fee is required. Enrollment is limited.

3 units, Aut (Leifer) TTh 1:15-2:45

218B. Integrated in Smart Product Design — The interface methodology of 218A will be extended for real-time control of a variety of external electro-mechanical devices. Open ended assignments will include human I/O, discrete system I/O, and analog system I/O. Logic analysis, in-circuit-emulation and high performance peripheral communication protocols will be used. Where the emphasis in 218A was on acquiring the basic tools, 218B stresses the application of these tools in design.

3 units, Win (Leifer) TTh 1:15-2:45

218C. Advanced Smart Product Design — In depth, project driven study of imbedded microcomputer based projects chosen by the student.

3 units, Spr (Leifer) TTh 1:15-2:45

219. An Introduction to Robotics and Computer Vision — An introduction to the basics of robot manipulators and a review of current applications. The following topics will be discussed in detail: kinematic structure, coordinate transformations, manipulator solutions, workspace, path selection, control and dynamics, and programming. Knowledge of matrix algebra and some familiarity with basic control theory and rigid body mechanics suggested.

3 units, Aut (Roth) MWF 9 alternate years, given 1987-88

219B. Introduction to Robotics and 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. Students will be introduced to numerous available techniques for sensing displacement, force, pressure, acceleration, velocity, temperature, optical and nuclear radiation, and other physical parameters. Elementary electronic interface circuits will be presented in a manner which assumes that the student has no prior knowledge of electronic circuits. The instructor, who is an industrial consultant specializing in sensing and measurement, will also present case histories of several sensing systems which he has designed and patented.

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 is the central theme of this course. The problem of determining linkage proportions to fulfill various design requirements is treated analytically. Topics include: three- and two-dimensional displacements and motions, the theory of higher plane curves, higher-order path-curvature analysis, circle and center-point theory.

3 units, Spr (Roth) 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) MW 9

224. Advanced Manufacturing Automation — Explores 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 course grade will be based on individual projects involving an in-depth application of the course 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. Prerequisites: 219 and Engineering 105 or equivalent. Recommended: 103 or 213. Some familiarity with microprocessors desirable.

3 units, Win (Cutkosky) MW 11-12:15

plus individual meetings by arrangement
225A. Control System Design and Simulation—(Enroll in Engineering 206.)

225B. On-Off 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—Treatment of 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, given 1987-88

MECHANICS OF SOLIDS

230. Advanced Kinematics—Discussion of kinematics from both the mathematical and engineering viewpoints. Introduction to algebraic geometry. Application of matrix, tensor, and dual-quaternion methods to kinematic analysis and synthesis. A survey of current research and unsolved problems in kinematics.

3 units, Win (Roth) M 2:15-4:45


3 units, Aut (Kane) TTh 9:30-10:45

231B. Dynamics — Generalized active forces. Contributing and noncontributing interaction forces. Generalized inertia forces. Relationship between generalized active forces and potential energy; generalized inertia forces and kinetic energy. Prerequisite: 231A.

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


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

232A. Spacecraft Attitude Dynamics I—(Same as Aeronautics and Astronautics 243A.) Kinematics of spacecraft; specification of large orientation changes of a rigid body in terms of direction cosines, Euler parameters, Rodrigues parameters, orientation angles; generalized speeds, partial angular velocities and partial velocities. Gravitational forces and moments. Dynamics of simple spacecraft; effects of gravitational moments and orbit eccentricity; gyrostats.

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


3 units, Spr (Kane) WF 11-12:15


3 units, Win (Breakwell) W 2:15-4:05 plus one hour by arrangement

Shock capturing schemes for compressible Euler and Navier-Stokes equations. Comparisons with finite difference methods.

3 units, Spr (Hughes) TTh 2:45-4 given 1988-89


3 units, Aut (Hughes) TTh 2:45-4 alternate years, given 1987-88


3 units, Win (Hughes) TTh 2:45-4 alternate years, given 1987-88


3 units, Spr (Hughes) TTh 2:45-4 alternate years, given 1987-88


3 units, Aut (Herrmann) TTh 11-2:15 alternate years, 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, etc. Applications are made to electromagnetic, acoustic, elastic and other types of waves. 236A is not a prerequisite.

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

237. Free and Forced Motion of Structures— (Enroll in Aeronautics and Astronautics 244A.)


3 units, Aut (Herrmann) MWF 10 alternate years, not given 1987-88


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. Sound 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-Papkovitch-Neuber functions and the Galerkin vector. Fundamental solutions to the Kelvin, the Bossinesq and the Mindlin problem, as well as their extensions. Rigid punch and elastic contact (Hertz) problems. Introduction to nonlinear elasticity.

3 units, Spr (Barnett) MWF 11


3 units, Aut (Simo) TTh 2:45-4 alternate years, not given 1987-88


3 units, Win (Steele) MWF 1:15 alternate years, given 1987-88


3 units, Spr (Barnett) MWF II

241A. 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, Aut (Steele) MWF 1:15 alternate years, given 1987-88

241B. 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, Spr (Simo) TTh 2:45-4


3 units, Spr (Simo) TTh 1:15-2:30

242A. Introduction to Nonlinear Continuum Mechanics—(Same as Mathematics 273.) Basic kinematics. Local description of a continuum. General notions of strain and rotation, rate of deformation and vorticity. Discussion of the spatial, material and convected descriptions. Consistent linearization techniques. General balance principles. The Piola transformation and alternative notions of stress tensors. Discussion of basic thermodynamic and the role of the second law. Constitutive equations, basic principles and invariance under superposed isometries. Discussion of material symmetries and symmetry group. Application to ideal and viscous fluids, and finite elasticity. Geometric methods and computational implications of the basic theory are emphasized.

3 units, Aut (Simo) TTh 11-12 alternate years, given 1987-88
242B.C. Nonlinear Continuum Mechanics—Continuation of 242A. Applications of the basic theory. Illustrative boundary value problem for viscous fluids and elastic solids at finite strain and discussion of basic results on uniqueness and stability. Conditions on the stored energy function. Variational formulation of boundary value problems. Direct methods of the calculus of variations, mixed and complementary variational principles. Application of the basic theory to the numerical solution of nonlinear boundary value problems. Variational treatment of constraints such as incompressibility. The last part of this sequence will be concerned with current research trends in computational mechanics. Selected applications and computational methodologies will be discussed.

242B. 3 units, Win (Simo) TTh 11-12:15 alternate years, given 1987-88
242C. 3 units, Spr (Simo) TTh 11-12:15 alternate years, given 1987-88


3 units, Win (Nelson) MWF 2:15-3:40

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, given 1987-88

245. Structural Fatigue—The mechanism of fatigue and occurrences of fatigue in service. Methods for predicting fatigue life and for protecting against premature fatigue failure. Use of elastic stress and inelastic strain analyses to predict crack initiation life. Use of linear elastic fracture mechanics to predict crack propagation life. Effects of notches, manufacturing processes, load sequence, irregular loading, multiaxial loading, and environment on fatigue behavior. The subject will be treated from the viewpoints of the designer seeking up-to-date methods of life prediction and the researcher interested in improving the understanding of fatigue behavior. Prerequisites: Undergraduate stress analysis and mechanical behavior of materials.

3 units, Spr (Nelson) MWF 2:15-3:40

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.)

248. Introduction to Experimental Mechanics—Theory and applications of photoelasticity, strain gages and laser interferometric and holographic techniques. Mechanical testing using modern closed-loop, electro-hydraulic equipment. Comparison of test results with theoretical predictions of stress and strain distributions, buckling loads, limit loads, thermal stresses, etc. Experimental uncertainty analysis and statistical evaluation of data. Discussion of other methods of stress and strain determination (e.g., acoustoelasticity, brittle coatings, Moiré, etc.). Students will also do a special project on use of strain gages "in the field". Limited enrollment.

3 units, Win (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

250. Introduction to Heat Transfer—For graduate students who seek a one-quarter introduction to heat transfer. The course covers the fundamentals of conduction, convection, and radiative heat transfer, with applications in engineering analysis. Students who have had an adequate undergraduate preparation in heat transfer, should take 253 and 252A,B instead. Prerequisite: Graduate standing. Some computer skills are desirable.

4 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.). Coverage includes fluid kinematics, global equations of mass conservation and momentum, forces in fluids, equations of inviscid flow (Euler's and Bernoulli's), methods for potential (irrotational) flow, lift and circulation.

3 units, Aut (Mungal) MWF 8
251B. Advanced Fluids Engineering—Continuation of 251A with emphasis on thin shear (boundary) layers. Theory of viscous flow, Navier-Stokes equations, the boundary layer approximation, stability and transition to turbulence, thin shear layers in turbulent flow, turbulent and laminar detachment (separation). Viscous-inviscid interactions. Application to diffusers and other duct flows. Prerequisite: 251A.

3 units, Win (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. Prerequisite: 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


4 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 intended 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. Some computer skills are desirable.

3 units, Aut (Moffatt) MWF 9

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 (Staff) MTWF 10 plus one 4-hour lab


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 to be placed on the problem of efficient exchange of energy between the fluid stream and the mechanical elements of the machine. Prerequisites: 251A and 255 or equivalents.

3 units, Spr (Johnson) TTh 8:35-9:50 alternate years, given 1987-88


2 units, Spr (Self) by arrangement

258. Fluid Dynamics—A concise introduction to the physical concepts and mathematical analysis, with emphasis on topics essential for modern computational fluid dynamics. Kinematic, stress, and thermodynamic properties of a fluid. Integral and differential equations for conservation of mass, momentum, and energy. Approximate solution of practical problems using control volume methods. Dynamical similarity and its application to experimental data and the classification of flows. Properties of shock waves, vorticity sheets, and other “discontinuities” in the fluid flow. Generalized Bernoulli’s theorem; Helmholtz, Kelvin and Bjerknes vorticity and circulation theorems. Exact solutions for viscous and inviscid flows with simple geometries. Stockes’ and Oseen’s theories for low Reynolds number flows; and Prandtl’s boundary layer theory for high Reynolds flows. Irrotational potential flow for an ideal inviscid fluid. Applications to topics of current interest.

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—Introduces basic physical properties of turbulent flows. Topics include: a general discussion of turbulence structure, scales of motion, energy production and dissipation; the kinematics and dynamics of vorticity with emphasis on 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 (Spreiter) TTh 2:45-4

261B. Analytical Methods for Turbulent Flows—Course covers 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. Prerequisite: 261A, plus a graduate sequence in fluid mechanics.

3 units, Win (Reynolds) MWF 2:15

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—Intended for engineering students interested in mass, energy and momentum transport in gases. The emphasis will be on transport in laminar flows, and both continuum and molecular points of view will be presented. Methods for calculation of fundamental transport properties for both single and multi-component mixtures will be developed. Approaches for computing transport in systems undergoing phase change or chemical reaction will be described. Prerequisite: 262A or equivalent.

3 units, Win (Bowman) MWF 1:15

263. Partially Ionized Plasmas and Gas Discharges—An introduction to partially ionized gases and the nature of gas discharges. Discharges will be discussed in the context of both low pressure and atmospheric pressure applications including energy conversion and materials processing. Prerequisites: 262A or consent of instructor.

3 units, Win (Self) MWF 3:15

264. Optical Diagnostics and Spectroscopy—An introduction to spectroscopy of gases and laser-based diagnostic techniques for measurements of species concentrations, temperature, density, velocity and other flowfield properties. Topics include: 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 (Self) MWF 3:15


3 units, Win (Hanson) MWF 9

266. Industrial Applications of Lasers—An introduction to the use of lasers in industry. Lasers treated as a special type of radiant energy used to heat materials and cause chemical changes. Thermal processing model of laser drilling, cutting, welding and micromachining. Material properties changed by laser heat treatment. Use of lasers in a flexible manufacturing system. Laser-induced chemical processes. Laser-assisted semiconductor processing. Sensing applications. Prerequisites: Graduate standing; undergraduate course in heat transfer; some knowledge of lasers.

3 units, Spr (Staff) MWF 11

267. Optical Diagnostics and Spectroscopy Laboratory—An introduction to principles,
procedures and instrumentation associated with optical measurements in gases. Absorption, fluorescence and emission methods. Measurements of temperature, species concentration and molecular properties.

3 units, Spr (Hanson, Niksa) MWF 9 plus one 3-hour lab by arrangement

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. Prerequisite: At least one graduate course each in heat transfer and fluid mechanics, or consent of instructor.

4 units, Spr (Moffat) MWF 10 plus one 4-hour lab by arrangement

269. Computational Methods in Fluid Mechanics—Finite difference methods for solving partial differential equations emphasizing the equations of fluid dynamics. Integral methods for boundary layers and their coupling to potential flow solutions, boundary integral methods for potential flow, choice of dependent variables, finite difference methods for solving boundary layer problems, finite difference methods for incompressible flows including turbulent flows, introduction to large eddy simulation. Prerequisites: 252B and 200C or equivalent.

3 units, Spr (Staff) MWF 11 alternate years, given 1987-88

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 (Kruger) MWF 2:15

272. Advanced Combustion—The role of chemical and physical processes in combustion; ignition, flammability and quenching of combustible gas mixtures; flame stabilization; laminar and turbulent flames; combustion of fuel droplets and sprays; combustion of coal. Prerequisite: 271 or consent of instructor.

3 units, Spr (Bowman) MWF 2:15

273. Thermodynamics of Propulsion Systems—Analysis of the performance of propulsion systems from thermodynamic and dynamic points of view including rocket, ramjet, turbojet, and turbofan engines as well as piston, gas turbine and compound piston-turbine type engines. Prerequisite: 270 or consent of instructor. Some familiarity with compressible gas dynamics is desirable.

4 units, Win (Bowman) MWF 1:15 plus one hour by arrangement

274. Introductory Hypersonic Aerophysics—(Enroll in Aeronautics and Astronautics 212.)

275. Solar Energy Applications/Building Energetics—The sun as a source of energy, economic value of solar energy, solar position calculations. Radiative properties of materials, materials for solar applications. Heat transfer aspects of solar collection: radiation, conduction, convection. Applications to water and space heating, air-conditioning and other uses. High performance solar devices; concentrators, special surfaces, electrical power plants. Solar conversion by biological systems, solar cells. This course will normally include a project—a solar device to be built by the student. Prerequisite: 131B or equivalent.

3 units, Spr (Whitehouse) MWF 11

276. Nuclear Energy—Theory, design and applications of nuclear energy systems; radioisotope heat sources, fission chain reactors and concepts of fusion reactors. The information thus developed is applied to a number of 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

Engineering evaluation of orthopaedic procedures and devices. Correlations between engineering predictions and clinical/biological results. Introductory anatomy and physiology will be presented. Prerequisite: 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, Win (Zajac) T 2:15-4:45

284. Dynamics of Viscous Fluids and Suspensions — (Enroll in Aeronautics and Astronautics 209.)

285. Biomechanical Fluid Mechanics — (Enroll in Aeronautics and Astronautics 229.)

SPECIAL AREAS

286. Atmospheric and Space Physics — (Enroll in Aeronautics and Astronautics 227.)

289. The Social Impact of Technology — (Enroll in Engineering 221.)

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 subject of mutual interest to student and staff member. May be used to prepare for experimental research during a later quarter under 292. Student must find a faculty sponsor.
1-5 units, any quarter (Staff) by arrangement

292. Experimental Investigation of Engineering Problems — Graduate engineering student may undertake experimental investigation under guidance of staff member. Previous work under 291 may be required to provide background for experimental program. The student must find a faculty sponsor.
1-5 units, any quarter (Staff) by arrangement

293. Innovation — (Same as VTSS 166.) The nature, processes, and management of research and development in industrial societies. Sociotechnical systems as the physical bases of society. The creation of abundant societies and the rise of R & D in the final quarter of 19th century in the U.S. and Germany. Conventional linear model and improved chain-linked model. Comparison of scientific (reductionist) view with the consistent view needed in innovation; operational consequences. Modes of institutionalizing R & D. Barriers to innovation, and countervailing forces. Revolutionary and evolutionary innovation in small and large companies. Effects of management style. Effects of industry and of product life cycle. Government role in innovation.
3 units, Win (Kline) T or W 1:15-3:05

294. Design Forum — Invited speakers address issues of interest to designers. Brief presentation followed by open discussion.
1 unit, Aut, Win (Staff) F 3:15-4:05
Spr (Freund) F 3:15-4:05

295. Seminar in Solid Mechanics — Problems in all branches of solid mechanics. All Ph.D. candidates in solid mechanics are normally expected to attend.
1 unit, Aut, Win, Spr (Staff) Th 4:15-5:30

297. Energy Policy Seminar — Weekly presentations and discussions on energy policy with emphasis on technological aspects. The status of various national programs for the advancement of energy technology will be reviewed. Views on the political, social and economic aspects of projects to which engineers devote their efforts will be presented. Prerequisite: Graduate standing in engineering.
1 unit, 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

2-15 units, any quarter (Staff) by arrangement
Offerings and Facilities

Operations Research is concerned with the formulation, analysis, and use of mathematical models relevant to the understanding and/or solution of significant problems of decision making. The department's principal objectives are to provide a comprehensive program of instruction in the mathematical foundations of operations research, to acquaint students with applications of these methods to significant problems, and to develop research scholars.

The department offers programs leading to a Master of Science, Engineer and Doctor of Philosophy, and participates in a program leading to a Bachelor of Science in Mathematical 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, and reliability theory; 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 (OR) 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.

OR 152 is an introduction to linear, nonlinear, and dynamic programming for students familiar with calculus. Operations Research 151 is similar except that it also assumes a knowledge of the elements of matrix algebra, includes a discussion of game theory, and gives less emphasis to nonlinear and dynamic programming. OR 153 is an introduction to stochastic processes and models in OR for students with a knowledge of calculus and undergraduate level probability theory. OR 154 is a condensation of OR 152 and 153 for students with similar backgrounds.

OR 240 is a first course in linear programming having matrix algebra as a corequisite. OR 250 is a sequel which discusses nonlinear and dynamic programming as well as game theory. OR 251 is an introduction to stochastic models in OR for students acquainted with the elements of stochastic processes. OR 240 and 250 provide a more extensive and higher-level presentation of topics of 151 and 152. OR 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 OR 340, 341, 342, 343, 344, 347, 349, 351, 355, 356, 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 OR. Thus, the emphasis is on providing a solid foundation for a life-long professional career involving the formulation, analysis, and use of operations research models of complex systems problems in business or government.

In addition to the University's basic requirements for the master's degree discussed in the "Degrees" section in this bulletin, a candidate is expected to complete an approved course program of 45 units. This program normally can be completed in one academic year (three academic quarters) of full-time work. A number of operations research practitioners in local industry also attend part-time, taking one or two daytime classes per quarter, under the Honors Cooperative Program. Each student will normally fulfill the following requirements for the Master of Science degree:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. Res. 240</td>
<td>Linear Programming</td>
<td>3</td>
</tr>
<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>
<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>
</tbody>
</table>

Electives from the 200 or higher-level offerings of the department (with at most two units of OR 290 counted) or from authorized courses in other departments 8

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

*Comp. Sci. 135 (Operations Research 237A) may be substituted with the permission of the student’s advisor.

No thesis is required. A minimum letter grade average of 2.75 is expected.
energy and economic modeling, mathematical programming, dynamic programming, stochastic systems, stochastic processes, network and combinatorial theory, reliability, queuing theory, inventory theory, and game theory.

Candidates for the Ph.D. in Operations Research will normally 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 Economics 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 student will be examined on their selection of three of the following four courses: 340, 341, 342, 345. Similarly, for the second examination the student 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 grade of 3.0 or higher. The courses will normally include Operations Research 240, 250, 251, and 257 or approved substitutes.

FELLOWSHIPS AND ASSISTANTSHIPS

Financial aid is available on a competitive basis for qualified doctoral candidates. This includes a number of fellowships as well as some research assistantships supported by departmental research grants and contracts. Although these research assistants work closely with the faculty on their research projects, they usually are able to take close to a full course load. Supplementary financial aid can sometimes be obtained by grading, assisting in special projects, or University loans.

All applicants for financial assistance are required to take the Aptitude Test and the Advanced Test (in a field of the applicant's choosing) of the Graduate Record Examination. Applications for fellowships and assistantships should be made to the Graduate Admissions Office by 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 113 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. Prerequisites: Mathematics 43 or consent of instructor. (DR:8)

4 units, Aut (Hillier) MWF 1-2:05
Win (Veinott) MWF 1-2:05

153. Introduction to Operations Research II

4 units, Win (Lieberman) MWF 1-2:05

154. Operations Research—An introduction to the techniques and models of operations research for students who have not had the equivalent of 151 or 152, and 153. Topics are similar to those of 152 and 153. Prerequisites: Calculus and Statistics 116.

4 units, Sum (Staff) TTh 3:15-5:30

PRIMARILY FOR MASTER'S CANDIDATES

These courses are oriented toward applications. Operations Research 240, 250, 251, 257, 280A and 280B form a basic one-year core program aimed at students who desire a professional career involving application of operations research in business, government, or industry. Operations Research 245 and 246 are useful supplementary electives.

240. Linear Programming—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) TTh 4:15-5:30
Sum (Staff) TTh 12:15-2


3 units, Win (Papadimitriou) MW 8:30-9:45

246. Mathematical Programming Computation—(Doctoral students register for 346.) An overview of major computational procedures used in solving mathematical programming problems, including large-scale systems. Students become familiar with computer implementation of algorithms for: linear programming, quadratic programming, unconstrained, linearly constrained, and nonlinearly constrained optimization and gain practical experience with techniques that increase speed, stability, and accuracy of computation. Prerequisites: 250 or 342, and Computer Science 106A or equivalent, or consent of instructor.

3 units, Sum (Staff) TTh 3:15-5:30

250. Deterministic Models in Operations Research—Formulation, solution, and analysis of mathematical programming models in operations research, including some of network flow theory, dynamic programming, inventory theory, integer programming, quadratic and nonlinear programming, and game theory. Prerequisite: 240.

3 units, Win (Eaves) TTh 4:15-5:30

251. Stochastic Models in Operations Research—Introduction to stochastic modeling. Orientation is applied and directed to students anticipating doing project work in government or industry which involves stochastic modeling. Emphasis on formulation, solution, and analysis of stochastic models in operations research. Topics include 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

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 a programming language such as FORTRAN, BASIC, or PASCAL; Statistics 217 or the equivalent.

3 units, Spr (Staff) TTh 2:40-3:55
Sum (Staff) MW 1:15-3


3 units, Spr (Staff) TTh 2:40-3:55
Sum (Staff) MW 1:15-3

250A. Applications of Operations Research—Applications of operations research to problems in business, nonprofit institutions and government. Case studies will illustrate the interplay
between theory and practice. Students will use microcomputers for spreadsheets, optimization and probabilistic simulation.

3 units, Win (Manne) 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 will illustrate the interplay between theory and practice. Case studies involving 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 (Eaves) MF 3:15-4:30

300. Colloquium—Presentation of current research in operations research.

1 unit, Aut, Win, Spr (Staff) W 4:30-5:30

399. 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—Course covers 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 time to be arranged.


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


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

347. Sectoral and Economywide Modeling—Formulation and solution of models for individual sectors and for the economy as a whole. Resource depletion. Optimal economic growth. Planning with economies of scale. Partial and general equilibrium analysis. Special emphasis will be placed upon the energy sector and upon energy-economy interactions.

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


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 (Vetnott) TTh 10:30-11:45

357. Simulation—(Same as 257.)

3 units, Spr (Staff) TTh 2:40-3:55

Sum (Staff) MW 1:15-3

358. Queueing Theory—(Same as 258.)

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


3 units, Spr (Iglehart) 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, among others; problems of coordination and incentives under incomplete information: search, signaling, and related phenomena.

5 units, Win (Arrow)

366A, B. Interdisciplinary Seminar in Decision Analysis—-(Same as Economics 396A, B, Psychology 283A, Business 494A, B.) The study of normative and descriptive decision making, particularly in the face of uncertainty. Examine general studies on the way decisions are made and problems arising in making decision analyses in applied policy contexts. Meets irregularly during one or two quarters.

366A. 1-2 units, Aut (Arrow, Tversky, Wilson) by arrangement

366B. 1-2 units, Win (Arrow, Tversky, Wilson) by arrangement


5 units, Aut (Staff) given 1987-88


4 units, Spr (Wilson) by arrangement

371. Topics in Mathematical Programming—A seminar type course with presentations by students and invited speakers. General topics covered include: Structured linear programs, generalized upper bounding (GUB), generalized linear programming, decomposition principle, basis factorization, convex programming, stochastic programming, continuous programming, multi-commodity problems, large-scale networks, integer programming. In addition, one or two research topics will be selected from the following typical list: Linkage of models and submodels (for example, of different sectors of the economy); development of end conditions in finite-horizon models; experimentation with different strategies for choosing the entering and exiting variables in large linear programs,
3 units, Win (Dantzig) by arrangement

375. Polyhedral Combinatorics—Proving combinatorial theorems using linear programming ideas. Examples include Baranyai parallelisms, Greene-Kleitman partitions of acyclic digraphs, flows and circulations, Hall-style representatives, matching, matroid intersections. Also discusses concepts and techniques (e.g., total and local unimodularity, total dual integrality, lattice polyhedra, blocking and anti-blocking), and related mathematical and algorithmic issues.
3 units, Win (Hoffman) by arrangement

376. Average Speed of the Simplex Method—Seminar format with subject matter from recent research papers.
3 units, Aut (Eaves) by arrangement

380B. Applications of Operations Research—(Same as 280B.)
3 units, Spr (Eaves) 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
Administrative Associate Dean: Sydney G. Burkhart

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 or 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 listing under Graduate Division Special Programs.

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), Sylvia Wynter (Spanish and Portuguese)
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), Henry Walker (Sociology), Edgar Yhap (Medicine)

UNDERGRADUATE MAJOR

The newly revised major for the Undergraduate Program in African and Afro-American Studies (AAAS) was established in Spring Quarter of 1985. The revised curriculum is based on the idea that the 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 choice of a thematic concentration in part III. Part III constitutes fifteen units. Both option A and B consist of a total of 63-65 units.

AAAS majors will have numerous opportunities for academic advisement. 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 to assist the student major. 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>

#### II. 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>

#### IIIB. EXPRESSIVE CULTURE of the AFRICAN DIASPORA (15 units)

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>114. Africa and the Black Diaspora</td>
<td>5</td>
</tr>
<tr>
<td>Drama 5. Introduction to Black American Drama</td>
<td>5</td>
</tr>
<tr>
<td>English 161A. The Afro-American Novel</td>
<td>5</td>
</tr>
<tr>
<td>Linguistics 73L. Black English</td>
<td>5</td>
</tr>
</tbody>
</table>

### III. THEMATIC CONCENTRATION

This area allows the student to focus 15 units of work on themes that either develops previous work in the major or explores new areas. There are five possible themes. In choosing a theme, the student will be advised by a faculty person with a specialization in the area or discipline as well as by the chair of the program. The themes are as follows:


- **Expressive Culture of the Africa Diaspora**—(an extension of IIB): Afro-American Studies 162E, Introduction to Caribbean Poetry; Afro-American Studies 165, Afro-Hispanic Culture and Literature; 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 not units counting 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 (given 1987-88), 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, Black Perspectives in Engineering; 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.

### 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.

COURSES

The core course of the program (105) provides a broad survey of the Afro-American experience. It is team taught by faculty from the humanities and social sciences and will introduce themes such as retained Africanisms, the Black family and Afro-American identity. Interaction with professors will also help students plan their future courses of study.

AAAS PROGRAM OFFERINGS

59 A,B,C. Dance Theater Production. 1-5 units, Aut, Win, Spr (Osumare)

81A,B,C. The Real News: A Student Publication. 1-3 units, Aut, Win, Spr

82A,B,C. Gospel Choir Workshop 1-3 units, Aut, Win, Spr (Staff)

105. Introduction to African and Afro-American Studies.—(Same as Anthropology 105.) Lecture course 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 considers 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 (Gibbs, Staff) MWF 11

113. Western Culture and the Black Diaspora: The Semiotics of Self and Other—Seminar uses narrative analyses of selected texts in order to examine the significations accorded Africa, the "Negro" and the Black Diaspora in the signification system of Western culture. 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—A general 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 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, this course 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. Black Perspectives in Engineering—(Same as Engineering 7.) The role of and opportunities available to Blacks in engineering and other technical fields with emphasis on 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. It will do this from 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, this course will concentrates on Spanish-speaking countries with a sizeable Black population, particularly Colombia and Cuba. Students will be introduced to other, less-known Afro-Hispanic cultures. Emphasis 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 studies. 5 units (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 141/241.) An overview to the literature and thought of Black Latin American writers in the Spanish-speaking Americas as well as in Brazil. An 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 Spanish 248.) A general introduction to 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, Win (G. and L. Spindler)
5 units (Donham) not given 1986-87
5 units, Win (Yanagisako)

ATHLETICS
81. Jazz Dance I.
1 unit, Aut, Win, Spr (Staff)
82. Jazz Dance II.
1 unit, Aut, Win, Spr (Staff)
83. Jazz Dance III.
1 unit, Aut, Win, Spr (Osumare)

DRAMA
5. Introduction to Black American Drama.
4 units, Spr (Richards)
1-3 units (Staff) any quarter
1-5 units (Staff) any quarter
5 units, Spr (Richards)

ECONOMICS
118. Economics of Development.
5 units, Aut (Anderson)
122. Theory of Capitalist Development.
5 units, given 1987-88

EDUCATION
175X. Women and Development in Africa—
(Stem as Anthropology 17X, Feminist Studies 138.)
4 units, Spr (Staff)
195. An Introduction to Africa Through Film:
Tarzan, Terrs, and Liberation.
4 units, Aut (Staff)
201. History of Education in the United States.
3 units, Spr (Tyack)
217S. 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)

ENGLISH
161A. The Afro-American Novel.
5 units, Aut (Drake)
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 Biology 136, Sociology 153.)
5 units, Aut (Arthur)
166. International Trade Policy—(Same as Economics 166.)
5 units, Spr (Pearson)
250. Nutritional Problems of Developing Nations—(Same as Anthropology 250.)
5 units, Win (Martorell)
251. Food and Nutrition Strategies in Development.
5 units, Spr (Johnston)
AFRICAN STUDIES

Emeriti: St. Clair Drake (Anthropology and Sociology), Joseph H. Greenberg (Anthropology and Linguistics), William O. Jones (Food Research Institute)

Chairman: James Lowell Gibbs, Jr. (Anthropology)

Professors: David B. Abernethy (Political Science), Martin Carnoy (Education), James Lowell Gibbs, Jr. (Anthropology), William B. Gould (Law), Bruce F. Johnston (Food Research Institute), Scott R. Pearson (Food Research Institute), Hans N. Weiler (Education and Political Science), Sylvia Wynter (African and Afro-American Studies)

Associate Professors: Paul F. Basch (Medicine), Kennell A. Jackson, Jr. (History), William R. Leben (Linguistics), Joel Samoff (Education)

Assistant Professors: Joel S. Beinin (History), Donald L. Donham (Anthropology), Sandra E. Drake (English and Comparative Literature), 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 Ph.D. 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 and Research. 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). Introduces African and Afro-American Studies as an interdisciplinary field by exploring contrasting and contradictory interpretations of several key, representative aspects of African and Afro-American social and cultural institutions. Topics include: (1) The question of African survivals in the New World; (2) Interpretations of slavery in the New World; (3) Contrasting interpretations of the black family; (4) The Afro-American as Artist; and (5) the Afro-American identity. Considers why particular ideas developed at particular times and examines the relationship between African and Afro-American Studies and other academic disciplines. (DR: 5*)

5 units, Aut (Staff) MWF 11

**Women and Development in Africa**—(Enroll in African and Afro-American Studies 175X, Anthropology 109, Education 175X, Feminist Studies 138.) A survey of women’s roles and experiences in both formal and informal development activities in Africa. Major topics include: 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.

4 units, Spr (Staff) 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.) A general 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 USA, 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 176, Anthropology 157, Law 316, Political Science 182L, or Sociology 138.) (Graduate students register in Anthropology 275.) Comparison of legal systems in Western, capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, course examines comparable issues in the law of the People’s Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order
to identify the historical, philosophical, social, and cultural factors which contributed to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights — especially at death, the handling of anti-social or "criminal" behavior, and the use of law as an instrument of social change in the introduction of family planning. Open to law students, graduate students in other departments and to juniors and seniors. First class meeting is January 26.

2 units, Win, plus 3 units, Spr (Gibbs, Barton, Chen, Nader)

The World Outside the West: Change and Tradition before the Age of European Imperialism—(Enroll in History 21, 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 22.)

5 units, Aut (Fox, Roberts, Van Slyke) MTWThF 10

The World Outside the West in the Age of European Imperialism—(Enroll in History 22, Anthropology 22, Political Science 22.) Confrontation and accommodation as non-European societies interact with Western Europe from the fifteenth century to the present. Changes in economy, social and political structures, and religious and ethical values in East Asia, West Africa, and Mexico. (DR:5*. Also satisfies Area 3 when taken in sequence with 21.)

5 units, Win (Abernethy, Collier, Van Slyke) MTWThF 10

Great Thinkers of the Black World—(Enroll in History 149.) Surveys two centuries (from 1785) of work by black thinkers from the United States, the Caribbean, and Africa, exploring the leading ideas that have shaped the black world as we know it; the ideas about the achievements and genesis of culture; the destiny of the black race; the role of blacks in world history; the political choices open to blacks; the paths to black economic prosperity; and the conception of the future. Lectures are devoted mainly to individual thinkers, to movements involving groups of thinkers, and to the great debates of the black intelligentsias.

5 units, Spr (Jackson) MTWThF 11

Colloquium: The End of Slavery in Africa and the Americas—(Enroll in History 248A/348A.)

5 units, Spr (Roberts)

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 347A.)

5 units, Aut (Jackson) W 2:15-4:05

Graduate Core Colloquium on African History—(Enroll in History 347B.)

5 units, Win (Roberts) W 2:15-4:05

Political Change in Sub-Saharan Africa—(Enroll in Political Science 118.) Examines the colonial situation, the growth of nationalism, the achievement of political independence, ethnic patterns in new states, civilian and military leadership, the role of party and bureaucracy, problems in development planning, and efforts at pan-African cooperation. (DR:5*)

5 units, Win (Abernethy)

Beginning Swahili—(Enroll in Linguistics 606A,B,C.) Swahili is the major lingua franca of East Africa. Conversation, grammar, reading. 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 Hausa—(Enroll in Linguistics 602A,B,C.) Hausa is one of the three major languages of Nigeria and is widely used as a lingua franca in parts of West Africa. It has an extensive literature, and is one of the African languages most widely studied by scholars. Successful completion of 602C may fulfill the foreign language requirement.

4 units, Aut, Win, Spr (Moshi)

Beginning Yoruba—(Enroll in Linguistics 610A,B,C)

3 units, Aut, Win, Spr (Staff)

Intermediate Yoruba—(Enroll in Linguistics 611A,B,C)

3 units, Aut, Win, Spr (Staff)

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. Call Rosemary Henze, (415) 293-3636.

The World Food Economy — (Enroll in Food Research 103, Economics 106.) The interrelationships between food, population, and economic development. Emphasis is on the role of agricultural and rural development in achieving economic and social progress in low-income nations. Attention is given to the economic and nutritional characteristics of the major types of food and to changes in food consumption asso-
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 related to the design of rural development strategies is stressed. Prerequisite: Economics 1 or equivalent understanding of economics; Economics 51 recommended.

3 units, Spr (Johnston) MWF 10

International Trade Policy—(Enroll in Food Research 166, Economics 166.) (May be taken as 266 by graduate students.) 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 the 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

Food and Nutrition Strategies in Development—(Enroll in Food Research 251.) Examines major policy issues related to raising food consumption levels and improving nutritional status of populations in developing countries, assessing both production—and consumption-oriented policies and programs, and problems of determining an appropriate balance between income-generating activities and social services. Principal focus on the low-income developing countries. 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 are discussed.

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

An Introduction to Africa Through Film: Tarzan, Terrs, and Liberation—(Enroll in Education 195.) The Images of Africa that reach American audiences are dominated by a vision of primitive backwardness (Tarzan), armed conflict and terrorists (Terrs), and the struggle for self-determination (Liberation). Class will work to understand both the African reality that the images often obscure and the factors that explain the persistence of the images themselves. Through an intensive exposure to and critique of films on Africa, students develop a basic familiarity with the contemporary African situation and with the use of film as an instructional medium. Those students who have already done some work on Africa will focus on the images of Africa projected to external audiences. (IDE)

4 units, Aut (Staff) alternate years, given 1987-88

Introduction to the Study of International Development Education—(Enroll in Education 206A.) Introduction to the theoretical orientations and the research agenda in International Development Education, and to resources for study and research at Stanford. Required for all first-year students in SIDEC: others by consent of instructor. (IDE)

2-3 units, Aut (Stromquist) M 12-2:05 and by arrangement

Project Workshop in International Development Education—(Enroll in Education 206B) Course concludes the 4-quarter A.M. program in SIDEC, and is required of all A.M. students. It is organized around the students' "Masters Project", and will provide in-depth reviews of draft project reports. The final version of the report is due at the end of the course. (IDE)

3 units, Sum (Staff) W 2:15-4:05

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

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

Implementing Educational Reform—(Enroll in Education 208X.) Examination of efforts to devise and implement educational reform policies in a single Third World country, focusing on: (1) the problem(s) the new policies are expected to address (and thus the political economy of the country studied); (2) the formation and articulation of alternative policies, emphasizing the social location of ideas and values; and (3) the policy making process and the implementation of the new policies, especially organizational characteristics, bureaucratic imperatives, political mobilization, and external influences. Organized as a seminar; each participant will study intensively a particular reform policy. Previous Third World course work and/or professional experience and familiarity with Education 306A-D topics helpful. (IDE)

4 units, Win (Staff) alternate years, given 1987-88

Teaching a Global Perspective: Cross-Cultural Approaches—(Enroll in Education 217S.) Overview of current research and practice in the emerging field of global education, with special emphasis on the work of the Stanford Program on International and Cross-Cultural Education (SPICE). Includes an examination of selected global and cross-cultural issues in some depth, with particular reference to the prob-
lems and prospects of teaching such issues in American classrooms. Offers exposure to various experiential approaches to global education, including simulations and computer-assisted instruction.

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

Ethics of Development in a Global Environment (EDGE)—(Enroll in Education 274A, B, C; Engineering 297A, B, C; Anthropology 133A, B, C; Political Science 140A, B, C.) The EDGE seminars present a series of speakers on current development issues with emphasis on the problems of the poorer nations. Autumn quarter speakers discuss world resources - energy, food, housing, population and environment. Winter quarter speakers address the role of institutions affecting the transfer of technology - political systems, world bank, transnationals, etc. Spring quarter addresses 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 is not required.)

1 unit, lecture only; 4 units, lecture plus workshop, Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel, 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, that is, all the people inhabiting the earth and the institutions through which their lives are organized are treated as participants in one global social system. Competing models of the emerging world order will be reviewed and compared. 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. (IDE)

5 units, Win (Staff) by arrangement

Education and Work—(Enroll in Education 277X.) Examines traditional models of socio-economic structure and educational change, concentrating on the relationship between education and work. Emphasis on functionalist and dialectical models. The literature covered includes work done in the U.S., Europe and the Third World. Specific case studies will be used to illustrate the models. Open to students from all areas.

5 units, Win (Carnoy)
ence of Tanzania and Guinea-Bissau offer comparative insight and through student research presentations insight will be gained of Angola, Mozambique and Zimbabwe. (IDE)

5 units, Spr (Samoff)
alternate years, given 1987-88

Research Workshop in International Development Education—(Enroll in Education 408A,B,C) Continuing research workshop for the review of (a) key issues in the methodology and epistemology as social research in education, and (b) research proposals and findings by students and faculty. Prerequisite: 306A-D or equivalent. Limited enrollment; priority given to advanced doctoral students in SIDEC and SSE. (IDE, SSE)

408A. Research Workshop in IDE I.
2-5 units, Aut (Staff) MW 3:15-5:05

408B. Research Workshop in IDE II.
2-5 units, Win (Carnoy) MW 3:15-5:05

408C. Research Workshop in IDE III.
2-5 units, Aut (Weiler) MW 3:15-5:05

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. Core Seminar: Western Culture and Black Diaspora.

ANTHROPOLOGY
125. Ethnographic Film—(Same as Communications 115.)
147. Peasant Migration and Social Change.
164. Ecological Anthropology.
177. Pidgins and Creoles.
262. Economic Anthropology.

EDUCATION
206A. Introduction to the Study of International Development Education.
306A. Education and Economic Development.

FOOD RESEARCH
121. Development and Population Interactions in the Third World—(Same as Economics 119.)

250. Nutritional Problems in Developing Nations—(Same as Anthropology 250.)

POLITICAL SCIENCE
125F. Seminar: Development and the International System.

AMERICAN STUDIES

Administrative Committee: (Chairman) Jack N. Rakove (History), Barton Bernstein (History), Jay Fliegelman (English), Albert J. Gelpi (English, Coe Professor of American Literature), Richard Gillam (American Studies, Program Co-ordinator), Hubert R. Marshall (Political Science), Gavin Wright (Economics)

The American Studies Program is administered through the Department of Humanities Special Programs.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

Majors will complete 60 units of approved coursework in American Studies for letter grades, including the following distribution: five courses in one of the concentrations (American Thought and Imagination, American Social Organization and Behavior, American Policy and Institutions) and three courses in each of the other two. Ordinarily, the five courses in the area of emphasis will include at least two courses from one of these groups: in American Thought and Imagination, English 122-126 (or equivalent); in American Social Organization and Behavior, History 165A, B, C; in American Policy and Institutions, Political Science 1, and Political Science 10. The program of study of each American Studies major will be subject to approval by the Administrative Committee; on application, appropriate courses not listed here may be approved by this Committee as counting toward the major.

Each major must include in the program of study: (1) the introductory course, American Studies 50, to be taken as soon as possible after declaring the major; (2) at least the first two quarters of the History 165 sequence; and (3) at least two core seminars, usually during the junior or senior year, but only after completing at least one course in each of the concentrations.

Before graduation, each student in American Studies must place in his/her academic file
copies of two papers (other than take-home or other examinations) completed and graded for approved courses in American Studies.

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 ten to fifteen units of credit. This application is to include the topic and a proposed outline of the senior thesis. The Administrative Committee may approve or disapprove the application, or request resubmission with revisions. The finished essay must be submitted six weeks before the date of graduation. 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.

INTRODUCTORY

American Studies 50. American Literature and Culture to 1855—(Same as English 121.) A detailed study of important and representative works of American culture from 1630 to 1855. Close textual readings will be supplemented with discussions of the intellectual, theological and political history of the period.
5 units, Win (Fliegelman) MTWTh 10

AMERICAN THOUGHT AND IMAGINATION

Art 130. American Art and Culture, 1670-1830.
4 units, Win (Wallach)

Art 130A. American Art and Culture, 1830-1900.
4 units, Spr (Wallach)

Art 234. Seminar; Gender and Sexuality in 19th Century American Art.
4 units, Aut (Lubin)

Art 234B. 19th-Century American Landscape Painting.
4 units, Spr (Wallach)

Art 278. The American College Campus.
4 units, Aut (Turner)

Drama 155. American Drama, 1960s to the Present.
4 units, Aut (Richards)

Drama 156. American Women Playwrights.
4 units, Win (Richards)

4 units, Spr (Richards)

5 units, Spr (Gelpi)

5 units, Spr (Fields)

English 120. The American Historical Novel.
5 units, Win (Dekker)

English 122. American Literature, 1855-1917.
5 units, Aut (Moser)

English 123. American Literature, 1917-Present.
5 units, Spr (Fields)

English 134C. American Fiction: Romance to Realism.
5 units, Aut (Halliburton)

English 156. Contemporary American Poetry.
5 units, Aut (Gelpi)

English 160G. The Puritan Self and the Errand into the Wilderness.
5 units, Aut (Miller)

English 160X. Painting, Literature and Life.
5 units, Spr (Miller)

English 161A. The Afro-American Novel.
5 units, Aut (Drake)

English 165C. The Reciprocal Vision.
5 units, Win (Evans)

English 179B. Faulkner.
5 units, Spr (Moser)

English 239. American Short Fiction.
5 units, Win (Fields)

English 285C. Gertrude Stein and Ezra Pound.
5 units, Win (Perloff)

English 293B. Fiction Writing and the American Experience.
5 units, Spr (Hacazelet)

Music 5A. Music in America.
3 units, Aut (Cohen)

Philosophy 106. William James.
4 units, Aut (Pruitt)
AMERICAN SOCIAL ORGANIZATION AND BEHAVIOR

American Studies 52. The Crisis of American Thought, 1890-Present.
5 units, Spr (Gillam)

American Studies 171. The Development of American Law—(Same as Law, 105, Political Science 183F.)
5 units (Friedman) given 1987-88

5 units, Spr (Barnett)

Anthropology 116. Anthropological Perspectives on American Culture.
5 units, Win (G., L. Spindler)

5 units, Spr (David, Wright)

5 units, Win (Rakove)

History 57S. Introductory Seminar: The American West.
5 units, Win (Camarillo)

History 64. Introduction to Chicano Life and Culture.
5 units, Aut (Camarillo, Rosaldo, Staff)

5 units, Spr (Carson)

History 159B. The Gilded Age: Late 19th-Century America.
5 units, Aut (Fredrickson)

History 162A. Race, Ethnicity and Gender in American Urban Society: History and Public Policy.
5 units, Spr (Camarillo)

History 165A. 18th-Century America.
5 units, Aut (Rakove)

History 165B. 19th-Century America.
5 units, Win (Degler)

History 165C. 20th-Century America.
5 units, Spr (Bernstein)

History 172A. America Since 1945.
4-5 units, Win (Bernstein)

5 units, Win (Freedman)

History 173B. History of Women in America Since 1870.
5 units, Spr (Freedman)

History 265A. Undergraduate Colloquium: Sexuality in American History.
5 units, Aut (Freedman)

Linguistics 50. Language and Social Issues in America.
5 units, Spr (Ferguson)

5 units, Spr (Staff)

Sociology 130. American Society Through Film and Literature.
3-5 units, Win (Zelditch)

AMERICAN POLICY AND INSTITUTIONS

American Studies 171. The Development of American Law—(Same as Political Science 183F.)
5 units (Friedman) given 1987-88

American Studies 176L. Law in Radically Different Cultures—(Same as Anthropology 157, Law 316, Sociology 138). Using American law as a benchmark, this course compares legal systems in Western capitalist, secular, industrialized societies with legal systems in such countries as China, Egypt and Botswana in order to identify the historical, philosophical, social and cultural factors which contribute to the development of different attitudes and practices regarding law. The course covers Winter and Spring quarters, starting January 26. Students must register for both quarters.
2 units, Win plus 3 units, Spr (Barton, Gibbs, Merryman) MWFTh 2:15

American Studies 179. Introduction to American Law—(Same as Law 106, Political Science 182F.) A general introduction to American law for undergraduates. Deals 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

Communications 139. Literature of the Press.
4 units, Win (Lewenstein)

Communications 140. History of American Journalism.
4 units, Win (Lewenstein)

History 158B. American Educational Policy—(Same as Political Science 186K.)
3 units, Aut (Kirst, Tyack)

Political Science 1. Major Issues of American Public Policy.
5 units, Aut, Win (Marshall)
Political Science 10. American National Government.
5 units, Win (Jacobson)
       Spr (Manley)
Political Science 106M. Politics of Bureaucracy.
5 units, Spr (Moe)
Political Science 145J. American Foreign Policy.
5 units, Aut (Bernstein)
Political Science 180. Civil Rights and Civil Liberties in the U.S.
5 units, Spr (Steyer)
Political Science 181. Conservatism and Constitutionalism.
5 units, Spr (Horn)
Political Science 186K. American Education and Public Policy—(Same as Education 105, History 158B.)
3 units, Aut (Kirst, Tyack)
Political Science 187. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—(Same as Education 22B.)
5 units, Win (Kirst)
Political Science 189. Voting in the American Political System.
5 units, Aut (Brody)
Political Science 192R. the Politics of Unemployment.
5 units, Win (Brody)
Political Science 193. Seminar: Civil Rights and the Constitution.
5 units, Spr (Steyer)
Political Science 201A,B. Seminar: Economy of Political Institutions.
5 units, Aut, Win (Ferejohn, Baron)
Political Science 202A. Seminar: American Political Institutions.
5 units, Aut (Ferejohn)
Political Science 202C. Seminar: American Political Economy.
5 units, Spr (Manley)
Sociology 105. Poverty and Public Policy in America.
3-5 units, Spr (Staff)
VTSS 101. Technology and Science in Contemporary Society.
4 units, Win (McGinn)

CORE SEMINARS
American Studies 201. The South Since 1850—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 will focus on Southern topics which lend themselves to interdepartmental study.
5 units, Spr (Sosna) TTh 2:15-4:05
American Studies 204. Critics of America—(Same as English 234D.)
5 units, Spr (Chace) TTh 1:15-3:05
American Studies 208. The American Character—Descriptions of the American character since the 17th century: comparisons of de Toqueville’s analysis of the American character with Ralph Waldo Emerson’s analysis of the English character; historical, literary, psychological, and sociological insights into national character.
5 units, Win (Gillam)
American Studies 209. Undergraduate Colloquium: Women in America—(Same as History 263.)
5 units, Spr (Degler) M 3:15-5:05
American Studies 210. Patronage, Museums and the Arts in 19th Century America—(Same as Art 234A.)
5 units, Win (Wallach)
American Studies 212. Ideas in America from the Revolution to 1900—(Same as History 271A.)
5 units, Spr (Fredrickson) M 1:15-3:05
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)
5 units (J. Corn) given 1987-88
American Studies 220. Photographs as Historical Documents—(Same as Art 231A.)
5 units (J. Corn, W. Corn) given 1987-88
American Studies 221. The Machine in American Culture.
5 units, Aut (J. Corn) given 1987-88
American Studies 222. Core Seminar: America in Vietnam—(Same as Political Science 144J.)
5 units, Spr (Goldstein)
ANTHROPOLOGY

Emeriti: (Professors) St. Clair Drake, Bert A. Gerow, Joseph H. Greenberg, Benjamin D. Paul, George D. Spindler

Chairman: Harumi Befu


Associate Professors: Jane Collier, Jose Cuellar, William H. Durham, James A. Fox, John W. Rick, Sylvia Yanagisako

Assistant Professor: Donald L. Donham

Professor (Research): Thomas P. Rohlen

Professor (Teaching): Donald C. Johanson

Affiliated Associate Professors: Elois Berlin, Shirley Brice Heath, Reynaldo Martorell

Lecturer: Louise S. Spindler

Visiting Associate Professor: Stefano Varese

OFFERINGS AND FACILITIES

The Anthropology Department is responsible for a large collection of historic and prehistoric 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 objects are used in Anthropology courses and are exhibited in the Felix M. Keesing Museum (Rm. 111K) in the Anthropology Department. Continuing excavations on Stanford property by department archaeologists contribute materials to the Anthropology collections.

The courses offered by this department are designed (1) to provide undergraduate students with instruction in Anthropology, a discipline treating humanity from the broad viewpoints of biological heritage, culture, society, and personality; (2) to provide undergraduate majors in Anthropology with a program of work leading to the bachelor's degree; and (3) to prepare candidates for advanced degrees in the discipline.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The Department of Anthropology offers three programs leading to the Bachelor of Arts degree: the Major in Anthropology, the Honors Program in Anthropology, and an interdisciplinary program entitled Major in Social Sciences (Anthropology). To declare a major in one of these fields a student must apply to the department'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 advisor. 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 recorded in a file kept by the Academic Assistant. It is the student's responsibility to see that this file is kept up to date.

The Honors Program in Anthropology is open to all majors. To apply, candidates of sophomore or junior standing should submit an application to the Academic Assistant no later than the end of the fourth week of the Spring Quarter. The application must include a brief statement of the project, a transcript, a short paper, and a letter of recommendation from the professor who will supervise the honors thesis. The Undergraduate Committee will review applications and notify students of their admission to the program.

The Major in Social 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 student's junior year. The Major in Social Science (Anthropology) allows a candidate to combine a concentration in anthropology with a selection of courses from history, sociology, economics, political science, and psychology. Students who want a program that includes more than ten units from a non-social science field (e.g. classics) are 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: a) Area Studies (8, 100-127); b) Social and Cultural Anthropology (1, 11-22, 128-168, 219-244, 246-276); c) Linguistic Anthropology (4, 5, 75-78, 172-178, 245, 277, 278); d) Archeological Anthropology (3, 91, 183-189); e) 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 grade of "C" or better, and not more than 5 of the required 45 units may be taken for a Pass/No Credit grade.

Undergraduate majors who have completed the prerequisites are encouraged to enroll in 100- or 200-level seminars. They may also take part in field work on local archeological sites, obtain training in museum methods by means of research with Stanford collections, and apply for funds to support summer field research in 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 schools 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 con-
sist of residence at Stanford University as a
graduate student for at least three quarters.
Students must take a minimum of 45 quarter
units in anthropology with a grade of B or better
in each course. They must have at least 15
additional units of anthropology, taken at Stan-
ford or elsewhere, constituting a minimum total
of 60 units in anthropology. Within the 45 units
taken at Stanford, students must take one quart-
er (5 units) of History of Anthropological Theory
plus one additional course from those designat-
ed as "core courses" by the faculty. The remain-
ing 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 an-
thropology 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 sub-
mit a sample of their writing. Successful appli-
cants 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 accept-
able graduate level, four of the courses des-
gnated 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 sub-
stituted for part of this requirement.
4. By the end of the second year pass, at a
satisfactory graduate level, four courses dis-
tributed in at least two of the following areas:
archeology, biological anthropology, lin-
guistics, 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 lan-
guage is not English are exempted from this
requirement by demonstration of satisfac-
tory 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 ap-
proved by the student's dissertation commit-
tee before undertaking doctoral research.
8. Present an approved dissertation based
upon independent research.

Ph.D. MINOR IN ANTHROPOLOGY

The requirements for a minor in Anthropol-
yogy consist of 30 units of anthropology taken at
Stanford with a grade of B or better in each
course. All students must have a departmental
advisor and should develop a coherent course of
study related to their particular interests. The
course of study approved by the advisor must be
filed with the Committee on Higher Degrees in
the department and must include at least three
courses in theory/methods and one course in a
geographical area.

FINANCIAL SUPPORT

The department endeavors to provide finan-
cial support (tuition plus scholarship) when
needed to all students admitted to the Ph.D.
Program who maintain a satisfactory course of
study. Currently the source of this support is
University funds. Applicants for the Ph.D. pro-
gram 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 require-
ments for teaching credentials, consult the
School of Education section of this bulletin or
address the inquiry to the Credential Admini-
strator, School of Education.
1. Social and Cultural Anthropology—(Upper division students register for 101). Cross-cultural anthropological perspectives on human behavior, including cultural transmission, social organization, sex and gender, culture change, technology, war and other related topics. Lectures, films and readings are used in the presentation of culture case studies illustrating basic generalizations. (DR:4* or DR:5*)

5 units, Win (G. and L. Spindler)

2. Genes, Culture, and Human Diversity—(Same as Human Biology 1.) Introduction to genetic and cultural evolutionary theory as applied to the analysis of human diversity. Uses a case study approach both to illustrate general principles of evolution and to emphasize similarities and differences between genetic and cultural change. Topics include Mendelian genetics, basic molecular biology, Darwinian theory, population genetics, the concept of culture, cultural evolutionary theory, differential cultural 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—Covers aims, methods and data of prehistoric archeology. Traces 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 course on the ethnography of communication and theories of language and culture. Intensive analysis of linguistic repertoire, rules of use, ethnosemantics, and linguistic history of a single speech community. Comparison with other speech communities throughout the world. (DR:4)

5 units, Win (Fox)

5. Biology and Evolution of Language—(Same as Human Biology 113, Linguistics 5.) Lecture course on the biology, function and evolution of the organs of speech and the brain. Topics include animal communication; non-verbal communication; language structure; the biology and physics of speech; speech disorders; color terminology and color vision; biological influences from language universals and acquisition. (DR:4)

5 units (Fox) alternate years, given 1987-88

6. Human Origins—Considers evidence for the evolution of humankind from its beginnings several million years ago to the emergence of Homo sapiens. Emphasis placed on a consideration of fossil hominid remains — from their discovery to their interpretations for elucidating human origins. (DR:7)

5 units, Spr (Johanson)

8. Introduction to China—Examines Chinese society in the late imperial period, traces the origins of its characteristic institutions, and then looks at the revolutionary changes that have transformed China in modern times. (DR:5*)

5 units (Wolf) not given 1986-87

11. Sex Roles and Society—Develops an appreciation of 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, Win (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*)

3-5 units, Aut (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 1986-87
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 are discussed. Current social movements are placed in the perspective of counter-culturalism, marginality, and cultural change. Field studies of relevant phenomena will be encouraged. (DR:5)
3-5 units, Win (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 with the purpose of learning something of humankind’s nature and mind from the diverse ways—ecological, conceptual, and symbolic—humans have coped with this challenging element. Topics include early long-distance voyaging, fishing as an ecological adaptation; maritime economics and national development.
5 units, alternate years, given 1987-88

17. Culture and Astronomy—A cross-cultural and historical examination of a variety of astronomical systems, 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, alternate years, given 1987-88

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, political structures, religious and ethical values in China, Nigeria and Mexico. (DR:5*; also satisfies DR:3 when taken in sequence with Anthropology 22.)
5 units, Aut (Fox, Roberts, Van Slyke)

22. The World Outside the West in the Age of European Imperialism—(Same as History 22, Political Science 22.) Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western institutions and ideas, from the early 19th century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Mexico, China, and Nigeria. Strongly recommended: Anthropology/History 21. (DR:5*; also satisfies Area 3 when taken in sequence with 21.)
5 units, Win (Collier, Abernethy, Van Slyke)

90. Theory in Social Anthropology—Anthropological interpretations of other societies have always contained assumptions about ourselves and about “Western” societies. This seminar highlights that interplay and, specifically 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, Yanagisako)

91. Archeological Field Methods—Field course involving students in actual archeological field research in the local area. The practical working methodology of the archeologist will be covered, primarily through excavation and site survey, although training in registration, preservation, and analysis of archeological remains will be included. Recommended: Anthropology 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-hist-
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 traces the fate of these civilizations under Spanish colonial rule and examines the legacy of their cultural heritage for the Americas.

4 units (Staff) not given 1986-87

105. Introduction to African and Afro-American Studies—(Same as African and Afro-American Studies 105.) Examines and critiques contrasting interpretations of Africa and Afro-American social and cultural institutions: (1) African survivals in the New World; (2) New World slavery; (3) the black family; (4) the Afro-American as Artist; and (5) the Afro-American identity. Considers why interpretations developed at particular times and examines relationship between African and Afro-American Studies and other disciplines. (DR:5*)

5 units, Aut (Carson, Gibbs, Jackson, Wynter)

106. Seminar on Selected Problems in Latin American Agrarian Societies—(Graduate students register for 206). Selected problems in the study of social structure and change in agrarian societies of Latin America. Among those to be considered are changing relations between agrarian communities and complex societies of which they are a part; power and patronage; plantation systems; ethnicity and race; and peasant movements.

5 units (Siegel) not given 1986-87

107. Latin American Migration to the United States—(Same as Latin American Studies 107.) Lectures and discussions dealing with migration from Mexico, Central America, and the Spanish-speaking Caribbean. Addresses current debates about U.S. policies and procedures by 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, Spr (Rouse) Th 10-11:50

108. African Societies and Cultures—(Same as Afro-American Studies 108.) A combination of lectures, discussions and films introduces the social institutions and cultural forms of Black
Africa in the wider context of colonialism, political independence, and national strategies of development. Topics explored include shifts in patterns of marriage and family life, the emergence of new classes, the impact of Islam and Christianity. (DR:5*)

5 units (Donham) not given 1986-87

109. Women and Development in Africa—(Same as Education 175X, African and Afro-American Studies 175X, Feminist Studies 138.) A survey of women’s roles and experiences in both formal and informal development activities in Africa. Major topics include 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 will be useful.

4 units, Spr (Staff)

110. Introduction to Chicano Life and Culture—(Same as Chicano Studies 110, History 64, Spanish 135.) Interdisciplinary course focuses on the history and culture of Mexican Americans during the nineteenth and twentieth centuries. Historical perspectives are balanced with anthropological and literary views focusing on the cultural patterns of Mexicans in the U.S. Offers students the opportunity to interact with three different Chicano faculty from three disciplines. Historical texts, novels, poems and, ethnographies will be the basis for required readings.

5 units, Aut (Camarillo, Cuellar, Ybarra-Frausto)

112. National State and Ethno-political Indigenous Movements in Latin America—(Same as Latin American Studies 112.) Examines the indigenous and peasant movements of colonial and contemporary Latin America in relation to political-economic developments, including the rise of capitalism and the formation of nation-states, and with special reference to ethnic consciousness.

5 units, Aut (Varese) MWF 9

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 (Frake) not given 1986-87

115. Peoples of Island Southeast Asia—Among topics discussed are prehistory, the process and impact of colonization, the contrast between hill and valley peoples, subsistence modes, social organization, religion, and aesthetics. (DR:5*)

5 units (Rosaldo) not given 1986-87

116. Anthropological Perspectives on American Culture—(See Anthropology 15.)

117. Traditional Chinese Society—Analyzes 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)

118. Communist Chinese Society—Analyzes sociocultural change and economic development in the People’s Republic of China, with attention to how the Chinese case relates to social science theory.

5 units, Spr (Skinner)

121. Japanese Society and Culture—Racial, cultural, social characteristics, and background. Relationships between the Japanese and other peoples of East Asia. Opportunities for reading in special subject areas.

5 units (Befu) not given 1986-87

123. Cultural Background of Japanese Economic Organization—Japan’s economic success and the variety of explanations and pseudo-explanations offered to account for it. Critically examines these hypotheses insofar as they concern social and cultural factors. Emphasis is on factors external to economic system which nonetheless impinge upon it. Comparison with U.S. and other economic systems will be central. The question of “institutional transfer” is considered in relation to Japanese multi-nationals in U.S.

5 units, Aut (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 1986-87

127. Peoples and Cultural Adaptation in Mediterranean Europe—The study of agrarian societies and cultures of Mediterranean Europe, with special emphasis on Italy, Greece, Spain and Portugal. Focus will be on ecology, land tenure and production, family and kinship, (beliefs and values). Consideration given to the relations between local communities and national and international forces that have historically shaped their adaptations.

5 units (Siegel) not given 1986-87
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: Anthropology 1.

5 units (Gibbs) not given 1986-87

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. (DR:5)

5 units (Siegel) not given 1986-87

131. Cultural Evolution—Analysis of the origin of human culture using evidence from primate ethnology, paleontology, archaeology and culture theory; examination of theories of cultural development from hunting-gathering economy through agriculture to industrialism, such as those of Morgan, Tyler, White, Steward, Marx, Ribeiro and others; systematic outline of processes and stages of cultural development up through modern period.

not given 1986-87

133A,B,C. Ethics of Development in a Global Environment (EDGE) — (Same as Education 274A,B,C; Engineering 297A,B,C; Political Science 140A,B,C.) The EDGE seminars present a series of speakers on current development issues emphasizing problems of the poorer nations. Autumn Quarter speakers discuss basic world resources, energy, food, housing, population and environment, and the political development and dependencies of developing regions. Winter Quarter speakers address 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 speakers address 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 often 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 they face and the 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 (lecture only) or 4 units (lecture plus workshop) Aut, Win, Spr (Fagen, Fuenzalida, 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 235.)

139. Seminar in Cultural Identity—Seminar investigating the nature of ethnicity, the mechanisms of ethnic boundary maintenance, and the role of ethnic groups in social, cultural, and ecological systems.

5 units, (Frake) not given 1986-87

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, field visits and guest panelists. Students will be assisted in carrying out research projects.

3-5 units, Win (Barnett)

141. Feminist Theory in Anthropology—(Graduate students register for 241.) Seminar examines ten years of feminist scholarship in anthropology. Topics include 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: Anthropology 11, courses in Feminist Studies or consent of the instructor.

5 units (J. Collier) not given 1986-87
143. Kinship and Social Organization—A lecture and discussion course contrasting Western notions of family and kinship with those of people in several non-Western societies. Topics include theories of descent, marriage, and the role of class in organizing domestic and non-domestic social groups. Competing theoretical frameworks will be evaluated through examination of case studies.
5 units (J. Collier) not given 1986-87

145. Women in Cities: A Cross-Cultural Perspective—(Same as Feminist Studies 142.) Explores the range of 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 (Yanagisako) not given 1986-87

146. Urban Problems in Anthropological Perspective—A series of issues derived from current urban problems are examined from the cross-cultural perspective of anthropology. Topics include the social consequences of crowding, rural-urban migration, changing sex roles, changing family and kinship patterns, urban ethnic communities and inter-ethnic relations, urban poverty, stratification, crime, and prostitution.
5 units, Win (Yanagisako) not given 1986-87

147. Peasant Migration and Social Change—Rural-to-urban migration as indicator and consequence of social change. Examines 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 (Siegel) not given 1986-87

148. Political Anthropology—A lecture-discussion introduction to some of the principal ways anthropologists view politics. Examines political structures and processes at the band, tribe, and various state levels of sociocultural evolution. Will use anthropological models and ethnographic case studies dealing with the formation and functioning of national political systems in the non-Western and Third Worlds. 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.) Begins with a history of anthropology in development projects from the Colonial Period through World War II. Continues with 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. Combination of lectures and seminar discussion. Major paper as a principal basis for grading.
5 units, Spr (Siegel) MW 11

150. Advanced Cognitive Anthropology—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 (Frake) not given 1986-87

152. Symbolic Anthropology—Symbolic analysis has developed on the premise that the examination of cultural meaning and phenomenological experience is essential for anthropological understanding. Recent monographs have applied symbolic approaches to history, ethnicity, politics, ritual, and social structure. The seminar will critically examine these applications and the questions they raise about the place of symbolic analysis in social inquiry. Prerequisite: Introductory course in social or cultural anthropology or consent of instructor.
not given 1986-87

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 1986-87

156. Law and Conflict Management—Lecture course focusing on problems of order and conflict in society. Considers whether all societies have “law,” and will examine the social settings of such dispute handling mechanisms as negotiation, mediation, arbitration, and adjudication. Students read ethnographic accounts of conflict management in other societies and are required to visit local courts in order to obtain first-hand knowledge of disputing in our society.
5 units (J. Collier) not given 1986-87
ence 182L, Law 316, Sociology 138.) (Graduate students register for 257.) Uses American law as a benchmark to examine comparable issues in the law of the Peoples Republic of China (Easter 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. The course covers Winter and Spring Quarters, starting January 28. Students must register for both quarters.

2 units, Win plus 3 units, Spr
(Gibbs, Barton, Merryman)

164. Ecological Anthropology—(Same as Human Biology 134.) Seminar on ecological analysis in anthropology with particular attention to patterns of covariation between social systems and ecosystems. Sample societies from diverse habitats (arctic, desert, tropical rain-forest, ocean islands, mountain tops, etc.) motivate the exploration of theoretical topics including cultural evolution, adaptation, optimal foraging, resource management, population dynamics, resource competition, warfare, and social stratification.

3 or 5 units, Aut (Durham)

165. Psychological Anthropology—An 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. Themes include childhood and parental bonding; sex differences; cultural motivation and perception; ethnographic psychologies of cognition and consciousness; deviance and self-justification; and life cycle transitions. Prerequisite: Anthropology 1 and Psychology 1. (DR:4*)

5 units, not given 1986-87

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. Special attention is given to what constitutes adequate explanation and to the question raised by attempts to explain social phenomena in biological terms. Course open to graduate students and majors in Anthropology and Human Biology.

5 units, Spr (Wolf)

167. Ethnography of Communications: Research Methods—A research seminar designed to provide intensive preparation in ethnographic field methods for the study of communication. Following a review of earlier efforts in ethnography of communication. Current research problems (determining unit of study, defining speech community), will be examined. Case studies include: (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, Win (Heath)

168. Medical Anthropology—Introduction to this relatively new field which deals with 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). Course is designed for students with interests in health care, no matter what their major.

5 units, Aut (Barnett)

LINGUISTIC ANTHROPOLOGY


5 units (Fox) not given 1986-87

173. Mayan Hieroglyphic Writing—Lecture course on principles of archeological decipherment as applied to the writing of the ancient Maya, with attention to the origins and functions of writing in Mesoamerica.

5 units (Fox) not given 1986-87

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. Attention given to 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 1986-87

178. Historical Linguistics and Culture History—Lecture course on basic principles of historical linguistics, with attention to cultural inferences from language distribution and class-
ification, reconstructed protovocabulary, and loanwords or other areal influences. Topics include: the comparative method; the rate of language change; glottochronology; migration theory. Prerequisite: Introductory course in linguistics, or consent of instructor.

5 units, Spr (Fox)

ARCHEOLOGY AND BIOLOGICAL ANTHROPOLOGY

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, with special emphasis on theory and supporting examples. Teams of students conduct original research projects and report to the class. Prerequisites: 2, the Human Biology Core, or consent of instructor.

4 units, Spr (Durham)

183. Prehistoric Technology and Culture—(Same as Values, Technology, Science and Society 137.) Course traces the related development of technology and culture over the first million years of human existence. In addition to lectures, students will practice prehistoric technologies. Special attention is given to the manufacture and use of stone tools; to ceramics, glass, metallurgy and other technologies using fire; and to the quarrying, transport and construction technology of the ancient stone buildings of Europe, Egypt, and Peru. Case studies focus on the interaction between early technology and social structure, values, and institutions.

3 or 5 units, Win (Runnels)

185. Prehistoric Peoples of California—Examines the historic and prehistoric record of California’s indigenous peoples, from the earliest archeological sites through present-day Native populations. Surveys ecological adaptations to coastal, valley, desert and sierra environments, with emphasis on explaining the diversity of hunting and gathering lifeways. Explores the contributions made by historic documents, archeological data, and modern Native culture as sources of information about California’s early peoples.

5 units, Win (Bocek)

186. Eastern Europe and the USSR: The Prehistory Basis—Explores the prehistory of Eastern Europe and the European U.S.S.R. through the study of archeological remains from the past 25,000 years. Emphasis is on socioeconomic transformations in prehistory, especially the transition from hunter/fisher to farmer. Slides and lectures are based on recent archeological research in an area generally lying between the Danube and the Volga. Discussion topics include 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, Aut (Voytek)

187. Hunter-Gatherers in Archeological Perspective—(Same as Human Biology 183.) Encompasses problems of the organization and subsistence of band-level hunter-gatherers, especially as approached through archeological investigations. Surveys modern hunter-gatherers, providing background for prehistoric groups. The archeological record of Africa, Europe, and the New World provides examples of how archeological data is used to reconstruct the cultural systems of extinct hunter-gatherers. (DR:5*)

5 units (J. Rick) alternate years, given 1987-88

188. The Evolution of Prehistoric Civilizations—(Same as Human Biology 188.) Examines radical transitions involved in the evolution from original non-complex societies to complex state organizations. Basic problems considered include the change from food collecting to food-producing societies, the evolution of rank and stratification in society, as well as the role of trade, interaction, mobility, population growth, and ideology in the development of civilizations. Various theories of state evolution will be examined in the light of prehistoric Mesoamerican and South American complex societies. (DR:5)

5 units, Spr (J. Rick)

189. Peruvian Archeology—Traces 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 and beautiful ceramics and textiles. Describes this cultural evolution, and explains why and how major transitions occurred.

5 units (J. Rick) not given 1986-87

RESEARCH METHODS

190A,B. Data Analysis—Introduction to data analysis through theory and use of parametric and non-parametric statistics with special emphasis on applications in anthropology. Offers training in the use of the computer for data analysis. Continuous enrollment through both quarters required for credit.

5 units (G. Collier)

alternate years, given 1987-88
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, select a problem, formulate it in social science terms, and 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, Win (Textor)

192B. Ethnographic Monitoring of Rapid Change II—(Same as Education 254B.) Optional continuation of Anthropology 192A for the student requiring additional time, training, or seminar participation to complete a paper or undergraduate Honors thesis or prepare same for publication, to develop a dissertation proposal, or to participate in the Stanford Fieldwork Project on the Human Impacts and Sociocultural Implications of High Technology.

3-5 units, Spr (Textor)

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, Aut, Win, Spr (Gerow, Staff) by arrangement

GRADUATE AND ADVANCED UNDERGRADUATE

203. Latin American Ethnohistory—Seminar concerning native peoples of Latin America and their experience of conquest, colonial rule, and post-independence state formations. Includes consideration of the methods, materials, and substantive findings of anthropologists and historians on these topics.

5 units, Win (G. Collier)

204. Andean Oral History—(Same as Latin American Studies 204.) Examines present-day Andeans and their perceptions of their past. Focuses on contemporary “official” history and interpretations by local inhabitants of Bolivia and Peru.

5 units, Win (Millones)

206. Seminar on Structure and Change in Rural Latin America—(See 106.)

214. Ethnographic Methods for Research in Complex Societies With Special Attention to Schooling—(Same as Education 280.) Develops skills in observation of behavior, interviewing, and in the interpretation and reporting of the data collected that are suitable for the study of segments of complex, contemporary societies, including schools and other educational settings. In-class exercises, using audiovisual materials for practice in observing, recording, and interviewing, and out-of-class field work provide practice in observation and interview. Procedures for drawing inferences and making cultural translations are implemented. Cultural models of interpretation are stressed.

5 units, Sum (G. and L. Spindler)

219. Comparative Social Organization of China and Japan—Seminar devoted to analyses of 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 1986-87

235. Cultural Dynamics—Seminar on processes of social-cultural continuity and change. Critical discussion of case studies bearing upon selected conceptual and theoretical orientations. Special attention will be paid to anthropological approaches to rural-urban migration adaptive strategies.

5 units, Win (Siegel)

237. Applied Anthropology—(Undergraduates register for 137. Same as VTSS 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. Course 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 1986-87

238. Sociocultural Implications of High Technology—(Undergraduates register for 138.
Same as VTSS 159.) Seminar dealing with the development, diffusion, and utilization of technology as a cultural process. Emphasis will be on high technology of the type developed in and around Stanford, telemicroelectronics, biogenetics, or materials science. Local technologists and venture capitalists will give occasional in-class presentations. Explores ways in which such technology can drive profound change in other parts of a sociocultural system (e.g., its symbolic, value, and belief systems, and its social and economic organization) and unintended or undesired human impacts of technological innovations, and the implications thereof for appropriate technological design and for public and educational policy. Open to all graduate students, and undergraduates contemplating Honors theses.

5 units, Aut (Textor)

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 are brought into confrontation with anthropological work on family and kinship.

5 units (Skinner) not given 1986-87

244. Family and Kinship Organization—Seminar on the major issues anthropologists have confronted in the comparative study of family and kinship. Competing theoretical perspectives will be evaluated through an examination of such topics as descent, marriage, gender, domestic groups, and kinship change. Prerequisite: Graduate standing in Anthropology or consent of instructor.

5 units, Win (Yanagisako)

246. Anthropology and History—(Same as History 349.) 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 1986-87

250. Nutritional Problems of Developing Nations—(Same as Food Research 250, Human Biology 110.) Malnutrition syndromes common in developing countries will be described, with emphasis upon protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations. 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 (Rosaldo) not given 1986-87

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 1986-87

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

256. The Politics and Ethno-politics of Community Development—(Same as Latin American Studies 256.) Seminar examining the impact of national development programs on rural communities and of grass-roots movements on development processes, particularly as concerns Latin America.

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

257. (See 157.)

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 1986-87

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 1986-87

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)

262. Economic Anthropology—Seminar on the dominant issues in current attempts to
analyze the economic organization of noncapitalist societies. Special attention is devoted to competing theoretical approaches, particularly neoclassical, substantivist, and Marxist and to such topics as the social organization or production, the circulation of goods and services, the generation and maintenance of economic inequality, and the encapsulation of local economic units within larger social systems.

5 units (Donham) not given 1986-87

263. Regional Systems in Agrarian Societies—Seminar devoted to the comparative analysis of the social structure and political economy of peasant-based societies. The regional-systems approach strives for holistic understanding of the larger spatial-temporal systems that envelop and condition peasant livelihood and culture.

5 units (Skinner) not given 1986-87

264. Advanced Ecological Anthropology—Seminar on role of ecological models in the analysis of culture and social systems. Uses major monographs both to review early efforts linking environments and social systems (e.g., multilinear evolution, neo-functionalism, adaptive radiation), and to 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, not given 1986-87

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, Spr (Gibbs)

266. Cultural Transmission—(Same as Education 315). The transmission and communication of explicit and implicit cultural assumptions in a variety of formal and informal educational contexts. Education in cross-cultural perspective, sequences of culturally constructed experiences in life careers, cultural analysis and sensitization. Case studies presented through films, lectures, and readings for both non-literate and complex modern societies. Development of a cultural theory of education.

3-5 units, Win (G. and L. Spindler)

269. Practicum in Ethnographic Futures Research—(Same as Education 212.) (Undergraduates register for 69.) Instruction in the rationale, and guidance in the practice, of Ethnographic Futures Research (EFR), a non-directional, recursive, semi-structured, open-ended, interactive, educational technique for both interviewer and interviewee. Instruction includes ways of combining EFR with conventional ethnography and other research methodologies.

3-5 units (Textor) not given 1986-87

270. Research Seminar: The Working Class at Stanford—After a brief introduction to issues of class, race, and gender, students will collect information on the history, culture, and organization of Stanford's lower-paid employees.

5 units, Win (Donham, Cuellar)

273. Seminar in Advanced Medical Anthropology—A working seminar for students 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: 165 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, Spr (Skinner)

276. Advanced Cognitive Anthropology—Seminar concerned with how people give meaning to behavior and other events they experience. The point of view is from the anthropological side of the intersection of anthropology, linguistics, cognitive psychology, and sociology thus presenting a cross-cultural perspective on the relations among knowledge, language, and social behavior.

5 units (Frake) not given 1986-87

277. Linguistic Anthropology—(Same as Linguistics 255L.) 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 256L.) Seminar devoted to a key issue in the relationships between language and culture. Topic for 1987-88 is kinship and kinship terminology.

5 units (Fox) alternate years, given 1987-88
290A,B. History of Anthropological Theory—
A historical survey of the chief theoretical
trends in anthropology with particular refer-
ence to social and cultural anthropology.
5 units, Aut, Win (Wulf)

292. Dissertation Seminar—Seminar for grad-
uate students in the process of writing disserta-
tion and preparing for professional employ-
ment.
5 units, Aut, Win, Spr (Donham)

294. Design of Field Research—A seminar
 treating research design and the research proc-
 ess, with special attention to the interrelation of
 both with theory and method. Consideration is
 also given to problems of preparing dissertation
 proposals and applications for research grants.
Prerequisite: Consent of instructor. Limited
enrollment.
5 units, Spr (G. 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

APPLIED PHYSICS

Emeriti: (Professors) Marvin Chodorow, C.
Chapin Cutler, W. Conyers Herring,
Mitchel Weissbluth
Chairman: Malcolm R. Beasley
Professors: Malcolm R. Beasley, Arthur Bien-
enstock, Robert L. Byer, Sebastian Doniach,
Theodore H. Geballe, Stephen E. Harris (on
leave Winter), Walter A. Harrison, Vahe
Petrosian, Calvin F. Quate, Peter A. Stur-
rock (on leave Autumn), Arthur B.C. Walker,
Jr.
Assistant Professor: Aharon Kapitulnik
Professors (Research): Bertram A. Auld,
George S. Brown, H. John Shaw, J. Gethyn
Timothy, Helmut Wiedemann, Herman
Winick
Affiliated Professors: Gordon S. Kino (Elec-
trical Engineering), Anthony E. Siegman
(Electrical Engineering), William E. Spicer
(Electrical Engineering)

Consulting Professors: Gerd K. Binnig, Richard
G. Brewer, Lawrence Colin, Peter M. Eisen-
berger, Bernardo A. Huberman, Robert M. White

OFFERINGS AND FACILITIES

The program in Applied Physics offers to
qualified students with backgrounds in physics
or engineering the opportunity for graduate
course work and research in those areas of
physics which may be relevant to technical
applications, and to natural phenomena. These
areas include condensed matter physics, super-
conductivity, quantum electronics, space sci-
ence, astrophysics, and physics of biological
macromolecules. Student research is super-
vised by the faculty members listed above and
also by various members of other departments
such as Physics, Materials Science and Elec-
trical 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 Re-
search, and the Stanford Synchrotron Radiation
Laboratory.

The number of graduate students admitted to
Applied Physics is limited. Applications should
be received by January 1, 1987. 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 engi-
neering 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 cate-
gories: 1) General; 2) Astrophysics; 3) Con-
densed Matter Physics; 4) Quantum Electron-
ics, 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 9 units must be graduate level
courses, in applied physics, physics, engineer-
ing, and mathematics are the minimum require-
ments for the degree. A recommended 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—2 quarters (6 units).
      (Physics 210, 211, Mathematics 220A, 220B, Electrical Engineering 261)
   b) Electrodynamics—2 quarters (6 units).
      (Physics 220, 221)
   c) Quantum Mechanics—2 quarters (6 units).
      (Physics 230, 231, 232, 330, 331, 332, 340, Electrical Engineering 324)
   d) Laboratory—1 quarter (3 units).
      (Applied Physics 356, 358A, 358B, Physics 200, 201, Electrical Engineering 245)

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 grade average 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)
      3) Quantum Mechanics—3 quarters
         (Physics 230, 231, 232, 330, 331, 332, 340, Electrical Engineering 324)
      4) Laboratory—1 quarter
         (Applied Physics 356, 358A, 358B, 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 grade average 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 "1b" may be partially or totally satisfied with equivalent courses taken elsewhere. The requirements under "1c" 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 by the end of the sixth quarter of registration, counting quarters of 9 units or more, excluding summers. 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 45 minutes duration (including presentation and questioning) to 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.

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."

ASSISTANTSHIPS

Research assistantships are available for Ph.D. candidates. Applications for financial aid are included in the admission packet received from the Graduate Admissions Office.

COURSES

GENERAL

3A. Breakthroughs and Inventions in Science and Technology—(Enroll in Freshman Sophomore Program seminar with the same title.)
   Aut (Cutler)
20. From Klystrons to Lasers: The Stanford Connection—The development of coherent radiation from the early radio and klystron sources to masers and lasers. The operational principles of the laser explored at the elementary level with laboratory visits. Principles of laser operation that are critical to many of the applications of modern lasers. Introduces both the science and non-science student to the world of physics, chemistry, biology and medicine through the application of modern laser sources.

3 units, Aut (Byer) alternate years, given 1987-88

130. Introductory Biophysics—Designed for undergraduate and graduate students who wish to learn about the physical basis underlying selected topics in contemporary molecular biology. 3-dimensional structure of macromolecules—x-ray diffraction and electron microscopy. Elementary statistical mechanics of conformational changes in biopolymers—proteins and lipids. Kinetic theory—mobility, diffusion, enzyme reactions. Passive and active transport through membranes—ionophores, channels and receptors. Physics of nerve impulse propagation. Prerequisites: Biology 21, Chemistry 30 series, Physics 50 series, or equivalents.

3 units, Spr (Doniach) 3 alternate years, given 1987-88


3 units, Aut (Doniach) TTh 11-12:15 alternate years, given 1987-88

245. Wave Measurement Techniques—(Enroll in Electrical Engineering 245.)

3 units, Spr (Kino)

300. Dissertation Research

any quarter (Staff) by arrangement

315. Computational Physics—A survey of recent advances in numerical simulation of systems with many degrees of freedom, with 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, Win (Doniach) TTh 11-12:15


3 units, Aut (Harris) MW 2:15 not given 1987-88

350. Special Topics in Applied Physics—The special topics courses are not taught regularly, and the subject of these courses varies from year to year.


2 units, Win (Huberman) Th 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) TTh 11-12:15
ASTROPHYSICS

Applied Physics 15 and Physics 15 (see
Astronomy Course Program listing) are address-
ed to students not majoring in the sciences.
They are taught in different quarters by differ-
ent 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—Intended to
familiarize undergraduates, without scientific
background, with the structure, origin and evo-
olution of our universe. Describes our growing
knowledge of the objects which make up the
universe: galaxies, stars, planets, etc. Discus-
sion of some enigmas of modern astronomy,
such as quasars, X-ray sources, black holes, and
pulsars. Presentation is non-mathematical.
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 (Staff)

50. Astronomy Laboratory and Observational
Astronomy—Theory and use of an optical tele-
scope and the interpretation of basic observa-
tional data to determine the physical properties
of planets, stars, and galactic systems. Consists
of individual observations with a 16-inch Casse-
grainian telescope 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—Provides the stu-
dent of physical science or engineering with an
introduction to observational techniques in
astronomy. Emphasis on measurement of fund-
damental astronomical parameters such as dis-
tance, temperature, mass and composition of
stars. One 2-hour lecture and one night of obser-
vation at the Stanford Student Observatory
where students will use the 16-inch telescope.
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, plan-
etary nebulae, supernovae, neutron stars, pul-
sars, binary stars, X-ray stars and black holes.
Galactic structure: interstellar medium, mol-
cular clouds, HI and HII regions, star formation
and element abundances. Prerequisite: Calcul-
us and one year of college physics at the level of
the Physics 50 series or equivalent.
3 units, Aut (Petrosian) TTh 2:15-3:30

111. Extragalactic Astrophysics and Cosmol-
ogy—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. Prerequi-
site: Calculus and one year of college physics at
the level of the Physics 50 series or equivalent.
3 units, Win (Petrosian) TTh 2:15-3:30

190A,B,C. Independent Study In Astrophys-
ics and Honors Thesis—(Enroll in Astronomy
190A,B,C.)
Aut, Win, Spr (Staff)

356. Astrophysics Laboratory — Combined
seminar and laboratory course which allows the
student to investigate the fundamental observa-
tional basis of physical models of astronomical
objects. The observational component of the
course makes use of the 16-inch telescope at the
Stanford Observatory, and ancillary photom-
etric and spectroscopic instrumentation.
Emphasis placed on spectroscopic and photom-
etric observation of main sequence, post-main
sequence, and variable stars. Limited enroll-
ment. Prerequisite: Consent of instructor.
3 units, Sum (Walker)
alternate years, not given 1987-88

360. Solar Physics—Internal structure: neu-
trino problem, convection and rotation, dyna-
mo processes, global oscillations. Atmospheric
structures: photosphere, chromosphere, tran-
sition region, corona. Activity: active regions,
sunspots, flares, particle acceleration, radio and
X-ray emission. Terrestrial effects of solar
radiation: electromagnetic, plasma, magneto-
plasma and energetic particles. Prerequisite:
Physics 132 and 221, or equivalents.
3 units, Spr (Sturrock)
alternate years, given 1987-88
362. Physical Processes in Stars—Astronomical data on stars and star clusters; classification, Hertzsprung-Russell diagram. Equations of hydrostatic equilibrium and energy transport, equation of state for normal and degenerate matter, opacity, nuclear and neutrino processes. Stellar evolution from main sequence to white dwarfs, neutron stars and black holes. Prerequisites: Physics 220 or equivalent, or consent of instructor. (Physics 132 desirable.)

3 units, Win (Petrosian)
alternate years, given 1987-88

364A,B. Basic Plasma Physics I and II—Course for the non-specialist who needs a working knowledge of plasma physics for space science, astrophysics, fusion or laser applications. Basic 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 quasi-linear theory, the Fokker-Planck equation, and relaxation processes. To be supplemented by a selection of more advanced topics such as 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

366. Cosmology and Extragalactic Astrophysics—Discussion of basic observational data and theories of the structure and evolution of the universe, with emphasis on the physical processes in the early phases of the big bang universe. Observational properties and theoretical models of galaxies and galactic activity and of quasars, with emphasis on nonthermal processes. Prerequisites: Physics 221 or equivalent.

3 units, Spr (Sturrock)

368, 369. Gravitation—(Enroll in Physics 368, 369.)

3 units, Aut, Win (Susskind)

380. Astrophysics Seminars—The special topics courses vary from year to year and are intended to cover current topics not included in the regular courses in this section. Course format varies from regular lecture format to research level seminars.

380A. Topics in High-Energy Astrophysics—(Enroll in Astronomy 380A.)

3 units, Aut (Sturrock)
alternate years, given 1987-88

385A. Topics in Disordered Systems.
2 units, Aut (Kapitulnik) by arrangement

385B. Nonlinear Phenomena in Condensed Matter Systems—A survey of nonlinear


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


3 units, Win (Beasley)

340. Theory of Many-Particle Systems—(Enroll in Physics 340.)

3 units, Aut (Laughlin)

370. Phase Transitions and Critical Phenomena—(Enroll in Physics 370.)

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

385. Special Topics in Condensed Matter Physics—Research level discussions of current topics in condensed matter physics. Content varies from quarter to quarter and from year to year, depending on the interests of staff and students. The course may be repeated.

385A. Topics in Disordered Systems.
2 units, Aut (Kapitulnik) by arrangement

385B. Nonlinear Phenomena in Condensed Matter Systems—A survey of nonlinear
dynamical theory with special emphasis on applications to condensed matter examples. Topics include physics of Josephson junctions and transport in charge-density wave systems; dynamics of a driven junction, Shapiro steps, routes to chaos; coupled junctions, Frenkel-Kontorova model for charge-density waves, breakdown of analyticity; coupled-domain models for charge-density wave dynamics.

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

385C. Surface and Interfacial Properties of Thin Films—Surface and interfacial structures of thin films will be related to electrical, magnetic and thermal properties. Model systems that can be made by vapor phase deposition processes will be considered.

2 units, Spr (Geballe) given 1987-88

390. Condensed Matter Physics Seminar—(Same as Electrical Engineering 320.) Discussion of current research and literature in condensed matter physics is offered by faculty, students and outside specialists.

1 unit, Aut, Win, Spr (Doniach, Geballe, Spicer) Th 4:15

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 (Siegman)

232A. Lasers—(Enroll in Electrical Engineering 232.)

3 units, Win (Siegman)


3 units, Spr (Auld)

alternate years, given 1987-88

324. Applications of Quantum Theory—(Enroll in Electrical Engineering 324.)

3 units, Spr (Pantell) not given 1987-88

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, Macovski)

Spr (Staff)

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 dioxide infrared laser, and the Nd:YAG laser. Measurements of laser threshold, gain, saturation and output power levels. Laser transverse and axial modes, linewidth and tuning, Q-switching and modelocking. Prerequisites: Electrical Engineering 231 and 232, or consent of instructor.

3 units, Win (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: Electrical Engineering 231 and 232, Applied Physics 358A, or consent of instructor.

3 units, Aut, Spr (Byer) not given 1987-88

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 (Siegman)

alternate years, given 1987-88
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: Albert Elsen
Chairman of Graduate Program in Studio Art: Keith Boyle
Director of Graduate Studies in Art History: Paul V. Turner
Professors: Keith Boyle (Painting), Elliot W. Eisner (Art Education), Lorenz Eitner (18th-19th century French art), Albert Elsen (mid-19th -20th century European art, American art since 1940, on leave Autumn), Matthew S. Kahn (Design), John-David La Plante (Indian art, on leave Winter), Suzanne Lewis (Medieval Art), Frank Lobdell (Painting, on leave Autumn), Dwight C. Miller (Baroque art), Nathan Oliveira (Painting/Printmaking), Paul V. Turner (Architectural History)
Associate Professors: Wanda M. Corn (American Art, on leave 1986-87), Richard Randell (Sculpture)
Assistant Professors: Kristina Branch (Painting/ Drawing); Greg Lynch (Design), Jody Maxmin (Ancient art), Melinda Takeuchi (Japanese art)
Affiliated Professor: John H. Merryman (Art and Law)
Senior Lecturer: Laura Volkerding (Photography)
Lecturer: Joel Leivick (Photography)
Visiting Associate Professor: Alan Wallach (American art, Winter and Spring)
Visiting Assistant Professor: David Lubin (American art, Autumn)

OFFERINGS AND FACILITIES

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 adviser 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, Art 2, Art 3, Art 5 and Art 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 take History 1, 2, 3 or students may take one course from the History 192A, 192B, 192C series, plus one course from the History 194, 194A, 194B series, plus one course from the History 1, 2, 3 series.
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. **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 an overall 3.5 letter grade indicator 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 subcommittee 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 subcommittee 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, students shall take a preliminary counseling test to determine the degree of the students' previous preparation. The students will be required to remedy deficiencies indicated by this test.

**Recommendation for the Degree**—To be recommended to the University Committee on Graduate Studies for the degree of Master of Arts in the history of art, the student must have satisfied the following requirements:

1. Completion of a minimum of three full quarters of graduate work in residence or its equivalent at this University.

2. Completion of a total of at least 36 units of graduate work in the history of art in courses at the 200 level, 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 coursework 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 and must have spent at least one of them in residence at Stanford.

**Dissertation Proposal**—Dissertation subjects are chosen in consultation with the candidate's advisor. A concise written statement of the topic and a plan of research for the doctoral thesis must be submitted to the art history faculty for approval at the end of the third year.
Collateral Studies—The student should be prepared to take 15 units in one or, at most, two supporting fields of study (such as history, literature, classics, anthropology, or philosophy), determined in consultation with the departmental advisors. In cases where the students' field of study requires competence in Greek and Latin or a third European language, or in the languages, institutions, thought and literature of the Far East, the permitted collateral units for the Ph.D. in art history will be increased, with the advisor's approval in each case, to 24 or 26 (excluding first year Chinese and Japanese).

Graduate Student Teaching and Museum Work Experience—As a required part of their art history training, all graduate students in art history, regardless of their source of funding, must assist with the Department's teaching program or, on some occasions, with Museum projects. Twenty hours of training per quarter is required beginning with the second quarter of the entering year through the end of the third year. Additional assignments requiring actual teaching duties will carry either 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 adviser and as chairman of his or her dissertation committee. The final draft of the dissertation must be in the advisor's hands at least four weeks before the University deadline in the quarter during which the candidate expects to receive his or her degree. Dissertations may not be submitted during the Summer Quarter. The dissertation must be completed within five years from the date of the student's acceptance to candidacy for the Ph.D. degree. A candidate taking more than five years will be required to reinstate his or her candidacy.

Oral Examination—The oral examination is taken after completion of the dissertation, and its acceptance by a majority of the committee, including the principal advisor. It serves primarily as a defense of the dissertation, over a wider field.

Ph.D. Minor—For a minor in Art History, a candidate is required to complete 24 units of graduate level art history courses (200 level or above), in consultation with a departmental advisor.

PRACTICE OF ART (STUDIO)

BACHELOR OF ARTS

The major program in the studio area must total 65 units. Students may major in one of five areas: painting/drawing, sculpture, printmaking, design, or photography.

REQUIREMENTS FOR PAINTING/DRAWING
Art 40, 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 121B)
Total Units Required: 48

REQUIREMENTS FOR SCULPTURE
Art 40, 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, 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, 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, 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 requirements in the major area of interest.

Students are required to formulate their program in careful consultation with their advisors. A program expressing the concerns of the student should evolve.
Overseas Campus Credit for Studio Art Courses—A minimum of 52 of the 65 units required for the studio art major must be taken at the Stanford campus. This will allow a student to take art courses at an overseas campus, but will still require that the bulk of the work be done under the guidance of an adviser and an approved curriculum. In all cases, a student should meet with his or her adviser prior to planning his overseas campus program.

Transfer Credit Evaluation—Upon declaring a studio art major, a student transferring from another school must have his or her work evaluated by an Art Department adviser. 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 adviser 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 average of "B-" in at least 65 units of undergraduate work in art.
3. Portfolio Specifications
   a) Painting and Sculpture: Six or more slides of painting or sculpture and six or more of drawings. Send in a Kodak Universal carousel. No actual work will be accepted.
   b) Printmaking: Six or more slides of prints and six or more slides of drawing. Actual prints will be accepted only if candidates can arrange for delivery and pick up.
   c) Photography: Twelve or more photographs.
   d) Design: Twelve or more slides or photographs of creative work.

All slides should be labelled 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 labelled with the same information and sent in the standard cardboard box received from processing. If applicants want their portfolios returned, a stamped self-addressed container must be included.

4. Applications and portfolios for the studio program must be submitted by January 1. Students accepted are admitted for the beginning of the following Autumn Quarter. No applicants for mid-year entrance will be considered.

The requirements for the degree of Master of Fine Arts in painting, sculpture, printmaking and photography are:

1. Completion of a minimum of two years (six full quarters) of graduate work in residence or its equivalent at this University.
2. 36 units of study must be completed; students must discuss their programs of study with the department's Administrator for Programs to ensure that the most favorable registration arrangement is made.
3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.

4. As a part of their training for the Master of Fine Arts degree, all students, regardless of their source of funding, are required to assist with the department's teaching program for the equivalent of eight hours per week over the period of six quarters; the percentage of work assigned in a given quarter is at the department's convenience.

The requirements for the degree of Master of Fine Arts in design are:

1. Completion of a minimum 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 section "School of Education" in this bulletin.

DOCTOR OF EDUCATION AND DOCTOR OF PHILOSOPHY IN EDUCATION

In cooperation with the School of Education the department offers work leading to the Ed.D. and Ph.D. degrees with a concentration in Art Education. Consult the section on "Graduate Degrees" listed in the "School of Education" section in this bulletin. Complete information concerning these degrees may be secured from the Office of the Dean of the School of Education.

TEACHING CREDENTIAL

(SINGLE SUBJECT—SECONDARY)

A program leading to a Master of Arts degree with a specialization in art education and/or including a California Teaching Credential in art is offered in art education by the School of Education. This program is available to students who have majored in art at the undergraduate level who have had no teaching experience, and who wish to become teachers of art at the elementary or secondary levels. For details with respect to this program consult the "Teaching Credential Program" listed in the "School of Education" section in this bulletin.

COURSES

HISTORY OF ART

BASIC

1. Introduction to Art—An introduction to the fundamental problems of meaning, form, and historical development in the visual arts, with emphasis on architecture, sculpture, painting, and printmaking.
   (DR:2)
   4 units, Aut (Eitner)

2. Ideas and Forms in Asian Art—To introduce the religious and philosophical ideas and social attitudes of India, China and Japan and to show how they are expressed in the architecture, painting, sculpture of the Orient and in such art forms as garden designing. (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 more general principles relevant to the study of architecture. (DR:2)
   4 units, Spr (Turner) not given 1986-87

4. Theme and Style in Japanese Art—Designed as a broad overview of Japanese artistic traditions. Selects from the great masterpieces of Japanese art from pre-history to the present and examines them in terms of the interplay between Japanese and Chinese cultural traditions. Material includes temples, castles, tea-houses, painting, sculpture, garden design and ceramics. Undergraduate lecture.
   4 units (Takeuchi) not given 1986-87

5. Introduction to Ancient Art—An introductory survey of the arts of Greece and Rome, with special attention given to architecture, sculp-
ture and painting, and to 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-lath 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) not given 1986-87

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)

65. Medieval Culture and Society—(Same as Medieval Studies 65, History 65.) (DR:2)
5 units, Win (Ferruolo, Lewis)
not given 1986-87

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 placed upon the formation, in 5th century Athens, of the classical ideal and to its development and diffusion in the centuries that followed. (DR:2)
4 units, Spr (Maxmin)

100C. Ancient Art III: Roman Art—An introduction to the rich and varied art and architec- ture of Rome from the Etruscans to the Late Empire. (DR:2)
4 units (Maxmin) not given 1986-87

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 particular attention given to the development of sculpture and painting in the 6th century.
4 units (Maxmin) not given 1986-87

102. Ancient Art V: Greek Vase Painting—(Same as Classics 120.) An introduction to the study and appreciation of Greek vases and their painters, especially to 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, Spr (Lewis) given 1987-88

5 units, Aut (Lewis) given 1987-88

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, Aut (Lewis)

107. Medieval Architecture—Development of functional and symbolic structures within the context of major medieval institutions and patronage: monasteries, castles, cathedrals and towns of Western Europe. (DR:2)
5 units, Spr (Lewis)

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, Win (Lewis)

110A. Renaissance Art I. (DR:2)
4 units, Aut

110B. Renaissance Art II. (DR:2)
4 units, Win

110C. Renaissance Art III. (DR:2)
4 units, Spr

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 1986-87

115B. 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt—Major artistic developments in the Low Countries during the seventeenth century focused on the great personalities and important episodes during this period. The question of the artist's position in his society will serve as the basic point of departure. (DR:2)
4 units, Aut (Miller)

4 units, Win (Miller)

116A. Masterpieces and Monuments of the Baroque Age. (DR:2)
4 units (Miller) not given 1986-87

120A. Modern Art I: Rococo to Revolution—Main currents in European art in the periods of the Enlightenment and Neoclassicism, Watteau, Boucher, Tiepolo, Chardin, Hogarth, Greuze, Fragonard, Robert, Piranesi, and early works of David, Goya, and Blake. (DR:2)
4 units (Eitner) not given 1986-87

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, Gericauld, Delacroix, and the landscape art of Turner, Constable. (DR:2)
4 units, Win (Eitner)

120C. Modern Art III: Realism and Impressionism—The origins of Impressionism in mid-nineteenth century realist art and in the work of the Barbizon School. The masters of Impressionism, particularly Monet and Renoir, are dealt with in detail, as well as the painters, such as Manet and Degas, who shared some of their goals and interests, without fully identifying themselves with Impressionism. (DR:2)
4 units (Eitner) not given 1986-87

120D. Modern Art IV: Alternatives to Impressionism—European art 1880-1900, Cezanne, VanGogh, Seurat, Gauguin, Symbolism, Lautrec, Ensor, Munch. (DR:2)
4 units, Win (Elsen)

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, Spr (Elsen) given 1987-88

4 units, Aut (Elsen) given 1987-88

123. Rodin—The art of Rodin and its relation to the time in which he lived. The course lectures are supplemented by sessions in the Stanford University Museum of Art's collection of Rodin's art and the Legion of Honor Collection in San Francisco.
4 units, Win (Elsen) 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, Lipchitz, Gabo, Arp, Giacometti, Moore, Gonzalez, Noguchi, D. Smith, Segal, Oldenberg and Christo. Films, field trips and use of the University's collections are planned.
4 units, Spr (Elsen) given 1987-88

124. Picasso—This course will be given either as a colloquium or lecture course depending upon enrollment.
4 units, Aut (Elsen) 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 1986-87

125B. The Art of India.
4 units, Win (LaPlante) not given 1986-87

125C. The Art and Architecture of Moghul India.
4 units (LaPlante) not given 1986-87

126A. Introduction to Chinese Art.
4 units, not given 1986-87

126B Introduction to Chinese Painting.
4 units, not given 1986-87

126E. The Meeting of Eastern and Western Art—The interaction between the art of the Far East, Europe, and America from the sixteenth century to the present day.
4 units, not given 1986-87

128A. Ritual Bronzes of Ancient China.
4 units, Win (LaPlante) not given 1986-87

128B. Chinese Ceramics.
4 units, Spr (LaPlante)

128C. Buddhist Art in Asia.
4 units (LaPlante) not given 1986-87

4 units (LaPlante) not given 1986-87

128E. Japanese Ceramics.
4 units (LaPlante) not given 1986-87
129A. Arts of Japan I—General 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, Win (Takeuchi)

129B. Arts of Japan II—A broad 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, Spr (Takeuchi)

129C. A survey of Japanese Painting—An introduction to the richness and diversity of Japanese painting from the 8th century to the present.
4 units (Takeuchi) not given 1986-87

129D. Japanese Buddhist Art—A history of the development of Buddhist art from its introduction in the 6th century through the 18th century.
4 units (Takeuchi) not given 1986-87

4 units, Win (Wallach)

130A. American Art and Culture, 1830-1900—A broad, interdisciplinary study of the art, literature, patronage and cultural institutions. Covers various types of painting such as landscape, genre, history and portraiture, as well as major figures: Cole, Durand, Church, Mount, Bingham, Homer, Eakins, Ryder and expatriate American artists such as Whistler, Sargent and Cassatt.
4 units, Spr (Wallach)

130B. Paris and New York: Transatlantic Exchange in Early Modernism—The study of artistic and cultural exchange between Paris and New York in the early decades of the 20th century. Discuss the Franco-American circle around Gertrude Stein, Alfred Stieglitz and Walter Arensberg, as well as movements such as Cubism, Expressionism and Dada. (DR: 2)
4 units (W. Corn) not given 1986-87

130C. American Art in the 1930s—Special attention paid to government patronage of the arts during the New Deal, to the rise of the short-lived Regionalist movement, to American Scene painting, and to Depression era photography. (DR: 2)
4 units (W. Corn) not given 1986-87

130D. American Art after World War II—A study of contemporary art as it developed in New York and on the West coast after the war. Focuses on the Abstract Expressionists and Pop artists in New York, and on the Assemblagists, Bay Area figurative and Funk artists on the West coast.
4 units (W. Corn) not given 1986-87

130E. The Poet and the Artist in American Modernism—(Same as English 269C.) An interdisciplinary study of the friendships, exchanges, and common concerns of writers and artists in the early modern period. Course 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 1986-87

4 units (Turner) not given 1986-87

175A,B. Modern Architecture I, II—A two-quarter course tracing the development, largely in Europe, which led to the present state of architecture and urbanism. Emphasis on the designer’s responses to new materials, technology and environmental conditions. (DR:2)
4 units, Win, Spr (Turner)

176. American Architecture and Urbanism—The development of architecture and city planning in the United States since colonial times, concentrating on those characteristics and problems which are distinctively American. (DR:2)
4 units, Win (Turner) not given 1986-87

ADVANCED UNDERGRADUATE AND GRADUATE

4 units, Aut, Win, Spr (Maxmin)
201. Colloquium: Beyond the Development of Attic Black-Figure Painting—A study of certain sixth-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, Spr (Lewis) given 1987-88

204. Studies on Art and Architecture in Medieval Britain.
  4 units, Aut (Lewis) given 1987-88

204A. Seminar: Medieval Manuscript Illumination—Introduction to the study of the illustrated medieval book, its technical, stylistic and iconographical aspects, as well as problems of patronage and usage. (May be taken as a sequel to English 209.) Permission of instructor required.
  4 units (Lewis) not given 1986-87

205. Studies on Art and Architecture in Medieval France.
  5 units, Aut (Lewis)

  4 units, Aut (Lewis) given 1987-88

206A. Seminar on the Gothic Cathedral.
  4 units, Win (Lewis) given 1987-88

206B. Colloquium on the Romance of the Rose: Text and Image—(Same as French 218.) An interdisciplinary approach to one of the most popular secular works of the High Middle Ages in English Translation. An exploration of how literature and art are uniquely joined together in illuminated manuscripts of the French romance, to reveal changing perceptions of meaning by succeeding generations of medieval readers, from the late 13th through the 15th century.
  5 units (Cazelles, Lewis) not given 1986-87

206C. Colloquium on Chartres Cathedral.
  4 units (Lewis) not given 1986-87

207. Studies on Medieval Architecture.
  5 units, Aut (Lewis)

208. Studies on 15th-Century Netherlandish Painting.
  5 units, Spr (Lewis)

210A,B,C. Studies on Renaissance Art I, II, III.
  4 units each

214A,B,C. Seminars on Renaissance Art.
  4 units each

215A. Studies on Artistic Culture in Italy During the 17th Century: Caravaggio, Bernini, Borromini, and Their Contemporaries.
  4 units (Miller) not given 1986-87

215B. Studies on 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt.
  4 units, Aut (Miller)

  4 units (Miller) not given 1986-87

216A. Studies on Great Masterpieces and Monuments of the Baroque Age.
  4 units (Miller) not given 1986-87

217. Connoisseurship in 17th Century Italian Drawings.
  4 units, Spr (Miller)

218. Colloquium on Art in 18th Century European Culture—A study of some of the principal artifacts of 18th century artistic culture: the Garden, the Palace, 18th century collecting, practical aesthetics and fashions of taste.
  4 units, Aut (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) not given 1986-87

219A. Colloquium on Caravaggio and the Artistic Culture of the Caravangisti.
  4 units (Miller) not given 1986-87

219B. Colloquium on the History of Printmaking.
  4 units (Miller) not given 1986-87

219C. Colloquium: The 17th Century School of Bologna.
  4 units (Miller) not given 1986-87

  4 units, Aut, Win, Spr (Eitner, Elsen)

221. Seminar on 19th Century Art.
  4 units, Spr (Eitner)

221A. Studies on 20th Century Painting From 1900-1920.
  4 units, Spr (Elsen)

221B. Studies on 20th Century Painting From 1920-1960.
  4 units, Aut (Elsen) given 1987-88

223. Studies on Rodin.
  4 units, Spr (Elsen) given 1987-88

223A. Studies on Modern Sculpture in Europe and America.
  4 units, Spr (Elsen) given 1987-88
223 C. Seminar on Late 19th Century Art: Rodin.
4 units (Elsen) not given 1986-87

223 D. Colloquium: Modern Sculpture in Europe and America.
4 units (Elsen) not given 1986-87

224. Picasso.
4 units, Aut (Elsen) given 1987-88

225 A. Studies on Indian Painting.
4 units (LaPlante) not given 1986-87

225 B. Studies on the Art of India.
4 units (LaPlante) not given 1986-87

225 C. Studies on the Art and Architecture of Moghul India.
4 units (LaPlante) not given 1986-87

226 A. Studies on Chinese Art.
4 units, not given 1986-87

226 B. Studies on Chinese Painting.
4 units, not given 1986-87

226 E. Studies on Meeting of Eastern and Western Art.
4 units, not given 1986-87

227 A, B. Seminar on Chinese Art.
4 units, not given 1986-87

227 C. Seminar on Far Eastern Art.
4 units, not given 1986-87

228 A. Studies on Ritual Bronzes of Ancient China.
4 units (LaPlante) not given 1986-87

228 B. Studies on Chinese Ceramics.
4 units, Spr (LaPlante)

228 C. Studies on Buddhist Art in Asia.
4 units (LaPlante) not given 1986-87

228 D. Studies on the Architecture and Gardens of Japan.
4 units (LaPlante) not given 1986-87

228 E. Studies on Japanese Ceramics.
4 units (LaPlante) not given 1986-87

229 A. Studies on the Arts of Japan I.
4 units, Win (Takeuchi)

229 B. Studies on the Arts of Japan II.
4 units, Spr (Takeuchi)

229 C. Studies on Japanese Buddhist Art.
4 units (Takeuchi) not given 1986-87

229 D. Seminar on Japanese Art.
4 units (Takeuchi) not given 1986-87

229 E. 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, Win (Takeuchi)

229 F. 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 1986-87

229 G. Studies on Japanese Buddhist Art
4 units (Takeuchi) not given 1986-87

229 H. Colloquium: Art, Culture and Society in Tokugawa Japan—An investigation of the interaction between social change, culture and the visual arts in Tokugawa Japan. The course is 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 1986-87

229 J. 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, Spr (Takeuchi)

230. Studies on American Art and Culture, 1670-1830.
4 units, Win (Wallach)

230 A. Studies on American Art and Culture, 1830-1900.
5 units, Spr (Wallach)

4 units (W. Corn) not given 1986-87

230 C. Studies on American Art in the 1930s.
4 units (W. Corn) not given 1986-87

230 D. Studies on American Art After World War II.
4 units (W. Corn) not given 1986-87

230 E. Studies on the Poet and the Artist in American Modernism.
4 units (W. Corn, A. Gelpi) not given 1986-87

231 A. Undergraduate Seminar: Photographs as Historical Documents—(Same as American Studies 220.)
5 units (J. Corn, W. Corn) not given 1986-87

231 B. Colloquium on the History of American Art History—An introduction to the major texts
on American art from the 19th century to the present.

4 units (W. Corn) not given 1986-87

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 1986-87

234. Seminar on Gender and Sexuality in 19th Century American Art—Masculinity, femininity, and erotic desire as manifested in 19th century American art. Readings include period fiction and poetry and texts in art history, psychoanalysis, social and intellectual history, and literary theory.

4 units, Aut (Lubin) T 3:15-5:05

234A. Seminar on Patronage, Museums, and the Arts in 19th Century America—(Same as American Studies 210.) The relationship between patronage and the art of production in 19th Century American art.

5 units, Win (Wallach)

234B. Seminar on 19th Century American Landscape Painting.

4 units, Spr (Wattach)

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—An introduction to important reference works in art and architectural history. Familiarity with this material will be encouraged through the frequent assignment of relevant bibliographical problems. A working knowledge of German, French and Italian is assumed. Primarily for art history graduate students, although junior or senior undergraduate majors who plan to continue in art history on the graduate level may enroll with the consent of the instructor.

4 units, Aut (Ross) given 1987-88


4 units (Elsen) not given 1986-87

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 counterfei• art; etc. Course is 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. Recommended for art history majors. Recommended prerequisites: 1 or 5 and 10.

4 units (Elsen) not given 1986-87


any quarter (Staff) by arrangement

274. Studies on Baroque Architecture.

4 units (Turner) not given 1986-87

275A,B. Studies in Modern Architecture I, II.

4 units, Win, Spr (Turner)

275A. Studies in Modern Architecture I.

5 units, Spr (Turner)


4 units (Turner) not given 1986-87

277. Seminar on Modern Architecture: Le Corbusier—(Prior consent of instructor required.)

4 units (Turner) not given 1986-87

278. Seminar on American Architecture: The Design of the American College Campus—(Prior consent of instructor required.)

4 units, Aut (Turner)

278A. Seminar on Frank Lloyd Wright—(Prior consent of instructor required.)

4 units, Spr (Turner)

278B. Seminar on 20th Century Urbanism.

4 units, Win (Stout, Turner) W 3-5

295. Teaching and Professional Work Experience.

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


any quarter (Staff) by arrangement


any quarter (Staff) by arrangement

RELATED TOPICS

Topography and Monuments of Greece—(See Classics 108.)

City of Athens—(See Classics 109.)

Classical Athletics—(See Classics 14.)

PRACTICE OF ART (STUDIO)

All courses listed below in practice of art (studio) will be offered in 1986-87.
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, Win (Kahr, Sparagana)

15. Special Seminar in Printmaking.
   3 units, not given 1986-87

   3 units, Spr (McKoy)

17. Special Seminar in Photography.
   3 units, Aut (Fischer)

### BASIC

40. Basic Drawing—Basic drawing concepts introduced through charcoal.
   3 units, Aut, Win, Spr (Staff)

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. Introduction to Abstraction—Figure and non-figure constructions in various materials with study and practice of sculpture deriving from the first half of the 20th century, and consideration of concepts involved in the beginnings of abstraction.
   3 units, 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 time used for 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)

145. Painting I—Introduction to painting procedure. Still life and landscape studies in oil. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.
   3 units, Aut, Win, Spr (Staff)

146. Painting II—Beginning and intermediate painting. Extended problems in pictorial organization and content, with stress on oil painting. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.
   3 units, Aut, Win, Spr (Staff)

147. Painting III—Advanced painting with emphasis on the individual point of view. Prerequisite: Three quarters of 145, 146, or equivalent, or consent of instructor.
   3 or more units, Aut, Win, Spr (Staff)

148. Monotype—Introduction to print-making using monotype, a graphic art medium which was used by such artists as Blake, Degas, Gauguin, Pendergast, and many others. Visits to the Achenbach Foundation collection and the Editions Press in San Francisco, and the Stanford Museum will supplement this course. Prerequisite: 40 or 140. May be repeated for credit.
   3 units, Aut, Win, Spr (Oliveira)

153. Recent Sculpture Concepts and Projects—Study and practice will be concerned with the art of recent decades with special emphasis on current post-abstract procedures. Various materials and non-materials will be utilized. Prerequisites: Any one of 40, 51 or 52, or 53, 60 or 70.
   3 units, Win, Spr (Randell)

160K,L. Design I: Intermediate Design—Comprehensive design assignments in diverse media with emphasis on the relationship between professional design problems and their
underlying elements and procedures. Prerequisite: 60.
3 or more units, Aut, Win, 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, Win (Lynch)

164. Color—Comprehensive study in the theories and practice of color. Emphasis is on working with color in a variety of media. Prerequisite: 60.
3 units, Spr (Lynch)

166. Silkscreen Process/Textiles—Design projects in pattern as it applies to cloth, paper and other surface materials. Production emphasis is on the silkscreen printing process. Prerequisite: 160 or 161.
3 or more units, Aut (Kahn)

167. 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 (Kahn) not given 1986-87

168A. Introduction to Urban Design—Examines urban design in theory and practice. Course overviews important theoretical ideas of city form and image, from historical principles inherited from the cities of Western Europe to late 20th Century models exemplified by Los Angeles and the sunbelt cities. Case studies examine urban design examples, projects and controversies in North America. Workshops focus on analysis of the image and physical characteristics of San Francisco neighborhoods. A 5-week term urban design problem summarizes principles discussed in the readings, seminars and workshops.
5 units, Win (Cast)

168B. Urban Design Studio—A 10-week comprehensive urban and architectural design project taken from a current problem in San Francisco. Course develops a step-by-step understanding of the urban design process and problem solving methods. Graphic, diagrammatic and other visual tools of analysis and communication are introduced and used in the study project. Recommended: Urban Studies 160. Enrollment limited to 14 students.
5 units, Spr (Cast)

169. Professional Design Exploration.
5 units (Kahn) not given 1986-87

170. Photography II—Students will individually pursue a topic of their own definition. Class sessions will meet for individual and group critiques, lab demonstration and discussions.
3 units, Win, Spr (Volkerding)

172. Alternative Processes—Course is concerned primarily with technical procedures and will investigate the uses of primitive and handmade photographic emulsions. Prerequisite: 70, 170, 270 or consent of the instructor. Class limited to 10 students; priority will be given to advanced students.
3 units, Aut (Leiteck)

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 (Leiteck, Volkerding)

ADVANCED UNDERGRADUATE AND GRADUATE

241. Advanced Drawing and Painting Criticism I—Prerequisite: At least two quarters of painting or drawing.
Aut, Win, Spr (Oliveira) by arrangement

242. Advanced Drawing and Painting Criticism II—Prerequisite: At least two quarters of painting or drawing.
Aut, Win, Spr (Boyle) by arrangement

243. Advanced Drawing and Painting Criticism III.
Aut, Win, Spr (Lobdell) by arrangement

244. Advanced Drawing and Painting Criticism IV.
Aut, Win, Spr (Branch) by arrangement

245. Undergraduate Seminar in Studio Art.
2 units, Win, Spr (Lobdell)

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)

any quarter (Randell) by arrangement

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 combina-
tion of typographic material and images. Prerequisite: Any two design courses above 160.

3 or more units, Spr (Lynch)

262. Advanced Design II: Graphic Organization—Design experiences in visual communication through analytical approaches of visual problem solving.

3 or more units, Win (Lynch)

264. Advanced Color.

3 units, Spr (Lynch)

268. Design Synthesis—Mature semi-elective problems in composite and multi-media design areas. Prerequisite: Any two design courses above 160.

3 or more units, Spr (Kahn)

269. Advanced Creative Studies—Evening seminar based upon elective design projects in areas of individual specialization. Consent of instructor required.

3 or more units, Aut, Win, Spr (Kahn)

270. Photography III.

Aut, Win, Spr (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 six students.

3 units, Win, Spr (Leivick)

272. Individual Work: Photography

any quarter (Leivick, Volkerding) by arrangement

281. Concepts of Text—(Same as Computer Science 273.) What every literate person should know about the basic principles of the visual organization of text. Subjects include handwriting, typewriting, typography and computerized documents. Perceptual, linguistic, and semiological issues will be discussed. Course work will consist primarily of visual exercises.

3 units, Spr (Bigelow) TTh


Aut, Win, Spr (Boyle) by arrangement

342. M.F.A. Project (Studio).

any quarter (Staff) by arrangement

360A,B,C. Master's Project (Seminar): Design.

Aut, Win, Spr (Kahn) by arrangement

RELATED TOPICS

Visual Thinking—(See Mechanical Engineering 101.)

Human Values in Design—(See Mechanical Engineering 115A.)

ART EDUCATION

Artistic Development of the Child—(Enroll in Education 219.)

4 units, Win (Eisner)

Seminar for Doctoral Students in Art Education—(Enroll in Education 461.)

2-5 units, Aut (Eisner) given 1987-88

ASIAN LANGUAGES

Emeritus: (Professor) Frederic Spiegelberg
Chairman: John C.Y. Wang

Professors: Albert E. Dien, David S. Nivison (on leave Autumn and Spring), Makoto Ueda (on leave Autumn and Winter), John C. Y. Wang

Associate Professors: Kung-yi Kao, Ian Levy (on leave Spring), William A. Lyell, Susan K. Matisoff (on leave Autumn)

Assistant Professor: Thomas W. Hare

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), Harumi Befu (Anthropology), Albert E. Dien (Asian Languages), Peter Duus (History, on leave 1986-87), John G. Gurley (Economics), Lawrence Lau (Economics), John W. Lewis (Political Science), Jeffrey Mass (History, on leave Spring), David S. Nivison (Asian Languages, Philosophy, and Religious Studies, on leave Autumn and Spring), G. William Skinner (Anthropology, on leave Autumn), Makoto Ueda (Asian Languages, on leave Autumn and Winter), Lyman P. Van Slyke (History), John C. Y. Wang (Asian Languages), Robert E. Ward (Political Science), Arthur P. Wolf (Anthropology)

Associate Professors: Harold L. Kahn (History, on leave Spring), Kung-yi Kao (Asian Languages), Ian Levy (Asian Languages, on leave Spring), William A. Lyell (Asian Languages), Susan K. Matisoff (Asian Languages, on leave Autumn), Daniel I. Okimoto (Political Science), Lee H. Yearley (Religious Studies)

Assistant Professors: Carl W. Bielefeldt (Religious Studies), Nina Halpern (Political Science), Thomas W. Hare (Asian Languages), John D. LaPlante (Art, on leave Winter),
OFFERINGS

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 IN ASIAN LANGUAGES

Majors with an overall letter-grade average of 3.5 may apply for the Honors Program by submitting a senior thesis proposal to the Honors Committee during the Spring or Winter Quarter of the junior year; the proposal will include a thesis outline, a list of all relevant courses the student has taken or plans to take, a skeleton reading list including a work or works in Chinese or Japanese, and the name of a faculty member who has agreed to act as Honors Supervisor.

If the proposal is approved, research and writing will begin in the Spring Quarter of the junior year, and for the first two quarters will take the form of directed reading with the chosen supervisor; the finished essay (normally about 15,000 words) will be submitted to the committee no later than the end of the Winter Quarter in the senior year. From ten to fifteen units of credit will be granted for the finished thesis.

EAST ASIAN STUDIES THEME HOUSE

EAST House, located at Governor’s Corner on campus, is an undergraduate residence which houses sixty 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.

ADMISSION TO GRADUATE STUDY

All students contemplating application for admission to graduate study must have a creditable undergraduate record at Stanford or elsewhere. The applicant need not have majored in Chinese or Japanese as an undergraduate, but must have had the equivalent of at least three years' training in the language in which he or she intends to specialize, and must also demonstrate a command of English adequate for the pursuit of graduate study. Applicants should not wish merely to acquire or improve language skills but to pursue study in one of the following fields: Chinese history (premodern), Chinese linguistics, Chinese literature, Chinese philosophy, Japanese cultural history, Japanese literature.

GRADUATE PROGRAMS

MASTER OF ARTS

The degree of Master of Arts is granted in Chinese and in Japanese. The normal length of study for the degree is two years.

Applicants who wish to obtain the A.M. only but do not intend to proceed to the Ph.D. will only be considered if no financial aid is requested.

Students who wish to spend their first year of graduate study at the Taipei or Tokyo Center must obtain departmental approval first.
Candidates for the degree must be in residence at Stanford in California during the final quarter of registration.

A thesis or an annotated translation of a text of suitable literary or historical worth is required for the A.M. degree. Under special circumstances, a paper approved by the Graduate Advisor may be substituted.

The University's basic requirements for the master's degree are given in the section "Degrees" in this bulletin. Departmental requirements are set forth below.

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, philosophy, 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 either by completing Chinese 113 or by taking Japanese 250 and subsequently passing a test on the prescribed reading list in Kambun.

4. Pass a set of four comprehensive written examinations. One of these will test the candidate's methodological competence in a discipline. The remaining three fields are to be chosen, with the approval of the Graduate Advisor in consultation with the student's individual advisor, from the following: Chinese literature, Chinese history, Chinese philosophy, Chinese linguistics, Chinese religion, Chinese art, Japanese literature, Japanese history, Japanese religion, Japanese art, and Japanese anthropology.

University Oral Examination—General regulations governing the oral examination will be found in the 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). They are described elsewhere 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.

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.

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., together with a brief introduction to Classical Chinese as used by early philosophers. (DR:3*)
4 units, Spr (Ivanhoe) MWF 10 discussion by arrangement

91. Traditional East Asian Civilization: China — An introduction to the various genres of traditional Chinese literature (poetry, novels, plays, philosophical works) set against the backdrop of history. (DR:2*)
5 units, Aut (Lyell) 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.
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 1987-88

114. Haiku—Reading and discussion of representative Japanese haiku from the 16th century to the present. Works of Bashō, Buson, Issa and other poets will be treated in English translation. Students will exchange their interpretations of individual poems in class, collectively trying to reach for the ultimate meaning of each. Aspects of traditional Japanese aesthetics will be touched on in the course of discussions. (DR:2*)
3 units, Aut (Ueda) given 1988-89
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) given 1988-89

131. Chinese Poetry and Drama in Translation—Readings in traditional Chinese poetry and drama with emphasis on genre, theme, and style. (DR:2*)

4 units, Aut (Staff) MWF 11

132. Chinese Fiction in Translation—A survey of Chinese prose fiction from early times to the late Ch'ing period, with emphasis on literary and thematic discussions of major representative works available in English translation. (Students who need to take this course to fulfill requirements may take 176 instead.) (DR:2*)

4 units, Win (Wang) given 1987-88

133. Modern Chinese Literature in Translation—Readings in representative 20th-century works of fiction, drama, and poetry in translation. (DR:2*)

4 units, Spr (Lyell) MWF 11

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 (Levy) TTh 3:15 plus discussion section by arrangement

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 will 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 (Matissoff) MWF 1:15

138. Modern Japanese Literature in Translation—An introductory course in Japanese poetry, drama, and fiction since 1868. Authors considered will include Tanizaki, Kawabata, Mishima, etc. Knowledge of premodern Japanese literature not required. (DR:2*)

4 units, Spr (Ueda) MWF 1:15


4 units, Spr (Nicolson) given 1987-88

152. Nomad Empires of Inner Asia—(Same as History 195.) Inner Asia as an arena of conflict between agricultural and nomadic societies and the traces of cultural diffusion. (DR:5*)

5 units, Spr (Dien) MWF 11

153. Science, Technology and Material Culture in Traditional China—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.

5 units, Spr (Dien) given 1987-88

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

176. Chinese Myths, Legends, and Folktales—A general survey of their respective forms and contents and their significance in the study of Chinese culture in general and Chinese literature in particular. (DR:2*)

4 units, Spr (Wang) MWF 11

177/277. Classic Japan—The cultural achievements of Heian (794-1185) Japan. Students will be introduced to The Tale of Genji, Japan's greatest work of prose fiction, to the visual arts, music, and poetry of the age. The religious and historical background of the period will also be discussed. (Graduate students may register under 277, with additional readings in Japanese.) (DR:2*)

4 units, Aut (Hare) MW 10

178. Performance of Lyric Poetry—The nexus between author and reader in a literary work has become a major point of controversy in contemporary critical theory, one particularly appropriate for investigation from the perspective of performance. This course takes the performance of a literary text as its central task, and 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 students.

3 units, Spr (Hare) M 2:15 W 2:15-4:05

179. Classical Japanese Drama—The development of Japanese drama from early religious ritual forms through nō, puppet theatre and kabuki. Readings include translation from several genres with the greatest emphasis given to nō. Plays will be analyzed both as dramatic literature and in
terms of performance. Video tapes and short films will be used extensively to supplement lectures. (DR:2*)

4 units, Spr (Matisoff) 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 will be read in translation. (DR:2*)

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

195/295. Modern Intellectuals in Japanese Literature — A study of modern Japanese novels that deal with problems of a modern intellectual. The novels, read in English translation, will include Kawabata’s Snow Country, Tanizaki’s The Key, Mishima’s Confessions of a Mask, and others.

3 units, Aut (Ueda) given 1987-88

197. Images of Women in Modern Japanese Literature — A study of modern Japanese novels that feature women performing various social roles. The novels, read in English translation, will include Wild Geese by Ogai, The Setting Sun by Dazai, After the Banquet by Mishima, The Woman in the Dunes by Abe, and others.

3 units, Win (Ueda) given 1987-88

255A. The Nature of Literature: Japanese and Western Views — Studies different attitudes toward literature in Japan and in the West. Among the books discussed are 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 1987-88

255B. Chinese and Western Poetics — Traditional Chinese poetics juxtaposed with recent trends in Western literary theory, such as phenomenological hermeneutics and deconstruction, with focus on paradox. Seminar with limited enrollment. (Graduate students in Chinese may enroll in this seminar in lieu of 361 and will be required to read original texts.)

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

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, Shou)
   Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 1:15

2. 5 units, Win (Kao and Shou)
   Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 1:15

3. 5 units, Spr (Kao and Shou)
   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 (Lyell) MTWThF 11

103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese — Equivalent to 101, 102, 103 combined. Prerequisite: 23 or equivalent.

12 units, Sum (Staff) MTWThF 9-12

111, 112, 113. Third-Year Chinese (Classical) — Prerequisite: 23 or equivalent.

111. 5 units, Aut (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 (Kao, Staff)
   by arrangement

132. 2 units, Win (Kao, Staff)
   by arrangement

133. 2 units, Spr (Kao, 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 11
   222. Historical Narration.
      5 units, Win (Dien) MWF 1:15
   223. Literary Essays.
      5 units, Spr (Staff) MWF 11

241, 242, 243. Modern Chinese Literature—Introduction through the use of annotated texts to the short story, essay, poem, play, and novel. Prerequisite: 103 or 113.
   241. Short Story.
      5 units, Aut (Lyell) MWF 9
      5 units, Win (Chuang) MWF 11
      5 units, Aut (Lyell) given 1987-88

260. Chinese Poetry (I)—Selected readings from the Shih-ching and poetry of the Han with emphasis on critical analysis. Prerequisite: 223 or consent of instructor.
   4 units, Aut (Staff) MWF 11

261. Chinese Poetry (II)—Selected readings from the poetry of the Wei through the Sung, with emphasis on critical analysis. Prerequisite: 260 or consent of instructor.
   4 units, Win (Staff) MWF 11

263. Lyrics and Songs—Selected readings of lyrics (ts'u) and songs (san-ch'ü), T'ang through Ming (8th-16th centuries), with emphasis on critical analysis. Prerequisite: 262 or consent of instructor.
   4 units, Win (Staff) given 1987-88

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) TTh 11-12:15
   272. 4 units, Win (Wang) TTh 11-12:15

273. Chinese Drama—Selected readings in dramatic works of the Yuan, Ming, and Ch'ing periods, with emphasis on literary rather than theatrical qualities. Prerequisite: 113 or consent of instructor.
   4 units, Spr (Wang) given 1987-88

291. The Structure of Modern Chinese—(Same as Linguistics 278L.) Prerequisite: 23 or equivalent. Recommended: A general introductory course in linguistics.
   4 units, Spr (Kao) given 1987-88

292. The Chinese Language and Current Linguistic Theories—(Same as Linguistics 279.) Prerequisite: 103 or equivalent. Recommended: A general introductory course in linguistics.
   4 units, Spr (Kao) by arrangement

299. Master's Thesis or Translation—A total of 5 units taken in one or more quarters.
   Aut, Win, Spr (Staff) by arrangement

331. Seminar in Confucian Ethics—(Same as Philosophy 331, Religious Studies 238.) Prerequisite: 223 or equivalent.
   5 units (Nivison) not given 1986-87

334. Seminar in Modern Chinese Literature—May be repeated for credit. Prerequisite: 243 or consent of instructor.
   5 units, Win (Lyell) TTh 1:15

361. Seminar in Chinese Literary Criticism—May be repeated for credit. Prerequisite: 265 or consent of instructor.
   5 units, Spr (Staff) given 1987-88

399. Dissertation.
   (Staff) by arrangement

400. Advanced Language Training—Open only to students in the Taipei Program. For more information, see the description under "Inter-University Program for Chinese Language Studies in Taipei." Offered on a Pass/No Credit basis.
   15 units per quarter (Staff)

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, Busbin)
      Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 1:15
2. 5 units, Win (Sakamoto, Nebrig, Busbin)  
Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 11:15

3. 5 units, Spr (Sakamoto, Nebrig, Busbin)  
Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11: Section 4 MTWThF 11:15

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 11-12:20  
8/108. 3 units, Win (Busbin) MWF 11-12:20  
9/109. 3 units, Spr (Busbin) MWF 11-12:20

21, 22, 23. Second-Year Modern Japanese —  
Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 3 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  
(Kusaka) 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

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 (Sakamoto) TTh 11:15  
28. 2 units, Win (Sakamoto) TTh 11:15  
29. 2 units, Spr (Sakamoto) TTh 11:15

ADVANCED

101, 102, 103. Modern Written Japanese —  
Reading texts representative of various modern written styles. Prerequisite: 23 or equivalent.  
101. 5 units, Aut (Kubota) 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 11:15  
122. 2 units, Win (Kubota) TTh 11:15  
123. 2 units, Spr (Kubota) TTh 11:15

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) given 1987-88  
202. 5 units, Spr (Hare) given 1987-88

211, 212, 213. Advanced Modern Japanese—  
Readings in modern Japanese scholarly, journalistic and literary prose. Each quarter may be taken separately. Prerequisite: 103 or equivalent.  
211. Essays and Scholarly Articles.  
5 units, Aut (Levy) TTh 12:30-1:45  
212. Newspaper Articles.  
5 units, Win (Levy) MW 12:30-1:45  
213. Fiction.  
5 units, Spr (Matisoff) TTh 11-12:15

246, 247, 248. Introduction to Classical Japanese—The basic principles of the classical literary language. The first quarter concentrates on basic grammar and vocabulary, while the subsequent quarters involve reading in progressively more difficult texts from the Nara through Tokugawa periods. Prerequisite: 103 or equivalent.  
246. 5 units, Aut (Hare) MW 11-12:50  
247. 5 units, Win (Hare) MW 11-12:50  
248. 5 units, Spr (Hare) MW 11-12:50

4 units, Spr (Ueda) MW 2:15-3:30

250. Introduction to Kambun—Selected readings from a variety of Japanese works written in Kambun, ranging from Kaiisui to Yoshida Shoin’s diary. Offered when there is sufficient demand.  
4 units, Spr (Ueda) MW 2:15-3:30

5 units, Spr (Mass) given 1987-88
4 units, Spr (Ueda) given 1987-88

5 units, Win (Bielefeldt) by arrangement

277. Classic Japan — (Same as 177 with additional work requiring knowledge of the language.)
4 units, Aut (Hare) MW 10

278. Japanese Poetry from Manyōshū to Shinkokinshū (759-1206)—An introduction to the history of Waka through close readings of selected texts in Japanese. Prerequisite: 247 or equivalent.
4 units, Win (Levy) given 1988-89

279. Readings in Modern Japanese Poetry—The evolution of modern Japanese poetry from the Meiji Period through the Second World War. Readings include selections from the work of major poets such as Kambara Ariake, Hagiwara Sakutarō, Miyazawa Kenji and Nishiwaki Junzaburo. Prerequisite: 213 or consent of instructor.
4 units, Win (Levy) W 3:15-5:05

280. Medieval Japanese Narrative and Dramatic Literature—Reading and discussion of selected works of the Muromachi through early Edo periods. Prerequisite: 247 or equivalent.
4 units, Spr (Matisoff) TTh 2:15-3:30

286. The Structure of Japanese—(Same as Linguistics 277.) 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) given 1987-88

294. Major Haiku Poets — Reading and discussion of selected haiku by Bashō, Buson, Issa and others. Prerequisite: 103 or equivalent.
4 units, Aut (Ueda) given 1987-88

296. Readings in Modern Japanese Literature—Reading and discussion of works selected from contemporary authors. Prerequisite: 213 or equivalent. May be repeated for credit.
4 units, Aut (Ueda) given 1987-88

297. Images of Women in Modern Japanese Literature—Reading and discussion of selected literary works illuminating various aspects of female experience in modern Japan. Prerequisite: 213 or equivalent.
4 units, Win (Ueda) given 1987-88

298. Translation Workshop—Discussion of problems involved in translating Japanese into English. Each student is expected to produce an original translation of a literary or documentary work from his or her major field of interest.
4 units, Spr (Ueda) given 1987-88

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 Modern Japanese Literature—Study of selected works by modern novelists.
5 units, Win (Ueda) given 1987-88

399. Dissertation.
(Staff) by arrangement

400. Advanced Language Training—Open only to students at the Tokyo Center. For more information, see the program description under “Inter-University Center for Japanese Studies in Tokyo.” The course is offered on a Pass/No Credit basis.
15 units per quarter, (Staff)

KOREAN

1, 2, 3. First-Year Modern Korean—Conversation, grammar, reading, elementary composition. Daily sections may be set at the beginning of the quarter to suit schedule requirements.
5 units, Aut, Win, Spr (Staff) MTWTh 1:15

21, 22, 23. Second-Year Modern Korean—Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 3 or equivalent.
5 units, Aut, Win, Spr (Staff) MTWTh 2:15
STATEMENT OF PURPOSE

Although Stanford University presently does not have a degree program in Astronomy or Space Science, teaching and research in various branches of these disciplines is an ongoing activity in 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; 356—Astrophysics Laboratory; 360—Solar Physics; 362—Physical Processes in Stars; 364—Plasma Physics; 366—Cosmology and Extragalactic Astrophysics; 222, 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 Interiors; 227 — Atmospheric and Space Physics; 279A — Space Mechanics; 279B — Advanced Space Mechanics; 279C — Optimal Space Trajectories; 348 — Ionospheric Processes; 350 — Radioscience Seminar; 352 — Wave Propagation in the Ionosphere and Magnetosphere; 354 — Introduction to Radio Wave Scattering; 359—Remote Probing of Atmospheric Environment; 392—Magnetospheric Physics.

COURSES

15. Topics in Modern Astronomy—The following two courses are addressed to students not majoring in the sciences. They are taught in different quarters by different instructors but are 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.) Familiarizes undergraduates, without scientific background with the structure, origin and evolution of our universe and describes our growing knowledge of the objects which make up the universe; galaxies, stars, planets, etc. Some enigmas of modern astronomy, such as quasars, X-ray sources, black holes, and pulsars will also be discussed. Presentation will be non-mathematical.

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

15B. Cosmic Horizons—(Enroll in Physics 15A.) Familiarizes the non-science student with modern cosmic explorations. After discussing the physical laws that govern the universe, its evolution will be traced from the initial primordial fireball, through the formation of galaxies, stars, and planets to the development of life. Exotic astronomical objects, such as quasars, pulsars, and black holes will also be discussed. Some algebra will be used. (DR:7)

3 units, Aut (Staff)

50. Astronomy Laboratory and Observational Astronomy—Theory and use of an optical telescope and the interpretation of basic observational data to determine the physical properties of planets, stars, and galactic systems. The course consists of individual observations with a 16-inch Cassegrainian telescope supplemented by lectures which will include discussions of basic observational techniques, astronomical catalogs and coordinate systems, and the relation of observations to astrophysical models. (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.) Provides the student of physical science or engineering with an introduction to observational techniques in astronomy. 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 at the Stanford Student Observatory where students will use the 16-inch telescope. Limited enrollment. Prerequisites: One year of physics or concurrent registration in Physics 25, 57 or 63, consent of instructor. (DR:7)

4 units, Spr (Walker) M 3:15-5
laboratory by arrangement

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


3 units, Aut (Petrosian) TTh 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, Win (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 outlined 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. Students will prepare 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

3 units, Spr (Sleep) TTh 10-11:30
alternate years, given 1987-88

222. Classical Gravitation—(Enroll in Physics 222.)
3 units, Spr (Staff)
alternate years, given 1987-88

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) MWF 1:15

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 (Bryson) TTh 9:30-10:45

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)
3 units, Spr (Breakwell) MWF 10

279C. Optimal Space Trajectories—(Enroll in Aeronautics and Astronautics 279C.)
3 units, Spr (Breakwell)
alternate years, given 1987-88

348. Ionospheric and Magnetospheric Processes—(Enroll in Electrical Engineering 348.)
3 units, Spr, alternate years, given 1987-88

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, Spr (Helliwell) TTh 11-12:15

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
3 units, Spr, alternate years, given 1987-88

356. Astrophysics Laboratory—(Enroll in Applied Physics 356.)
3 units, Sum (Walker)
Sports Directors: Mark Marquess (Baseball, men), Mike Montgomery (Basketball, men), Tara Van Derveer (Basketball, women), Ken Dreyfuss (Crew, men), John Davis (Crew, women), Brooks Johnson (Cross Country, Track and Field), Richard Schavone (Diving), Edwin Hurst (Fencing), Sheryl Johnson (Field Hockey), Jack Elway (Football), Timothy Schaaf (Golf, men), Tim Baldwin (Golf, women), Sadao Hamada (Gymnastics, men), Homer Sardina (Gymnastics, women), Joe Petrucci (Sailing), Sam Koch (Soccer, men), Helen Keohane (Soccer, women), Skip Kennedy (Swimming, men), George Haines (Swimming, women), Richard Gould (Tennis, men), Frank Brennan (Tennis, women), Frederick Sturm (Volleyball), Dante Dettemanti (Water Polo), Chris Horpel (Wrestling)

Sport Assistant Coaches: Dean Stotz (Baseball), June Daugherty, Julie Plank, Amy Tucker (Basketball, women), Sherry Posthumus (Fencing), David Baldwin, Tom Beckett, Larry Kerr, Otto Koffer, Louis Lubick, Dick Mannini, Tony Samuel, James Walsh (Football), Remi Korchemny, David Wollman (Track and Field), Don Shaw (Volleyball), Dave Schultz (Wrestling)

Teaching Specialists: Joe Petrucci (Sailing), Shirley H. Schoof (Badminton and Tennis)

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. Undergraduates may enter the co-terminal degree program during their eighth quarter, which permits them to study simultaneously for the Master of Arts: Education/Dance Specialization degree and a bachelor's degree of their choice.

Graduate students interested in dance education leading to a performing or teaching career may apply for admission to graduate study. A prerequisite to successful completion of all graduate work in dance is technical proficiency as demonstrated by preparation in dance at Stanford, a bachelor's degree in dance from another college or university, or documented training in dance. The master's degree program expects graduate students to develop skill in choreography, production, teaching and research. Achievement of these skills is demonstrated by an individually designed creative project, com-
pletion of a teaching apprenticeship and submission of a research paper.

For further information about the Stanford Dance Program, contact Susan Cashion.

INTERCOLLEGIATE ATHLETICS

In keeping with our cultural heritage and American university tradition, Stanford offers a broad intercollegiate athletic program. The objectives of this program are to provide the opportunity to compete at the highest possible level without jeopardizing the integrity of the individual or the institution, to adhere strictly to all university, association and conference rules governing athletic participation, and to encourage effectively the achievement of academic goals by student athletes at the same rate as by other university students. As a member of the National Collegiate Athletic Association (NCAA), Stanford fields both men's and women's varsity teams. These are for men: 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's varsity teams. These are for men: 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

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.

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 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, tennis and volleyball courts, and weight training facilities are located at the Roble Gym Complex and near the Encina Gym. The deGuerre Complex houses swimming and diving pools as well as handball, racquetball and squash courts. The Dance Studio (for classes and dance concerts) and small activity rooms are located at the Roble Gym complex along with the department's repository for the University Dance Collection of reference materials. 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 the Dance Curriculum Coordinator, 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 may be applied toward undergraduate graduation requirements. 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 in intercollegiate JV or Varsity team classes.) Students have first priority for auditing and must record this enrollment on their Official Study Lists. Enrollment and grade received will be reflected on the End-Quarter Grade Reports and student transcripts.

**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 lockerooms. 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. For additional related courses, see Drama Section (Movement for Actors).

61. Modern Dance I—Introduction to modern dance technique with particular 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)

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. Prerequisite: 61 or equivalent.

1 unit, Aut, Win, Spr (Staff)

63. Modern Dance III—Intermediate technique reinforcing and extending concepts developed in 61 and 62. Emphasis on clarity of styling, rhythmic versatility, and phrasing. Prerequisite: 62 or equivalent.

1 unit, Aut, Win, Spr (Staff)

64. Modern Dance IV—Intermediate-advanced technique. Increasing complexity of sequences and subtlety in phrasing, rhythm and movement quality. Prerequisite: 63 or equivalent.

1 unit, Aut, Win, Spr (Staff)

71. Ballet Technique I—Introductory class with emphasis on fundamentals of classical technique: alignment, basic barre exercises and
movement sequences in the center and across
the floor.
1 unit, Aut, Win, Spr (Staff)

72. Ballet Technique II—Beginning-intermediate level. Continuation of 70, repeating
the fundamentals with increased complexity and introducing additional movement vocabu-
lary. Prerequisite: 70 or equivalent.
1 unit, Aut, Win (Staff)

73. Ballet Technique III—Intermediate level stressing accuracy and facility with fundamental
classical vocabulary. Particular attention to movement shape and line, spatial concepts,
musicality and phrasing. Prerequisite: 70A or equivalent.
1 unit, Spr (Staff)

81. Jazz Dance I—Introduction to jazz dance styles. Emphasis on rhythmic variation, coordi-
nation, isolation of body parts and movement combinations.
1 unit, Aut, Win, Spr (Staff)

82. Jazz Dance II—Beginning-intermediate level emphasizing control, rhythmic coordina-
tion, and the learning of movement combinations. Prerequisite: 72 or equivalent.
1 unit, Aut, Win, Spr (Staff)

83. Jazz Dance III—Intermediate jazz technique. Prerequisite: Consent of instructor.
1 unit, Aut, Win, Spr (Osumare)

85. African-Caribbean Roots of American Jazz Dance—The study of traditional African and
Caribbean Dance forms and their influence on contemporary American Jazz Dance. Drum-
mers and visual resources will support the introduction of traditional Afro-Caribbean Dance
styles.
1 unit, Aut (Osumare)

90. Character Dance—Introduction to the discipline of character dance, a technique which inte-
grates the study of ballet and ethnic dance. Appropriate for the intermediate dance student as an
enhancement for technical versatility and performance quality. Prerequisite: 70 or equivalent.
1 unit, Spr (Arkin)

91. International Folk Dance I—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. Focus on the participation in folk dance as an
enjoyable social activity.
1 unit, Aut, Win (Arkin)

92. International Folk Dance II—A continuation in the study of international folk dance at the
beginning-intermediate level. Films and video will be used on selected occasions to enhance understanding of folk dance forms.
1 unit, Spr (Arkin)

96. Social Dance—Introduction to selected social dance styles including swing, foxtrot,
waltz and cha-cha-cha.
1 unit, Aut, Spr (Arkin)

100. Individual Study—With consent of instructor, administrative internship or in-depth
study of topics directly related to the discipline of dance. (PE:X)
3-5 units, Aut, Win, Spr (Cashion)
by arrangement

156. Conditioning Techniques for Dance—Movement analysis and fitness techniques de-
dsigned for the particular needs of the dancer. Special attention to breath, alignment, endur-
ance and performance skills, as well as theory and practical applications of selected body ther-
apy techniques. Individualized according to ability and need. No dance training required.
(PE:X)
1 unit, Spr (Staff)

157. Introduction to Music for Dancers—Includes basic musical vocabulary, rhythm,
melody, harmony, phrasing, dynamics and notation. Experiences with voice, keyboard,
and percussion to accompany dance technique. (PE:X)
1 unit, Aut (Watson)

160. Labanotation—Introduction to the principles and tools for the analysis and recording of
movement based on the Laban system of nota-
tion. (PE:X)
2 units, Aut (Limpert)

161. Improvisation—Introduction to dance composition based on improvisation dealing
with a wide range of dance elements: rhythm, spatial design and shape, movement qualities,
words, music, etc. (PE:X)
1 unit, Aut, Spr (Staff)

162. Dance Composition—Development of the craft of choreography, emphasizing con-
cepts of design, form and content. (PE:X)
2 units, Win (Cashion)

164. Advanced Contemporary Dance I—Development of technical versatility and disci-
plines for strong control and expressive use of movement. Progressive study of projection and
the dynamic image in form and function.
1 unit, Aut (Weiss)

165. Advanced Contemporary Dance II—Manipulation of movement influences and atti-
tudes in contemporary techniques. Prerequisite: 164 or equivalent.
1 unit, Win (Weiss)

166. Advanced Contemporary Dance III—Identification of artistic trends in contemporary
dance. Comparative studies in stylization and technical concepts for performance. Prerequisite: 164 or 165 or equivalent.

1 unit, Spr (Weiss)

167. Variations for Dancers I—A class dedicated to the integration of sound and motion, to relating vitality and temperament to movement and music. Technical efficiency required in order to focus on musical form. (PE:X)

1 unit, Aut (Weiss)


1 unit, Spr (Weiss)

175. Mexican Dance and Folklore I—Introduction to three forms of Mexican Dance: regional, popular/social and religious. Taught for technical and cultural understanding. Designed for the novice dancer. (PE:X)

2 units, Aut (Cashion)

176. Mexican Dance and Folklore II—Emphasis on two to three selected regional dance styles. Taught within the framework of their cultural context. Concentration on increasing skill in footwork. (PE:X)

2 units, Win (Cashion)

177. Mexican Dance and Folklore III—Materials selected from the diverse repertoire of Mexican dance. Emphasis given to origin, development and styling. Performance opportunities available. Consent of instructor. (PE:X)

2 units, Spr (Cashion)

178. Mexican Dance Performance—Regional dance material of Mexico taught and rehearsed for rhythmic, stylistic and technical proficiency. Performances both on and off campus will be planned and executed by the students. Prerequisites: Mexican Dance and Folklore Series or consent of instructor.

1 unit, Aut, Win, Spr (Cashion)

193. Stanford International Folk Dance Ensemble—Training in stylistic versatility and mastery of traditional folk dance forms. Advanced folk dances taught in rehearsal-like format to prepare for performances. Several performances each quarter.

1 unit, Aut, Win, Spr (Codman)

200. Individual Study—With consent of instructor, administrative internship or continued in-depth study of specific topics related to the disciplines of dance.

3-5 units, Aut, Win, Spr (Cashion)

by arrangement

257. Dance/Music Repertoire—A class concerned with the selection process of music for dance. Presentation of resources for choreographic concepts. (PE:X)

1 unit, Win (Weiss)

262. Performance Workshop: Public Performance—A workshop designed to explore and develop performance skills. Includes public performance in faculty and/or student-directed productions.

1 unit, by arrangement (Staff)

263. Musical Theatre Workshop—Dance performance skills and choreography appropriate for musical theatre productions. Extensive dance background not required. (PE:X)

2 units, Win (Cashion)

264. Faculty Choreography—Rehearsal and performance of faculty choreography. Selection by audition.

1 unit, by arrangement (Staff)

266. Dance Exploration for Educators—Examination of the role of dance in education with emphasis on elementary and secondary school levels. Explores the relationship of dance to the arts as well as other academic subjects. Weekly theory discussions and technique sessions; lab sessions with elementary school children. (PE:X)

3 units, Aut (Valenzuela)

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—(Same as Education 218.) An examination of dance in Western Culture from a variety of perspectives: historical, philosophical, ethnographic, dance in education, contemporary problems and current trends. Lectures amplified by readings, films and discussion. (PE:X)

3 units, Win (Staff)

363. Dance Production Management—Analytical and practical experience in producing Dance Division dance events under the supervision of the faculty coordinator. Focus will be on the areas of finances, publicity, booking, technical production, and artistic direction of 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 (Cashion)

368. Dance Research—Tools and methods for dance research. Seminar sessions focus on selec-
tion and development of research topics. Research paper required. (PE:X)

3 units, Win (Cashion)

PHYSICAL EDUCATION AND SPORTS THEORY

All courses listed below are exempt from the “12-unit” policy.

100. Individual Study—With consent of instructor, administrative internship or in-depth study of topics directly related to the discipline of physical education. (PE:X)
3-5 units, Aut, Win, Spr (Strathairn) by arrangement

104. Analysis of Human Movement—Overview of skeletal and muscular anatomy and study of the mechanical principles of movement as related to efficient performance in aquatics, dance and sports. (PE:X)
3 units, Aut, Spr (Weeks) TTh 9-10:50

110. Classical Athletics—(Same as Classics 14.) A study of the origins and the history of competitive sport in the ancient world, from the funeral games for Patroclus (Homer) to the chariot races in the Hippodrome of Constantinople, based on the literary and monumental evidence. Attention will be paid to the spirit of competition apart from athletics. Lectures (illustrated) and discussion groups. (PE:X) (DR:5)
3 units, Spr (Raubitschek) given 1987-88

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. Prerequisite: Consent of instructor and course in Human Anatomy or Analysis of Human Movement. (PE:X)
3 units, Win (Scott) TTh 9-10:50

200. Individual Study—With consent of instructor, administrative internship or continued in-depth study of specific topics related to the discipline of physical education. (PE:X)
3-5 units, Aut, Win, Spr (Strathairn) by arrangement

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 to enhance enjoyment of these sports and to prevent injury. Prerequisite: Biology or basic physiology highly recommended.
2 units, Aut (Spivack) W 3:15-5

LEADERSHIP OPPORTUNITIES IN PHYSICAL EDUCATION

81. Student Assistant—Includes 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 student in a given sport seeking experience in teaching/coaching. Work under close guidance of experienced teacher/coach. Includes lesson plans; organization and evaluation of practice; teaching; skill demonstrations; paper relevant to sport. Prerequisite: Consent of instructor. (PE:X)
2 units, Aut, Win, Spr (Staff)
by arrangement

AQUATIC ACTIVITY AND THEORY

Only courses with PE:X notation are exempt from the 12-unit activity class limitation policy.

48. Swimming: Beginning—For non-swimmers or those who are so novice as to have self doubts. Includes instruction in the basic strokes and personal safety skills. Minimum goal — drown-proofing; optimal goal — enjoy swimming as a recreational activity.
1 unit, Aut, Spr (Weeks)

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 Life-saving Certificate upon successful completion of the course. Prerequisite: Strong crawl, breaststroke, sidestroke; tread water and floats 3-5 minutes; surface dives; 500 yard continuous swim.
2 units, Aut, Win, Spr (Williams, Weeks, Staff)

55. Sailing: Beginning—Basic skills, theory, and techniques to enable beginners to sail with confidence. Fee.
1 unit, Spr (Petrucci)
55A. Sailing: Intermediate—Refinement of skills. Introduction to racing. Fee. Prerequisite: Consent of instructor.
1 unit, Spr (Petrucci)

56. Windsurfing—Theory and techniques of windsurfing safely and confidently. Fee.
1 unit, Spr (Petrucci)

1 unit, Aut, Win, Spr (Kenney, Williams, 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 Advanced Lifesaving certificate and advanced swimming skills. Priority given to those whose summer jobs depend upon certification. Letter indicating same required at first class meeting.
(PE:X)
3 units, Spr (Weeks, Williams)

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 and watch. Prerequisites: SCUBA certification, medical clearance and consent of instructor. (PE:X)
1-3 units, Aut (Williams)

INDIVIDUAL AND TEAM SPORT ACTIVITIES

All classes listed below are subject to the 12-unit limitation policy.

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)

15. Gymnastics: Beginning—Fundamental gymnastics movement including various flexibility and strength exercises taught on mats and on the Olympic apparatus for men and for women.
1 unit, Aut, Win, Spr (Hamada)

20. Equitation: Beginning—No background or very little. Includes walk, trot, canter.
1 unit, Aut, Win, Spr (Saxe, Staff)

20A. Equitation: Advanced Beginner—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: Promoted from 22 or the equivalent or ability to score in the 60's for nine holes on a regulation length course.
   1 unit, Aut, Win, Spr (Diaz, Schaaf)

   1 unit, Aut, Win, Spr (Schoof)

   1 unit, Aut, Win, Spr (Posthumus)

   1 unit, Aut, Win, Spr (Hurst)

32. Tennis: Beginning—Covers fundamental strokes (forehead, 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 the intercollegiate sport of 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 the game of soccer. Includes skills of passing, shooting, control, dribbling as well as general offensive and defensive tactics and rules.
   1 unit, Aut, Win, Spr (Horpel)

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—Class is designed around Olympic style lifting (cleans, jerks, snatches, high pulls) and power lifts. Prerequisite: Intermediate/advanced weight training or equivalent. 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 for women.
   1 unit, Aut, Win, Spr (Sardina)

120. Equitation: Advanced—Has developed good control over horse. Includes doing more advanced movements and jumping more demanding courses.
   1 unit, Aut, Win, Spr (Saxe, Staff)

121. Equitation: (Special Class)—Includes different area of interest each quarter, such as quadrille (drill team), introduction to dressage, advanced jumping, equine practicum (care and feeding, injuries, immunization), vaulting. See Time Schedule for topic.
   1 unit, Aut, Win, Spr (Saxe, Staff)

128. Badminton: Intermediate/Advanced—Review of all fundamental strokes with an emphasis on refinement of all strokes. Concentration on developing high level of ability and on strategic skills practiced in a competitive atmosphere. Fee.
   1 unit, Aut, Win, Spr (Diaz, Schaaf)

129. Badminton: Intermediate/Advanced—Review of all fundamental strokes with an emphasis on refinement of all strokes. Concentration on developing high level of ability and on strategic skills practiced in a competitive atmosphere. Fee.
   1 unit, Aut, Win, Spr (Diaz, Schaaf)

131. Fencing: Advanced—Emphasis on the techniques of attack and defense. Introduction to combat tactics. Fee. Prerequisite: Promoted from 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: Promoted from 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. 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 (Koch)

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. Assists player and coaches by collecting data on player performance. Background in computers and statistics helpful but not necessary. Prerequisite: Excellent knowledge of tennis highly recommended, consent of instructor.
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, Pac West and other conference competitive schedules 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 unit, Aut, Win, Spr (Hamada, Sardina)
MTWThF 2:30-5:30 (men)
M-F 2-6 (women)

117V. Track and Field: Varsity (men's and women's teams).
1 unit, Aut, Win (Johnson, Staff)
MTWThF 3
Spr (Johnson, Staff) MTWThF 2

118V. Cross Country: Varsity (men's and women's teams).
1 unit, Aut (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 unit, Aut, Win (Hurst, Posthumus)
MTWThF 3:30-5:30 and T 7-10 p.m.
Spr MW 3:15 (Hurst, Posthumus) and T 7:30-10 p.m.

133V. Tennis: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Gould, Brennan)
MTWThF 2:30-5:30 (men)
1:30-5:30 (women)

134V. Wrestling: Varsity.
1 unit, Aut, Win (Horpel) MTWThF 3:15-5:30
Spr MTWThF 4:15

135V. Baseball: Varsity.
1 unit, Aut (Marquess, Stotz) MTWThF 2-5
Win, Spr, MTWThF 1:30-5:30

136V. Basketball: Varsity.
1 unit, Aut, Win (Montgomery, Staff) men's team MTWThF 3:30-6
(VanDerveer, Staff) women's team MTWThF, Aut 6-8:30 p.m.,
Win 1:30-3:30

137J. Field Hockey: Junior Varsity (women's team).
1 unit, Aut (Johnson) MTWThF 2:15
Spr MTWThF 2-5

137V. Field Hockey: Varsity (women's team).
1 unit, Aut (Johnson) MTWThF 3-5:15
Spr MTWTh 3-5

138V. Football: Varsity.
1 unit, Aut (Elway, Staff) MTWThF 2:30-5
and Spr, TTh 1:30-5, 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 unit, (Koch) men's team
Aut, MTWThF 3:15-3:45
Win, TTh 6-8:15 and Su 8-10 p.m.;
Spr 3:30-5:30
1 unit, (Keohane) women’s team
Aut, MTWThF 3:15-5:15
Win, Spr, MTWTh 3:15-5:15

14IV. Volleyball: Varsity (men’s and women’s teams).

1 unit (Sturm) men’s team
Aut, MTWThF 1-3:30
Win, Spr, MTWThF 6:30-8:30

1 unit (Sturm) women’s team
Aut, MTWThF 6:30-8:30
Win, Spr, MTWThF 6-9 p.m.

149V. Swimming: Varsity (men’s and women’s teams).

1 unit, Aut, Win, Spr (Kenney, Haines)
MTWThF 2:30-5

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 MWF 3-5

155V. Sailing: Varsity (men’s and women’s teams).

1 unit, Aut, Win, Spr (Petrucci)
TWFh 2:30-6

156V. Crew: Varsity (men’s and women’s teams).

1 unit, Aut, Win, Spr (Dreyfuss, J. Davis)

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

12C. Tai Chi Chuan.
1 unit, Aut, Win, Spr MTWTh 4-5 and by arrangement

112C. Capoeira Club.
1 unit, Aut, Win, Spr MWF 12-1

113C. Judo.
1 unit, Aut, Win, Spr MWF 1-2:30

114C. Ultimate Frisbee Team.
1 unit, Aut, Win, Spr MWF 3:30-5

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

147C. Synchronized Swimming Club Team.
1 unit, Aut, Win

Additional clubs (Badminton, Bowling, Cricket, Horse Polo, Men’s Field Hockey, Racquetball, Squash, Tae Kwon Do, and Women’s Water Polo) schedule activities each quarter for no credit.

BIOLOGICAL SCIENCES


Chairman: Philip C. Hanawalt
Associate Chairman: Allan M. Campbell


By Courtesy: Joseph A. Berry, Olle E. Bjorkman, David C. Fork, Frank E. Stockdale, Richard F. Thompson, Irving L. Weissman
OFFERINGS AND FACILITIES

The Department of Biological Sciences comprises 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 Hall, T-333) 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.

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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</thead>
<tbody>
<tr>
<td>Biology 31</td>
<td>5</td>
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<tr>
<td>Biology 32</td>
<td>5</td>
</tr>
<tr>
<td>Biology 33</td>
<td>3</td>
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<tr>
<td>Biology 44X</td>
<td>3</td>
</tr>
<tr>
<td>Biology 44H/Y (may be replaced with 155H or 175H)</td>
<td>3</td>
</tr>
</tbody>
</table>

Total: 21 units

2. Elective Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electives</td>
<td>18</td>
</tr>
</tbody>
</table>

Total Core and Electives: 39 units

3. Cognate Courses

Required courses in cognate fields include:

a) Introductory, organic, and physical chemistry:
   - with laboratory: Chemistry 31, 33, 35, 36, 131, 130 or 132, 135
b) General Physics: Physics 21, 22, 23, 24; or 51, 53, 55

c) Mathematics through Calculus: Mathematics 19, 20, 21; or 41, 42

d) One additional course in Mathematics, Statistics, or Computer Science: Mathematics 44 or beyond; Biology 141, or Psychology 60, or Statistics 60 or beyond; or Computer Science 101, 105A, 105B, or 106

Elective courses may be 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 and also appears in the "Bachelor of Science Handbook." 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 courses at Hopkins Marine Station during Spring (155H or 175H) Quarter, or going overseas, fulfillment of as many university distribution requirements as possible in the first two years is highly recommended. Note that 155H or 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>A</th>
<th>W</th>
<th>Sp</th>
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<tbody>
<tr>
<td>Chem. 31, 33, 35, 36</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Math 19, 20, 21, Calculus and Analytic Geometry</td>
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<td>4</td>
<td>7</td>
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SECOND YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>A</th>
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<tbody>
<tr>
<td>Biology 31. Principles of Biology</td>
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<tr>
<td>Biology 32. Principles of Biology</td>
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<tr>
<td>Biology 33. Principles of Biology</td>
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<tr>
<td>Biology 44. Core Experimental Laboratory</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Chem. 131; 130 or 132; 135. Organic &amp; Physical Chemistry</td>
<td>8</td>
<td>3</td>
<td>—</td>
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<tr>
<td>Writing &amp; Distribution Requirements or Electives</td>
<td>3</td>
<td>5</td>
<td>8</td>
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THIRD YEAR

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<tr>
<th>Course No.</th>
<th>A</th>
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<tbody>
<tr>
<td>Physics 21, 22, 23, 24 Introductory Physics</td>
<td>4</td>
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<tr>
<td>Distribution Requirements or Electives</td>
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FOURTH YEAR

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<tr>
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<tbody>
<tr>
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<tbody>
<tr>
<td>Chem. 31, 33, 35, 36</td>
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SECOND YEAR

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DEPARTMENTAL HONORS

In order to graduate with Departmental Honors a student must: (1) complete at least 10 units of a suitable 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; 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 T-333.

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 Hall T-333 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 student's Stanford transcript.

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, Old Union 306).

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 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 residence equivalent) of registration during which at least 45 units of credit are earned. At least 33 of the 45 units must be completed in biological sciences or approved biology-equivalent courses (minimum 24 of the 33 units) or cognate area courses (maximum 9 units in chemistry, physics, mathematics, computer science and/or statistics courses beyond the level required for the B.S. degree). In addition, of these 33 units, a minimum of three courses of at least three units each must be taken from the Department of Biological Sciences. No financial support derived from Stanford University funds is available for either tuition or living expenses associated with the master's program. Some M.S. students, however, do locate teaching assistantships or research assistantships on their own. Appropriate application materials for the program can be obtained from the Graduate Admissions Office. A more detailed description of the master's degree program may be obtained from the Student Services Office of the department.

DOCTOR OF PHILOSOPHY

Preparation for Graduate Study—Students seeking entrance to graduate study in biology ordinarily will 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 for graduate work in the Biological Sciences. Such students will be advised at the time of initial registration as to how they should complete their background training during the first year of graduate study. In addition to the usual basic undergraduate courses in biology, it is recommended that preparation for graduate work include courses in chemistry through organic chemistry, general physics and mathematics through calculus. Reading knowledge of a foreign language is recommended.

Application, Admission, and Financial Aid—Prospective graduate students should apply formally through the Graduate Admissions Office which 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 aptitude tests and the advanced biology test of the Graduate Record Examination as part of the application. It is strongly recommended that the GRE be taken in October so that scores will be available when applications are evaluated.

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. For this reason it seems prudent...
to advise only well-qualified students to apply for admission.

All admitted students are normally offered financial support in the form of Biology Fellowships or Graduate Research Assistantships. Such awards are for one year and are renewable as funds permit, assuming continuing excellent performance. It is current policy not to offer financial support from University-derived funds beyond the fourth year of graduate study. Qualified applicants are urged to take the initiative in applying for predoctoral national fellowships in open competition, especially those from the National Science Foundation, and to consult their Financial Aid Officers for information and applications.

Students who have had their undergraduate training in biology at Stanford are ordinarily encouraged to undertake graduate study elsewhere to ensure breadth of experience. Some printed information on graduate school is available in the Student Services Office (Herrin T-333) while a more extensive collection is printed information on graduate school is available at the Undergraduate Advising Center at the Old Union, Room 306.

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 work as a graduate under each of four or more Stanford faculty members. Course work to be taken will be determined in consultation with an advising committee. All first year graduate students in the Ph.D. program are required to complete 1-3 units of 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**

are 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.

**The Biology Seminar**

meets on most Monday afternoons at 4:15. Topics of current biological interest are presented by speakers from Stanford and from other institutions, and are announced in the weekly Campus Report. Graduate students are expected to attend.

**The 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 Winter Quarter of the third 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.

**Language Requirement**

A reading knowledge of a modern scientific language (ordinarily French or German) is recommended at the time of entry. If an entering student is deficient, the advising committee and the student should carefully weigh the value of language study vs. other needs, and decide whether further study of a foreign language should be undertaken.

**Residency Requirement**

A minimum of three years (nine quarters) of full-time graduate registration is required of each candidate. The department normally accepts only full-time students for study leading to the Ph.D. However, it recognizes that because of family and child-bearing responsibilities, military or alternative service obligations, or other personal reasons, students may wish at various times to interrupt
their graduate education or to pursue their studies on a half-time basis. The department is willing to undertake such arrangements, which can include partial stipends if the student is being supported from departmental funds.

Dissertation—A contribution to knowledge which is the result of independent work, expressed in satisfactory form. Abstracts of Ph.D. theses are published in Dissertation Abstracts.

The Oral Examination—This consists of a formal seminar open to the public, followed by a closed session of questioning. This examination is taken after the dissertation is completed in draft form and approved by all members of the Reading Committee. More information on oral examination procedures is available at the Student Services office.

COURSES

Additional courses not listed here are frequently offered in the areas of their special research competence by selected postdoctoral or terminal Ph.D. personnel. These are listed in the quarterly time schedules, and course descriptions are circulated prior to registration.

INTRODUCTORY

31, 32, 33. Principles of Biology—A comprehensive study of the principles of modern biological science. These courses 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 course dealing with the biochemical and structural basis of cell function, emphasizing macromolecules, including proteins, lipids, carbohydrates and nucleic acids, and how their structure relates both to function and to higher order assembly. Topics include 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, Jones, Simoni, Scheller, Staff) 10 plus optional discussion sections

32. Developmental and Organismal Biology—Core lecture course covering development, physiology, and organistial biology. Topics include 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 specializations which utilize these principles in adapting organisms to different environments. A major theme will be the mechanisms by which the functions of each system are controlled and regulated. Prerequisites: See above.

5 units, Win (Sapolsky, Goodman, Scheller, Walbot) MTWThF 10 plus optional discussion sections

33. Evolutionary Biology and Ecology—Core lecture course covering biological diversity, evolution, and ecology. Topics include 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, Baker, Holm, Watt) MTWThF 10 plus optional discussion sections

44. Core Experimental Laboratory—Two-quarter course of laboratory projects which give students a working familiarity with the concepts, organisms and techniques of modern biological research. Emphasis is on experimental design by the student and critical analysis of data. Taken concurrently with or subsequent to 31, 32, and 33. 44X and Y should be taken in sequence. Prerequisites: Chemistry 31 and 33. Grading is mandatory Pass/No Credit.

44H. Honors sections for students prepared to take on more challenging work. Limited enrollment.

3 units, Win, Spr (Snapp) labs T or W 1:15-5:05; discussion sections by arrangement

44X. 3 units, Win (Boggs, Snapp, Watt) labs T, W, Th, or F 1:15-5:05 discussion sections by arrangement

44Y. 3 units, Spr (Boggs, Snapp, Watt) labs T, W, Th, or F 1:15-5:05 discussion sections by arrangement

45. Research Biology—Designed to allow students who have taken Biology 44X and 44Y to pursue specific experiments in greater detail.
50. Biology and the Oceans—Not a survey course, but an introduction to selected topics felt to be exciting by the faculty of Hopkins Marine Station and visiting lecturers. These include aspects of ecology, coastal oceanography, neurobiology, biomechanics, behavior, cell biology, developmental biology, and organismal diversity. Weekend field trips to Hopkins Marine Station provide students “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. (DR:7)

4 units, Win (Baxter, Denny, Epel, Gilly, Mazia, Roughgarden, Thompson, and visiting lecturers) TTh lecture
Three weekend field trips (accommodations provided at Hopkins Marine Station) alternate years, given 1987-88

51. Scientific Philosophy and Bioethics—The philosophy of science analyzed from various perspectives (e.g., philosophy, science, politics, society), and treated from historical as well as contemporary considerations. Emphasis toward 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

UPPER DIVISION

Prerequisites: The upper-division course descriptions refer to prerequisite courses from the core sequence by their old numbers. For students who took the core courses prior to 1980-81, the following equivalencies pertain: 40 equivalent to former 1 and 23; 41 was equivalent to the former 21; 42 is the newer course; 43 was equivalent to the former 22; and 44 XY was the equivalent of the former 24 YZ. 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.

101. 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. The objective is to present the pursuit of biological research as a human activity. Does not qualify toward biology elective units for biology majors. (DR:7)

3 units, Win (Vitousek, Staff) TTh 11

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. Primary focus on local coastal communities. Provides a background in the natural history of marine systems as well as the issues confronted by marine research. Prerequisites: 33 or 40 or equivalent.

3 units, Win (Baxter) MT 3:15-4:30

105. Biological Circadian Rhythms—Biological clocks that sense daily cycles is analyzed in a variety of organisms. Physiological, genetic and biochemical approaches to localizing understanding mechanisms of both the oscillator and its blue light photoreceptor. Learning how organisms track time is the object. Prerequisites: Biology or Human Biology core.

3 units, Spr (Woodward) TTh 11

105H. Subtidal Communities—Lectures, laboratory, and field trips treating shallow water marine communities. Emphasis will be on local habitats and the course will introduce physical environmental parameters, community composition, aspects of the biology of constituent species and methods for subtidal studies. Prerequisites: SCUBA certification, SCUBA equipment, ocean diving experience, and some background in biology. Course is taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Staff)

106. Ecology—An examination of biological interactions at higher levels of organization. Topics include the physiological ecology of individual organisms, population biology and the evolution of life histories, community ecology, and ecosystem structure and function. Lectures and discussion/laboratory. Prerequisite: Biology or Human Biology core, or permission of instructor.

3 units, Aut (Vitousek) MWF 10

107. Cell Development and Morphogenesis—A study of those theories which account for the progression of the cell through its cycle and for the progression of the embryo through its development. The still unsolved problems of the origin of form and pattern are addressed from a biophysical perspective. Prerequisites: 31, 32, or 41, 42, or equivalent. An interest in college physics and/or mathematics is helpful.

3 units, Win (Green) MWF 2:15

108. Organismal Development—A study of those processes responsible for development of multicellular organisms. Morphogenesis, cytodifferentiation, growth control, and regulatory
phenomena will be discussed. Prerequisite: Biology or Human Biology core.

3 units, Spr (Porzig, Wessells) MWF 9

110. Vertebrate Biology—Structure, function, behavior, and evolution of vertebrates. Prerequisites: Biology or Human Biology core.

4 units, Aut (Wessells) TTh 9-11

110L. Vertebrate Biology Laboratory — Dissection of selected vertebrates. Pass/No Credit only. Prerequisites: Same as for 110.

3 units, Aut (Porzig, Wessells)

T or W or Th 1:15-5:05 or W 7-11 p.m.

112. Human Physiology—(Same as Human Biology 111.) The functioning of organ systems with emphasis on mechanisms of control and regulation. Topics include 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. Limited to 120.

4 units, Win (Heller, Staff) MWF 9

113H. Introduction to Oceanic Biology—Introduction to the ocean as an environment; to its major categories of inhabitants, producer and consumer, benthic and pelagic, invertebrate and vertebrate; and to the functioning of the oceanic ecosystem. Prerequisite: Introductory biology or general zoology. Course taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Staff)

115. Evolutionary Ecology—(Same as Human Biology 102.) Covers the fundamental concepts of evolutionary ecology, including population growth equations, foraging, reproductive and life history strategies, predator/prey, and competitive and mutualistic interactions among species. Prerequisites: Human Biology Core, or Biology 3 or 40, or equivalent; Calculus 20, or 41, or equivalent; or consent of instructor.

4 units, Aut (Boggs) MWF 1:15

plus discussion

120. General Botany—The diversity of plant groups is considered, plus a brief 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 or W 2:15-5:05 discussion Th or F 2:15-3:05

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

field trips by arrangement

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

field trips by arrangement

alternate years, given 1987-88

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 ecological significance and utilization in studying cell and developmental biological problems. Lectures, laboratories, and field trips. Prerequisite: 33, or 40, or equivalent.

4 units, Win (Fultz, Grossman) MWF 1:15, lab T 2:15-5:05; not given 1986-87

131. Mosses and Ferns—Structure, development, evolutionary relationships of mosses and ferns. Lectures, laboratories, and field trips. Prerequisite: 32, 33; or 40, 43; or consent of instructor.

5 units, Aut (J. Thomas) WF 2:15-5:05,

132. Seed Plants—Structure, development, evolutionary relationships of seed plants. Lectures, laboratories, and 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, given 1987-88

133. Plants and Civilization—Discussion of the economic uses of plants and plant substances. Food, fiber, medicinal, and structural uses will be considered from a biological and ecological point of view. Lectures and demonstrations. Prerequisites: Biology or Human Biology core, or consent of instructor.

4 units, Win (Holm, J. Thomas) MWF 11

demonstrations W 2-4, Th 10-12, or 2-4

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, Aut (Hanawalt) TTh 4:15-5:30

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

136H. Cell Biology of Early Development—Five-week workshop centers on cellular phenomena seen during early embryonic development, such as 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 their microscopy, micro-manipulation and chemistry. Post-graduate level course but advanced undergraduates considered. Taught at Hopkins Marine Station. Apply to Hopkins.

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

151. Plant-Microbe Interactions—A study emphasizing genetics and biochemistry of important microbial interactions with plants. Includes the basics of plant pathology. Critically examines unifying theories such as the gene-for-gene hypothesis and discusses experimental methods being used in molecular studies of pathogenicity and resistance. The Agrobacterium-Rhizobium group of pathogens and symbionts are studied in detail, especially the use of genetics and molecular techniques to analyze plant-bacterial interactions.

1-3 units, Spr (Long) TTh 11, plus F discussion section

153. Introduction to the Nervous System—(Same as Psychology 107.) A survey of neural mechanisms and interactions underlying behavior. Recommended: Psychology 107 or Biology 32 or 43 or Human Biology 4A.

4 units, Aut (Donegan) TTh 1:15-2:30 alternate years, not given 1987-88

154. Cellular and Molecular Neurobiology—A study of the function of the nervous system at the cellular and molecular level. Discussion of membrane biophysics, synaptic transmission, biochemistry and molecular genetics of neuronal function, and their relationship to behavior and learning. Prerequisites: 32 or 42 and 153 (Same as Psychology 107), or consent of instructor.

4 units, Win (Scheller) MWF 10 plus required discussion section by arrangement, alternate years, given 1987-88

155. Developmental Neurobiology—(Formerly 109.) A study of the development of the nervous system at the cellular and molecular level. Discussion of axon guidance and cell migration, neuronal determination and lineage, and synaptogenesis and selective pruning. Prerequisites: 32 or 42; and 153 (same as Psychology 107), or consent of instructor.

4 units, Win (Goodman) MWF 10 not given 1986-87
1. Experimental Methods in Neurobiology—An intensive laboratory and lecture course with projects emphasizing microelectrode techniques, extracellular recording, intracellular microinjection, and morphological methods for the study of single neurons. Lectures on membrane biophysics, neuroregulation, synaptic mechanisms and experimental techniques. Prerequisites: 153 and either 154 or 155, or consent of instructor. Course taught at Hopkins Marine Station. Apply to Hopkins. 15 units, Spr (S. Thompson)

2. Plant Physiology—Principal functions of green plants, including photosynthesis, gas exchange, water and nutrient transport, mineral metabolism, growth, hormonal regulation, and environmental responses. Introduces and emphasizes quantitative aspects of these functions. Prerequisites: 31, 32; or 41, 42, 43; or equivalent, and introductory organic chemistry or biochemistry. 4 units, Win (Ray) lecture MWF 10; discussion TTh 10

3. Problems in Behavioral Biology—Group and individual studies on local marine organisms and communities in nature, tanks and simulated habitats. Analysis by observation and manipulation, and facilitated by the aquarium and video capabilities of the Monterey Bay Aquarium. 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)

4. Problems in Subtidal Ecology—Studies focus on some selected research area in our local kelp forest. Topics will vary each summer and be 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 the first session of 105H, Subtidal Communities, but equivalent training and background will be considered. Intended for students seriously interested in designing and carrying out research studies in the SCUBA zone. Results will be prepared as a scientific paper and presented at a course symposium. Taught at Hopkins Marine Station. Apply to Hopkins. 6 units, Sum (Staff)

5. 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, not given 1987-88

6. Animal Behavior: Neurobiological Aspects—(Same as Psychology 147.) Ethological studies of behavior with an emphasis on understanding physiological substrates of simple behavior. Prerequisites: 32 or 43 or Human Biology 3A or Biology 153/Psychology 107, or consent of instructor. 4 units, Aut (Wine) TTh 1:15-2:30 given 1988-89

7. Animal Behavior: Ecological and Evolutionary Aspects—A comparative survey of principles and patterns of animal behavior stressing their evolution and adaptive significance. Emphasis will be placed on vertebrates. Lecture and discussion. Prerequisite: 33, or 40, or Human Biology 2A. (DR:7). 3 units, Aut (Heller) MWF 11 alternate years, not given 1987-88

8. Genetics (Eukaryotes)—The principles of genetics as developed in and applied to studies of eukaryotic organisms. Emphasis on the transmission of genetic factors. Prerequisite: 40 or consent of instructor. 3 units, Win (Woodward) MWF 11

9. Genetics (Prokaryotes)—Continuation of 106 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: 106. 3 units, Spr (Campbell) MWF 11

10. Vegetation and Fire—An examination of the past and present role of fire in the evolution and maintenance of vegetation types, with particular reference to the diverse California flora. Prerequisite: Consent of instructor. 3 units, Aut (J. Thomas) Th 2:15-4:05; field trips by arrangement, not given 1986-87

11. Microscopy for Biologists—A broad survey of the methods which use light and other radiation (electrons, X-rays) for the analysis of cells in biological and medical research. Topics range from cell sorters and holography through polarized light and electron microscopy. Lectures cover the physical principles. The laboratory involves partial assembly and extensive use of pertinent instruments. Campus laboratories developing advanced optical techniques for biology, will be visited. Prerequisites: 31, 32, or 41, 42, 43; and 44XY. 3 units, Aut (Green) TTh 1:15; lab T or Th 2:15-5:05

12. Techniques in Electron Microscopy—Practical training in the use of the transmission
and scanning microscopes. Course covers specimen preparation, microscope operation, photography, and interpretation. Prerequisite: General theory as in 170.

3 units, Win (F. Thomas) by arrangement

172. Advanced Molecular Biology Laboratory—An intensive course covering the isolation, characterization, and cloning of eukaryotic DNAs using bacterial and yeast hosts. Students practice a variety of techniques in the first part of the quarter, then apply these techniques to individual projects in the second part. The goal is to design and carry out research in molecular biology. Prerequisites: Biology core and consent of instructor.

8 units, Aut (Berlani) MWF; lecture 10-11; lab 12:30-5:05 plus other hours by arrangement, not given 1986-87

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. Students spend the Spring Quarter in residence at the Marine Station, Pacific Grove. For further description see Hopkins Marine Station Bulletin. Prerequisites: Junior or senior standing in biology and permission of instructors.

15 units, Spr (Gilly, Baxter, Denny)

178. Biology of Natural Populations—Introduction to independent study of natural populations. Jasper Ridge serves as an outdoor laboratory for course. Prerequisite: Consent of instructor.

4 units, Spr (Mooney) by arrangement

180. Conservation Biology—(Same as Human Biology 119.) An introductory course on conservation biology and its application to conservation practice and policy. Covers biological theory relevant to natural area protection and sustainable development. Yosemite National Park serves as a case study. Prerequisites: 33, or 40 or equivalent and permission of instructor.

2 units, Spr (Wilcox) TTh 10 plus field trips

182. Empirical Population Genetics—The results of experimental field and human population genetics studies will be discussed. Relationship to theory introduced.

3 units, Aut (Feldman) TTh 9-10:30 alternate years, given 1987-88

183. Colloquium on Population Studies—(Same as Human Biology 60, Food Research 188/288.) 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 will be considered, as well as more specialized topics intended to illustrate or emphasize unusual features of insects which make them attractive as objects of research. Lab sometimes meets for the full time as a lab or field exercise, and at other times only for the first hour as a lecture-discussion. Prerequisites: Biology core lecture series, or consent of instructor.

Spr (Watt) MWF 11 lab T 1:15-5:05, alternate years, given 1987-88

185. Coevolution—Evolutionary interactions among different kinds of organisms—plants and herbivores, models and mimics, predators and prey, parasites and hosts, etc. 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 1987-88

186. Advanced Topics in Geographical Ecology—Will deal in depth with the biogeography and ecology of specific regions or special habitats. The subject matter will vary from year to year and the course may be repeated for credit. Prerequisite: 33, or 40, or Human Biology 2A and consent of instructor.

3 units, Spr (Ehrlich, Holm) M 2:15-4:05 alternate years, not given 1987-88

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 not given 1986-87

188. Ecosystems of the Tropics—An examination of diverse tropical ecosystems ranging from lowland rainforest to savanna, from shifting cultivation to high-elevation ecosystems. Focus on production, nutrient cycling, and regulation of ecosystem structure and function; the specific content depends in part upon student participation in this seminar course.

1-3 units, Win (Vitousek) Th 2:15-4:05 alternate years, given 1987-88

189. Biology of Birds—Two sessions per week: a one-hour lecture and a three-hour lecture/field trip. Focus is on the ways birds interact with their environments and with each other; emphasis on studies that have 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. Prerequisites:
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site: 33, or 40, or equivalent and consent of instructor. Limited to 20 students.

3 units, Spr (Ehrlich) M 10, Th 8-11
alternate years, not given 1987-88

190. Population Biology of Butterflies—Lectures will focus on field studies of the dynamics and genetics of butterfly populations, life histories, and resource utilization. Also covered will be the evolution and taxonomy of this group of insects which has become a key research tool in population biology. Lab includes field work on Euphydryas populations now under study, both 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, Aut, Win, Spr (Ehrlich, Feldman, Holm, Mooney, J. Thomas, Vitousek) by arrangement

196A,B. Jasper Ridge 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

1990. Special Problems—Individual research or directed reading taken by arrangement with biology department instructors. Successful completion of a minimum of 10 units of “Special Problems” shall be applied toward graduation with Departmental Honors. Entry into the Honors Program requires submission of a petition to the Committee on Undergraduate Studies. Forms are available in the departmental 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, to be submitted in duplicate, will be deposited in the departmental Library and in the University Archives. See unit limitation under “Bachelor of Science Course Requirements.”

199H. Special Problems—Research done under supervision of Hopkins Marine Station faculty. See above for more information on 199 research work.

199X. Special Problems—To be used for out-of-department instructors. For Biology majors only. By petition only. Petition forms available at Student Services Office, Herrin Hall T-333.

GRADUATE

205. DNA Repair and Mutagenesis—(Same as 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: 41 and/or consent of instructor.

3 units, Spr (Hanawalt, Friedberg, K.C. Smith) alternate years, given 1987-88

208. Advanced Topics in Genetics—Deals in depth with topics of current interest. Subject matter will vary from year to 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—(Same as Biochemistry 210.) Structure, function, and biosynthesis of cellular membranes and organelles. The course is based on the current literature and is required extensive student participation. Prerequisites: Biochemistry 200-201 or equivalent experience in biochemistry and molecular biology, as well as consent of instructors.

4 units (Rothman, Simoni) TTh 10-12 not given 1986-87

213. Viruses—Principles of virus growth, genetics, architecture and assembly. Relation of temperate viruses and other episomes to the host cell. Prerequisite: 31 or 41.

3 units, Win (Campbell) MWF 9

215. Biochemical Evolution—Lectures and discussion periods covering biochemical viewpoints on diverse aspects of the evolutionary process. Topics will include, but not be limited to: prebiotic biochemistry and the origins of life; adaptive organization of metabolism; enzyme polymorphisms and other biochemical aspects of population genetics; “macromolecular phylogeny” and “protein clocks.” Prerequisites: 31,
32, 33; or 40, 41, 42, 43; or substantial equivalents.

3 units, Win (Watt) MWF 10

H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques—An advanced treatment of membrane 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. Course is taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Gilly, S. Thompson)

238. Advanced Plant Systematics—A study of selected families of flowering plants with particular attention to phylogenetic relationships. Prerequisite: Consent of instructor.

4 units, Aut, Win, Spr (Holm, J. Thomas) by arrangement

230. Topics in Immunology—Introduction to the basic elements of the immune system: structure and functions of antibody molecules; cellular basis for immunity and its regulation; genetics of immune responsiveness; molecular biology of antibody genes. For graduate students and advanced undergraduates. Prerequisites: Biology core or consent of instructor.

3 units (Gones) not given 1986-87

248. Regulatory Biochemistry in Higher Eukaryotes—A lecture and student discussion course on various aspects of the regulation of protein synthesis and degradation in higher organisms, with special emphasis on molecular mechanisms involved in developmental processes and actions of hormones. Prerequisites: 252 desirable but not necessary; Biochemistry 201 and 202.

4 units, Win (Schimke) TTh 11
plus 1 hour by arrangement

250. Molecular Biophysics—Physical biochemistry and physical approaches to biological problems at the molecular level. Lectures include discussion of macromolecular structure and intermolecular interactions, physical methods for characterizing proteins and nucleic acids, the interaction of electromagnetic radiation with biological molecules, isotopic tracer techniques, and classical physics of cellular processes. Open to qualified advanced students upon consent of instructor.

4 units, Aut (Hanawalt, Jardetzky, Staff) TTh 10 and Th 1:15-3:05
not given 1986-87

252. Gene Action—Lectures and student seminars on various aspects of gene structure and function and regulation of gene expression in microorganisms. Prerequisite: Biochemistry 201 and consent of instructor.

3 units, Spr (Yanofsky) TTh 9-10:30
alternate years, given 1987-88

263. Regulatory Physiology—Lectures, student presentations, and discussion. The course will be based largely on recent research literature and will stress mechanisms of control and regulation. The specific topics covered will change from year to year. Prerequisite: 32, or 43, or an equivalent course in animal physiology.

3 units, Win (Heller) not given 1986-87

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, not given 1987-88

286. Theoretical Ecology—Lectures on contemporary issues in theoretical population ecology, including the theory of coevolution, population dynamics in fluctuating environments, niche theory, and the theory of nonlinear oscillations in population models.

3 units, Aut (Roughgarden) TTh 1:15-3:05
alternate years, given 1987-88

286H. Theoretical Ecology—Focuses on the evolution of marine life histories, beginning with a review of terrestrial life history and the evidence relating to that theory. It examines phenomena that a marine life history theory should explain; and concludes by investigating 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)

290. Teaching of Biological Science—Practical experience in teaching laboratory biology or serving as a course assistant in a lecture course. Open to upper division and graduate students.

Aut, Win, Spr (Staff) by arrangement

300. Research.
(Staff) by arrangement

300H. Research—(Same as 300.) To be used for research done under supervision of Hopkins Marine Station faculty.

300X. Research—(Same as 300.) To be used for out-of-department instructors. By petition only.

301. Current Topics in Biology—Lectures in the areas of current research interests of the
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faculty. Enrollment is limited to Biology Ph.D. students in their first year of graduate study.
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. Seminar in Developmental and Molecular Neurobiology — Literature and research review of selected topics in cellular, molecular, and developmental neurobiology. Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Scheller) 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

335. Seminar in Immunobiology and Immunogenetics — Literature review of current topics in immunology. Prerequisite: Introductory immunology course and consent of instructor.
1-3 units, Aut, Win, Spr (Jones) not given 1986-87

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 (Baker, Campbell, Hanawalt, Long, Perkins, Simoni, Walbot, Woodward, Yanofsky) by arrangement

346. Seminar in Regulatory Biology — Literature review of elected topics in eukaryote regulatory biology. Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Schimke) T 12

DIVISION OF MARINE BIOLOGY
HOPKINS MARINE STATION

Emeriti: (Professors) Isabella A. Abbott, Lawrence R. Blinks, Arthur C. Giese, Daniel Mazia, John H. Phillips, Jr., Colin S. Pittendrigh
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 eleven acres, consisting of the main portion of Cabrillo Point, and including a sheltered landing place and storage for small boats. Buildings include the Lawrence Blinks Laboratory, the Alexander Agassiz Laboratory, the Jacques Loeb Laboratory, the Monterey Boat Works, which houses the C. B. vanNiel 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 ecology, and includes a provision for work in progress by seminar participants. Prerequisite: Consent of instructor.
1-3 units, Spr (Roughgarden) by arrangement

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

352. Seminar in Developmental Biology — Literature and research review of selected topics in development. Prerequisite: Consent of instructor.
1-3 units, Win, Spr (Green, Wessells) 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

355. Seminar in Population Genetics — Literature review and research discussion of current problems in the theory and practice of population genetics. Student participation required. Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Feldman) by arrangement

356. 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, Spr (Roughgarden) by arrangement

DIVISION OF MARINE BIOLOGY
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1-3 units, Spr (Roughgarden) by arrangement

349. Seminar in Population Ecology of Insects — Prerequisite: Consent of instructor.
1-3 units, Aut, Win, Spr (Ehrlich, Holm) by arrangement
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

155H. Experimental Methods in Neurobiology—An intensive laboratory and lecture course with projects emphasizing microelectrode techniques, extracellular recording, intracellular microinjection, and morphological methods for the study of single neurons. Lectures on membrane biophysics neuromodulation, synaptic mechanisms and experimental techniques. Students spend the entire quarter in residence at the Marine Station. Prerequisites: Biology 153 and either 154 or 155, or consent of instructor.

15 units, Spr (Thompson)

175H. Problems in Marine Biology—Lectures, laboratory work, field studies, and individual problems. The course is designed primarily to give advanced undergraduates an opportunity to engage in research. Students will spend the entire Spring Quarter in residence at the Marine Station, Pacific Grove. For further description see Hopkins Marine Station Bulletin. Prerequisites: junior or senior standing in biology and permission of instructors.

15 units, Spr (Gilly, Baxter, Denny) by arrangement

199H. Special Problems—Properly qualified undergraduate students may undertake individual work in the fields indicated under course 300H, listed below. Such studies are intended to give the serious student experience in biological research. Preference is given to Stanford students who have already completed Biology 155H or 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

SUMMER

The summer program is open to all advanced undergraduate, graduate, postdoctoral students and teachers whose biological background, teaching or research activities can benefit from a summer's study of marine life. Application blanks may be obtained by writing directly to the Academic Secretary, Hopkins Marine Station, Pacific Grove, CA 93950. Completed applications should be submitted by March 31. Applications received later are considered if space is still available in classes.

The Summer Quarter is divided into two terms of five weeks each. Those courses requiring the lower tides of early summer are scheduled in the first term. It is possible to register for either term, or for the full quarter. 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

1051H. Subtidal Communities—Lectures, laboratory, and field trips treating shallow water marine communities. Emphasis will be on local habitats and the course will introduce physical environmental parameters, community composition, aspects of the biology of constituent species and methods for subtidal studies. Prerequisites: SCUBA certification SCUBA equipment, ocean diving experience, and some background in biology.

6 units, (Staff) by arrangement

136H. Cell Biology of Early Development—This five-week workshop centers on cellular...
phenomena seen during early embryonic development, such as properties of sperm and egg, fertilization, mitosis and cell division, early morphogenesis of the embryo and determination and polarity. Gametes of marine organisms will be utilized, emphasizing experimentation and observation of living cells, including their microscopy, micromanipulation and chemistry. The course is at the post-graduate level but advanced undergraduates will be considered.

6 units (Epel, Mazia) by arrangement

138H. Biomechanics of Intertidal Organisms — Introduction to the mechanical design of wave-swept organisms with a particular emphasis on the ecological implications of wave forces. The basic theories of water waves, fluid dynamics and solid mechanics will be presented and the applications of theory to understanding the design of materials, structures, whole organisms and communities will be explored. Laboratory work will familiarize students with the various techniques of intertidal biomechanics. Each student will be responsible for completing an individual research project. Prerequisites: A background in invertebrate zoology, algology or intertidal ecology helpful, basic physics and calculus helpful but not essential.

6 units (Denny) by arrangement

142H. Eco-physiology and Cell Biology of Marine Macrophytes — Course takes advantage of the rich marine environments at Hopkins 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 will 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. Analysis will be by observation and manipulation and facilitated by the aquarium and video capabilities of the Monterey Bay Aquarium. The potential range of topics is broad and may deal with organisms from sea anemones to harbor seals. Topics will be introduced by lecture, group studies, research projects. The course will conclude with 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 — Introduction to the ocean as an environment; to its major categories of inhabitants, producer and consumer, benthic and pelagic, invertebrate and vertebrate; and to the functioning of the oceanic ecosystem. Prerequisite: Introductory biology or general zoology.

6 units (Staff) by arrangement

160H. Problems in Subtidal Ecology — Studies focus on some selected research area in our local kelp forest. Topics vary each summer, determined by the research interests of a rotating staff member. Research projects may deal with 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 the first session 105H, Subtidal Communities, but individuals with equivalent training and background will be considered. Intended for students seriously interested in designing and carrying out research studies in the SCUBA zone. Results will be prepared as a scientific paper and presented at a course symposium.

6 units (Staff) by arrangement

199H. Special Problems — (See above, Autumn, Winter and Spring Quarters.)

222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques — Course presents an advanced treatment of membrane physiology and several modern experimental techniques with emphasis placed on the regulation of ionic channels. Laboratory work will concentrate 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 — Course will focus on the evolution of marine life histories. Beginning with a review of terrestrial life history and the evidence relating to that theory. It will examine phenomena that a marine life history theory should explain, and conclude by investigating new theoretical formulations appropriate to marine organisms. Prerequisites: Course in ecology and evolutionary biology and one year of calculus.

6 units, (Roughgarden) by arrangement

300H. Research — (See above, Autumn, Winter, and Spring Quarters.)
COMMITTEE ON BLACK PERFORMING ARTS

**Director:** Sandra L. Richards (Drama)

**Committee in Charge:** Kennell Jackson (African and Afro-American Studies, and History), Halifu Osumare (Dance), John Rickford (Linguistics), James Cadena (Row Housing), Daniel Coles (Student Representative)

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 1970. The committee serves three major functions: (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.) Introductory course tracing the development of Black Drama in the United States; its literature and performing companies from 1958-1969.

*4 units, Spr (Richards)*

29. Theater Performance: Acting—(Enroll in Drama 29) Students who have been cast in committee productions may receive credit for their participation as actors.

*1-3 units, any quarter (Staff)*

39. Theater Performance: Crew—(Enroll in Drama 39A,B,C.) Students may 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)*

73. Jazz Dance III—(Enroll in Athletics 83.) Introduction to jazz dance based on techniques from African and Caribbean dance styles. Includes historical information and the Afro-American influence on American jazz dance.

*1 unit, Aut, Win, Spr (Osumare)*

82A,B,C. Gospel Choir Workshop—(Enroll in African and Afro-American Studies 82A,B,C.) The study and practice of gospel music. Includes regular rehearsals and performances. Credit can be 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)*

85. Black English—(Enroll in Linguistics 73.) Survey of the features of the English vernacular spoken by Black Americans, especially in big city settings, and its relation to the creole English dialects spoken on the South Carolina Sea Island ("Gullah"), in the Caribbean, and West Africa. The expressive uses of Black English will also be considered, and its educational implications will be explored.

*4 units, Spr (Rickford)*

105. Introduction to African and Afro-American Studies—(Enroll in African and Afro-American Studies 105.) Lecture course exploring interdisciplinary contrasting and contradictory interpretations of several key, representative aspects of African and Afro-American social and cultural institutions. Topics include retained Africanisms, slavery, the Black family, Afro-American artists, and Afro-American identity.

*5 units, Aut (Gibbs, Staff)*

161A. The Afro-American Novel—(Enroll in English 161A.) By reading a range of Afro-American novels, by both men and women, in historical context, examine ways in which Afro-American writers have used and adapted the novel genre to interpret various aspects of the Afro-American experience.

*5 units, Aut (Drake)*
CHEMISTRY*

Chairman: John Ross
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. Pirrung

ENTRANCE PREPARATION

Students who intend to major in chemistry are expected to offer entrance credit in the preparatory subjects of chemistry, physics, and mathematics (including algebra and plane trigonometry). Those who do not have entrance credit or equivalent training in the foregoing subjects, particularly mathematics, may experience some difficulty in meeting the department requirements for graduation in four years, especially if they expect to pursue a program leading to professional certification by the American Chemical Society or to the B.S. degree with Honors. A year or more of secondary school preparation in German is desirable.

Advanced placement in chemistry courses, based on the College Board Advanced Placement Examination, is not available.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

MINIMUM REQUIREMENTS

University writing and distribution requirements: 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, a reading knowledge of scientific German is strongly recommended. Chemistry 133 is offered as staffing permits. In years when it is not offered, students may petition to substitute other courses relevant to their programs in consultation with their faculty advisors. Premedical students who declared a major in chemistry prior to September 24, 1984, may substitute 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 complete Physics 51-58. Students interested in attending overseas campuses should consult their advisors as early as possible in order to avoid scheduling problems. Note that it is particularly convenient to attend an overseas campus during spring and summer of the second year, since the courses listed in these quarters may be delayed to subsequent years without disadvantage. No required course may be taken on a Pass/No Credit basis.

TYPICAL SCHEDULE FOR FOUR-YEAR PROGRAM

FIRST YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31</td>
<td>Chemical Principles</td>
<td>4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Chem. 33</td>
<td>Structure and Reactivity</td>
<td>—</td>
<td>4</td>
<td>—</td>
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<tr>
<td>Chem. 35</td>
<td>Monofunctional Compounds</td>
<td>—</td>
<td>3</td>
<td>—</td>
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<tr>
<td>Chem. 36</td>
<td>Chemical Separations</td>
<td>—</td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>Math. 19, 20, 21, Calculus and Analytic Geometry</td>
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SECOND YEAR

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<th>Subject</th>
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<tbody>
<tr>
<td>Chem. 131</td>
<td>Polymolecular Compounds</td>
<td>3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Chem. 132</td>
<td>Qualitative Organic Analysis</td>
<td>5</td>
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<tr>
<td>Chem. 133</td>
<td>Special Topics in Organic Chemistry</td>
<td>—</td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>Chem. 134</td>
<td>Theory and Practice of Quantitative Chemistry</td>
<td>—</td>
<td>4</td>
<td>—</td>
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<tr>
<td>Chem. 136</td>
<td>Synthesis Laboratory</td>
<td>—</td>
<td>3</td>
<td>—</td>
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<tr>
<td>Math. 22, 23, Analytic Geometry and Calculus</td>
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<tr>
<td>Physics 51, 53-54, Mechanics, Sound, Electricity</td>
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<td>4</td>
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<tr>
<td>Electives (see Note below)</td>
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THIRD YEAR

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<tbody>
<tr>
<td>Chem. 171, 173, 175. Physical Chemistry</td>
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<td>Chem. 174, 176. Physical Chemistry Laboratory</td>
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<td>Chem. 151, 153. Inorganic Chemistry</td>
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<tr>
<td>Physics 55-56, 57-58. Light, Heat, Atomic Physics</td>
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FOURTH YEAR

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<th>A</th>
<th>W</th>
<th>Sp</th>
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</thead>
<tbody>
<tr>
<td>Electives (see Note below)</td>
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<td>Totals</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: Chem. Engr. 20, 120, 130; Econ. 1; English 191; Math 44, 106, 113, 130, 131, 132; Physics 110, 111, 132; Stat. 40, 110, 116; Geol. 1; 278; Engr. 50; Appl. Earth Sci. 105; Mat. Sci. and Engr. 50; Med. Micro. 101; Biol. Sci. 40, 41, 42, 43; Biochem. 200, 201; Comp. Sci. 106, 135; Civil Engr. 170, 175, 276A.

**AMERICAN CHEMICAL SOCIETY CERTIFICATION**

Students who wish to be certified as having met the minimum requirements of the American Chemical Society for professional training must complete, in addition to the above requirements, at least six units from Chemistry 136 and/or 190; and at least three additional units from one of the following: Chemistry 136, any chemistry course numbered above 200 for which permission to register had been granted by the instructor; Biochemistry 200; or an advanced course in mathematics or physics. A reading knowledge of scientific German or Russian is strongly recommended.

**HONORS PROGRAM**

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

To be admitted to the program, the student must have a grade average of at least B in all course work in the University. In addition to the minimum requirements for the B.S. degree, the student must complete nine units of Chemistry 190 to be taken three units per quarter for three quarters; and nine additional units from Chemistry 221, 223, 225, 227, 251, 253, 255, 271, 273, 275, Biochemistry 200, 201, Mathematics 130, 131, 132, Physics lecture courses numbered 100 and higher, Geology 278, or other advanced courses approved by the student’s advisor and by the supervisor of his or her work Chemistry 190. An overall 3.3 average in mathematics, physics and chemistry is required for graduation with honors.

Students who wish to be admitted to the Honors Program should register in the department office at the beginning of their senior year. Those who do not meet all of the above formal requirements may petition the department for admission.

**TEACHING CREDENTIALS**

The requirements for certification to teach chemistry in the secondary schools of California may be ascertained by consulting the section on credentials under “School of Education” in this bulletin and the Credential Administrator of the School of Education.

**GRADUATE PROGRAMS**

**GENERAL REQUIREMENTS**

Qualifying examinations are given prior to the first week of the Autumn Quarter and in the first week of the Winter Quarter. Each new graduate student must take these examinations on entrance. Satisfactory performance is required for permission to begin thesis research and to continue work for an advanced degree. Students on full time fellowships may complete all requirements for the Ph.D. degree in 9 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 grade average of B for all chemistry lecture courses as well as for all courses taken during graduate study. Required courses may not be taken under the pass/no credit option. All students are expected to give full time to their graduate work once they have begun thesis research. All prospective Ph.D. candidates, regardless of the source of their financial support, are required to gain teaching experience as an integral part of their graduate training. 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 will be advised to repeat them during the first week of the Winter Quarter. All qualifying examinations will be given September 19, 20, 1986 and all must be taken at this time.

MASTER OF SCIENCE

All applicants for the degree of Master of Science in Chemistry are required to complete, in addition to the requirements for the bachelor's degree, a minimum of 39 units of work. Of the 39 units approximately two-thirds must be in the department and must include at least 12 units of advanced course work in chemistry exclusive of the thesis. Of the 12 units, at least three units must be from Chemistry 221, 223, 225, 251, 253, 255, 271, 273, or 275.

MASTER OF ARTS IN TEACHING

(Chemistry)

In cooperation with the School of Education, the department offers a program leading to a degree, Master of Arts in Teaching (Chemistry). This degree is intended for candidates who have a teaching credential and who wish to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements are outlined in this bulletin under “School of Education, the Master of Arts in Teaching.”

DOCTOR OF PHILOSOPHY

The graduate student does not become a formal candidate for the Ph.D. degree until he or she has passed the department qualifying and language examinations and has been admitted to candidacy by the University Committee on the Graduate Division. Filing for admission to candidacy for the Ph.D. degree must be done before June of the second year of graduate registration. The foreign language requirement for the Ph.D. in organic chemistry ordinarily will be met in German and French, or Russian. The foreign language requirement in physical, biophysical, or inorganic chemistry ordinarily will be met in either German or Russian. Proposals to substitute another language or a program of course work for French or Russian will be considered by the department on petition by the candidate. Candidates for the Ph.D. degree are required to participate continually in the department seminar (Chemistry 300), and in the division seminar of the major subject. In addition, continuous enrollment in Chemistry 301 is expected after the student has passed the qualifying examinations and chosen a research supervisor. 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 make a grade average of at least B in these three courses may not become candidates for the Ph.D. degree in organic chemistry; (2) take Chemistry 271 (or be exempted therefrom by passing a special examination administered by the professor in charge of this course); (3) take Chemistry 233 in the second and third year (3 units); (4) take Chemistry 227 or an approved substitute; 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 make a grade average of at least "B" in these courses may not become candidates for the Ph.D. degree in physical chemistry; (2) six units of advanced lecture courses in physical chemistry, biophysical chemistry, or inorganic chemistry; (3) Chemistry 221, or 223, or 225; 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 287, 289, 291 and 293; and (3) two additional courses (at least six units) of advanced lecture courses in fields appropriate to their research interests to be chosen in consultation with their research supervisors.

Chemical Physics—Students with an excep-
tionally 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 grade average of "B" or better, 12 units of chemistry courses more advanced than those that meet the minimum requirements for a bachelor's degree in chemistry.

FELLOWSHIPS AND SCHOLARSHIPS

In addition to the University fellowships and scholarships that are open to properly qualified students, there are at present several departmental fellowships in chemistry. The Edward Curtis Franklin Fellowship, James W. McBain Memorial Fellowship, Frederick P. Whitaker Fellowship, William H. and Myrtle B. Sloan Scholarship, David L. and Lavinia 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

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, periodicity, bonding properties of matter, stoichiometry. Prerequisite: High school algebra; high school chemistry and physics desirable. (DR:7)
4 units, Aut (Andersen, Lewis)
lec (1) MWF 9; lec (2) MWF 11,
one recitation by arrangement
Win (Fayer) 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 (Staff) MWF 1:15
Spr (Huestis, Pirrung) 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 will treat the theory while the laboratory will provide practice. Prerequisites: 33 and concurrent or previous enrollment in 35. Pre-register in Chemistry Department.
3 units, Spr (McElwee-White) lec M 1:15;
lab M 2:15-6:05, or T,W,Th or F 1:15-5:05

123. Introduction to the Chemical Sciences—For non-science majors. An introduction to scientific principles and methods with emphasis on chemistry. Designed to further the understanding of what science is and how chemistry plays a central role in today's technological society. Simple experiments will be conducted outside of class. (DR:7)
3 units, Spr (Zare) MWF 10
one recitation section by arrangement
students in biomedical sciences. (Chemistry majors take 132.) Prerequisites: 35, 36 and concurrent registration in 131.

4 units, Aut (Frost); lec (1)
TTh 9 lab MTW or Th 1:15-5:05

131. Organic Polyfunctional Compounds—
Aromatic compounds, polysaccharides, amino acids, proteins, natural products, dyes, purines, pyrimidines, nucleic acids and polymers. Prerequisite: 35.
3 units, Aut (Huestis) lec TTh 11-12:15
3 units, Win (Collman) TTh 1:15-2:30

132. Qualitative Organic Analysis—
Separation of mixtures of organic compounds and identification of the components using rational synthesis and analysis of spectral data. Required for and limited to chemistry majors; others may be admitted with consent of instructor. Prerequisites: 35, 36 and concurrent registration in 131.
5 units, Aut (Frost)
lec (1) TTh 8 plus lab MW 1:15-5:05
or TTh 1:15-5:05

133. Special Topics in Organic Chemistry—
Primarily for chemistry majors. Mechanisms, orbital symmetry, physical methods, biogenesis, synthesis. Prerequisites: 131 and calculus.
3 units, Win (Staff) MWF 11

134. Theory and Practice of Quantitative Chemistry—
Theory and practice of quantitative analysis. Methods considered include gravimetric, volumetric, spectrophotometric, and electrometric. Prerequisite: 132.
5 units, Win (Staff) lec TTh 9 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 is on those portions of physical chemistry most useful for students of the life sciences. Introduction to chemical thermodynamics, heterogeneous equilibria, thermodynamics of solutions, electrolytes, chemical kinetics, macromolecular solutions and colloidal dispersions. Prerequisites: 31 and calculus.
3 units, Win (Pecora) TTh 11-12:15
3 units, 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, Feminist Studies 150A.) Problems of introducing a new, practical birth control method involves legal, political, cultural and economic factors in addi-

tion to purely biological ones. Course deals with a critical evaluation of logistic aspects of human fertility control. Limited to 45 students with at least junior standing. Complete application for admission in Human Biology office.
6 units (Djerassi) TTh 1:15-4:05

139. Pest Control: Technical and Policy Aspects—
(Same as Human Biology 152.) The technical, operational and policy issues of pest control in agriculture and public health. History of chemical pest control, present research on bioregional alternatives with special emphasis on recent developments in insect endocrinology and pheromones; economic and political factors that affect pest control practices; measuring the costs and benefits of chemical controls; impact of regulation on the development of new technology in private and public sectors. Limited to 25 students with at least Junior standing. Prerequisites: Chemistry 33 and/or 35 or consent of instructor. Preregistration prior to Winter Quarter is essential using special preregistration forms available from the Human Biology or Chemistry Department offices.
5 units, Win (Djerassi) TTh 1:15-4:05
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 theory, ligand field theory, application of physical methods to predict the geometry, magnetism and electronic spectra of transition metal complexes, and theoretical aspects of electron transfer reactions. Prerequisites: 151 and 173.
3 units, Spr (Hodgson) MWF 10

171. Physical Chemistry—
Chemical thermodynamics: fundamental principles, Gibbsonian equations, equilibrium conditions, phase rule, systematic deduction of equations, gases, solutions. Prerequisites: 35, Mathematics 19, 20, 21 (or equivalent) and Physics 51, 53, 54 and previous or concurrent registration in Physics 55 (or Physics 21, 23, 29 in the case of premedical students majoring in chemistry; see under "Minimum Requirements").
3 units, Aut (Pecora) MWF 11

173. Physical Chemistry—
Introduction to quantum chemistry: basic principles of wave
mechanics, the harmonic oscillator, the rigid rotator, infrared and microwave spectroscopy, the hydrogen atom, atomic structure, molecular structure, valence theory.

3 units, Win (Boxer) MWF 11

174. Physical Chemistry Laboratory—Use of chemical instrumentation to study fundamental areas of physical chemical concern. Lectures introduce spectroscopy using group theory. Experiments include rotational-vibrational, laser Raman, and visible spectroscopy; x-ray diffraction; and an introduction to integrated circuit electronics. An understanding of the theory relevant to each experiment is emphasized. Prerequisites: 134 and previous or concurrent enrollment in 173. Familiarity with linear algebra on at least the level of Mathematics 113S is strongly encouraged.

3 units, Win (McConnell) lee 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 Chemistry 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 (Tolbert) 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 (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.


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 (Staff) 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 will be practiced and criticized with the student using his own research as a vehicle. Required of all 2nd and 3rd year Ph.D. candidates. Winter and Spring: the art of formulating, writing, and orally defending an original research proposal will be practiced and criticized.

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

251. Selected Topics in Advanced Inorganic Chemistry—May be repeated for credit. Prerequisite: One year of physical chemistry.

3 units, Aut, Win, Spr (Staff) TTh 11, by permission of instructor

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 will be assumed.

3 units, Spr (Solomon) TTh 11-12:15
3 units, Spr (Collman) TTh 10-12

257. Research Proposals in Inorganic Chemistry—Research progress reports (Autumn) and research proposals (Winter and Spring) will be presented in oral and written form. Writing ability and oral defense will be criticized as well as scientific content. Required of all second-year inorganic students.
1 unit, Aut, Win, Spr (Taube) by arrangement

259. Inorganic Chemistry Seminar—Attendance required of all graduate students majoring in inorganic chemistry.
1 unit, Aut, Win, Spr (Taube) 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. Examination of the experimental and theoretical basis for various models of molecular structure; review of quantum theory of atomic and molecular structure. Born-Oppenheimer approximation, molecular energy levels, interaction of radiation with matter, microwave, infrared, and ultraviolet spectroscopy of molecules. Also, special topics to be chosen according to the interests of the students and instructor; 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 (George) 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 (McConnell) by arrangement

283. Research Proposals in Physical Chemistry—Students will present research proposals and progress reports on their research in physical chemistry, using oral and written forms. Topics may be drawn from the student's research of a related area in physical chemistry. Written form, oral presentation and scientific merit will be evaluated. May be required of 2nd- and 3rd-year graduate students at the discretion of the research advisor.
1 unit, Aut, Win, Spr (Staff) by arrangement

287. Biophysical Chemistry—Covers theoretical and experimental aspects of biophysical phenomena with emphasis on membrane biophysics and membrane biology. Minimal prerequisites are previous or concurrent registration in 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. Minimal prerequisites are previous or concurrent registration in 171 and 173, or the equivalent.
3 units, Win (McConnell) 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 (McConnell) 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 will be assumed.
3 units (Solomon) TTh 11-12:15

299. Teaching of Chemistry—Techniques of teaching chemistry by means of lectures and
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 development opportunity to advanced Stanford graduate students. Each year the program offers courses designed specially 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.

With the addition of a visiting faculty as a new feature of the Chicano Fellows Program in 1986-87, the instructional offerings of the program have been significantly strengthened and enhanced. In 1986-87, as in the four 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. Students should check with the Program coordinator for further information.

COURSES PROGRAM

For the 1986-87 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, Spanish 135.) Interdisciplinary course focuses on the history and culture of Mexican Americans during the nineteenth and twentieth centuries. Historical perspectives are balanced with anthropological and literary views focusing on the cultural patterns of Mexicans in the U.S. Students are offered the opportunity to interact with three different Chicano faculty from three different disciplines. Historical texts, novels, poems, and ethnographies will be the basis for required readings.

5 units, Aut (Camarillo, Cuellar, Ybarra-Frausto)

186. Chicano Bibliography: Information Sources and Search Strategies—An introduc-
tion to the fundamentals of library research methods for the study of the historical experience and contemporary condition of the Chicano/Mexicano population in the United States. The Chicano bibliography includes the study and use of standard library resources as well as subject specialized information sources. Designed to help the student studying the Chicano experience to develop search strategies for locating diverse types of information and resources related to their specific interests.

3 units, Aut (Trujillo)

188. Microcomputers in Instruction & Educational Equity—(Same as Education 188.) Introduction to and examination of how microcomputers have been used within U.S. schools, especially at the primary and secondary levels. The types of computer offerings available to middle- and upper-socioeconomic status (SES) students are compared/contrasted with computer instruction generally provided to lower-SES students, especially minorities. Issues of gender, language, and geography. Educational and economic implications are analyzed from the perspective of educational equity and include the elements of computer access, degree of participation, and types of benefits derived.

3 units, Spr (DeVillar) TTh 4:15-5:45

DEPARTMENTAL

For (DR) information, see the respective departments.

SPANISH

11B. Second-Year Spanish for Bilingual Students—Designed for students of Hispanic background. Intensive study of grammar with emphasis on written Spanish. Short readings by and about Hispanics in the United States. Prerequisite: Pass Bilingual Placement Test.

4-5 units, Aut (Staff)

12B. Second-Year Spanish for Bilingual Students—Introduction to various Hispanic dialects, with emphasis on Chicano Spanish and bilingualism in speech and literature.

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. (DR:2)

3-5 units, Aut (Staff)

CLASSICS

Emeriti: (Professors) Lionel Pearson, Antony E. Raubitschek

Chairman: Edward Courtney

Professors: Edward Courtney, N. Gregson Davis (Classics and Comparative Literature), Andrew M. Devine, Mark W. Edwards, Edwin M. Good (Religious Studies and, by courtesy, Classics), Michael H. Jameson (Classics and, by courtesy, History), Marsh H. McCall, Jr., Julius Moravcsik (Philosophy and, by courtesy, Classics), Susan Treggiari (Classics and, by courtesy, History)

Associate Professors: Wilbur Knorr (History of Science), Sabine G. MacCormack (Classics and History), Susan A. Stephens, Michael Wigodsky, John J. Winkler

Assistant Professors: Jody Maxim (Art History and Classics), Mark H. Munn, Bruce B. Rosenstock

Professor (Teaching): Edward W. Spofford

Lecturers: Robert Hamerton-Kelly (Classics and History), Mary-Lou Munn

Acting Assistant Professor: Maryline Parca Webster Visiting Professor: John A. North (Spring)

OFFERINGS

The Department of Classics offers work in the Greek and Latin languages and literatures (both in the original languages and in translation), in Greek and Roman history, 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.

ADMISSION

Those who are considering a major in Classics (Latin and Greek) should enroll in the department as early as possible, since at least three
years of work in Latin or Greek or both will generally be required of them, and those with no previous knowledge of Latin (or Greek) should begin the study of the language in their freshman year, or as early as possible in their sophomore year. Prospective majors in Classical Studies should normally enroll not later than the beginning of their junior year, but are urged to discuss their plans with a member of the department as early as possible.

UNDERGRADUATE PROGRAMS

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 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 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; 
   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 grade lower than C may be counted toward fulfilling major requirements.

Note 3—Students who are contemplating graduate work in classics, or a professional career as teachers of Greek and Latin, might suitably follow either of the first two programs, 1 or 2. 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 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 twelve months (usually 3 quarters of course work plus 3 months study for the thesis or examination). Students without an undergraduate major in Classics may also be accepted as candidates, though they may require a longer period of study before completing the requirements for the degree. These requirements are:

1. Satisfactory demonstration of competence in Greek and/or Latin composition.
2. Attainment of a standard of scholarship such as would normally be reached by three quarters of study in the department after fulfilling the requirements for an undergraduate major in the department. This would normally mean the completion of at least 18 units of graduate courses and 18 units of work at the 140 level or above.
3. The satisfactory completion of one Greek course at the 100 level (if the undergraduate major has been Latin) or one Latin course at the 100 level (if the undergraduate major has been Greek).
4. The passing of an examination testing the candidate's ability to translate into English from a selected list of Greek and/or Latin authors.
5. The writing of a thesis, or the passing of an examination on a particular author or topic.
6. A reading knowledge of French or German.

Students who are candidates for the Ph.D. degree may also (on the recommendation of the department) become candidates for the A.M. degree. In their case requirement 5 above will be waived provided that they have completed some work beyond the course requirements listed under 2 and 3 above.

**DOCTOR OF PHILOSOPHY**

University regulations regarding admission and application for candidacy are discussed in the "Degrees" section of this bulletin.

All candidates for the Ph.D. degree in Classics must fulfill the following requirements:

1. 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 special topics, such as selected authors or selected aspects of Greek or Latin literature, linguistics, history, archaeology, philosophy, epigraphy, papyrology, or palaeography.

3. The examinations in translation from Greek and Latin authors and from sight will normally be taken in the second year of graduate work, the general written and oral examinations and the special author and field examinations in the third year, the dissertation oral examination during the fourth year. The period between the translation and general examinations will be devoted largely to seminar work and to an intensive preparation for the latter examinations, during the course of which candidates will be expected to make full use of relevant secondary material in modern languages. They should therefore plan to satisfy the requirements in French and German as soon as possible, preferably before the time of the translation examinations. Except in very special circumstances they will not be allowed to take the general examinations until the modern language requirements have been successfully completed.

4. Each candidate (not later than the end of the third year) should submit to the chairman of the department a statement of his or her dissertation topic as approved by his or her dissertation committee. This committee will normally be appointed (for each candidate) by the chairman of the department at least one quarter before the student's dissertation topic is due to be submitted. At the same time or earlier a member of the department will be appointed as the candidate's advisor and will thereafter supervise the candidate's writing of the dissertation. An acceptable dissertation must be a genuine contribution to classical scholarship and must be written in an acceptable style. All theses are to be written in English.

5. All students are required to undertake the equivalent of three one-quarter courses of teaching under the supervision of the department.

**Ph.D. MINOR IN CLASSICS**

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.

**Fifth Year**—Dissertation. University oral examination.

**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 Greek 52.

During the first year some Xenophon or Plato will be read, so as to prepare the student in the following year for further reading of Plato, Euripides, and Homer. These courses all form part of a series, but qualified students may be admitted to the class in winter or spring by consent of the instructor.

Students who have done previous work elsewhere in Greek should consult 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.

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

51. **First-Year Greek**—Accelerated course.
   Completion of Greek 51 and 52 fulfills (DR:4).
   6 units, Win (Parca) MTWThF 1:15

52. **First-Year Greek**—Continuation of 51.
   Completion of Greek 51 and 52 fulfills (DR:4).
   6 units, Spr (Parca) MTWThF 1:15

The intensive Greek course (Greek 10) offered in Summer Quarter also prepares students to enter Greek 101 in Autumn Quarter.

**INTERMEDIATE**

101. **Second-Year Greek**—Reading of selections from Plato.
   5 units, Aut (Berg) MWF 10
   with review session by arrangement

102. **Second-Year Greek**—Euripides, one play.
   5 units, Win (Raubitschek)

103. **Second-Year Greek**—Homer, Odyssey.
   5 units, Spr (Jameson)

104. **New Testament Greek**.
   3 units, Win (Hamerton-Kelly)

113. **Attic Prose**.
   4 units, Aut (Garrison) TTh 10-11:30

**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.
Herodotus.
4 units, Win (Jameson)

Hesiod and Greek Lyric Poetry.
4 units, Spr (McCall)

Individual Work.
by arrangement

Senior Seminar.
4-5 units, by arrangement

Undergraduate Thesis.
by arrangement

UNDERGRADUATE AND GRADUATE

Greek Style and Syntax—Teaches some of the nuances of Greek syntax and style. Classes are devoted to stylistic analysis of selected prose authors, techniques of sight-translation, and the writing of idiomatic Greek prose. Designed for the major, but all students enrolled in Greek language courses are encouraged to take Greek 175 as soon as possible after the completion of 103.

4 units, Aut (McCall) TTh 2:15-3:45

Introduction to Classical Scholarship.
1 unit, Aut, Win, Spr (Wigodsky, Staff)

Tutorial in Greek Poetry.
3 units, Aut, Win (Jameson, McCall)

Greek Language and Style.
3 units, Win, Spr (Stephens, Parca)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1985-86 there were literary seminars in the following authors or topics: Introduction to Papyrology; Ancient Rhetoric and Literary Criticism; Herodotus, Thucydides and the Enlightenment; Romantic Plays of Euripides. The following courses and seminars will be offered in 1986-87. (See also seminars listed under Latin, Literature, Philosophy, Ancient History, Religion and Mythology, Art and Archaeology, Indo-European Linguistics, and History of Science.)

Directed Reading.
by arrangement

Greek Prose or Verse Composition.
by arrangement

Classical Conventions in European Lyric.
4 units, Win (Davis)

Menander.
5 units, Aut (Parca) Th 2:15-4:05

Greek Epigrams.
2 units, Win
5 units, Spr (Raubitschek)

Note—Some of the courses listed above may require the writing of an extended research paper based on work directly related to the course.

LATIN

INTRODUCTORY

Students with no previous experience may begin the study of Latin with either Latin 1 or Latin 51. The series 1, 2, 3 begins in Autumn Quarter (5 units a quarter), the series 51, 52 begins in Winter Quarter (6 units a quarter) and is intended to cover the same ground at a more rapid pace, so that the series 101, 102, 103 forms a sequel equally to Latin 3 and Latin 52. During the first year some Caesar or other simple Latin prose will be read so as to prepare the students in the following year for Cicero, Virgil, Ovid, and other authors. These courses all form part of a series, but qualified students may be admitted to the class in Winter or Spring 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.

1. First-Year Latin—For beginners.
5 units, Aut (Evans-Grubbs) MTWF 9

2. First-Year Latin—Continuation of 1.
5 units, Win (Evans-Grubbs) MTWF 9

3. First-Year Latin—Continuation of 2.
5 units, Spr (Staff) MTWF 9

6 units, Win (Devine) MTWThF 1:15

52. First-Year Latin—Continuation of 51. Completion of Latin 51 and 52 fulfills (DR:4).
6 units, Spr (Devine) MTWThF 1:15

The intensive Latin course (Latin 10) offered in Summer Quarter also prepares students to enter Latin 101 in Autumn Quarter.

INTERMEDIATE

Students will be admitted to these courses by completing Latin 3 or Latin 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
with review session by arrangement

5 units, Win (Staff) with review session by arrangement

103. Second-Year Latin—Selections from Virgil, Aeneid.
5 units, Spr (Wigodsky) with review session by arrangement

111. Horace, Odes.
4 units, Aut (Davis) MWF 2:15

118. Post-Classical Latin—Careful reading of Latin texts of graded difficulty, beginning with the Vulgate Bible, working through various patristic writings and medieval literature toward Latin of the Renaissance.
4 units, given 1987-88

ADVANCED

151. Roman Comedy.
4 units, Win (Wigodsky)

154. Roman Historical Writing.
4 units, Spr (Treggiari)

160. Individual Work.
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

175. Latin Style and Syntax—Teaches some of the nuances of Latin syntax and style. Classes are devoted to stylistic analysis of selected prose authors, the techniques of sight-translation, and the writing of idiomatic Latin prose. Designed for the major, but all students enrolled in Latin language courses are encouraged to take Latin 175 as soon as possible after the completion of 103.
4 units, Aut (Courtney) MWF 11

GRADUATE

177. Introduction to Paleography and Codicology—(Same as English 209.)
5 units, Spr (Brown)

201. Introduction to Classical Scholarship.
1 unit, Aut, Win, Spr (Wigodsky, Staff)

3 units, Aut, Win (Wigodsky, Parca) TTh

205. Latin Language and Style.
3 units, Win, Spr (Davis, Wigodsky)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1985-86 there were literary seminars in the following authors or topics: Ancient Rhetoric and Literary Criticism, Lucretius. The following courses and seminars will be offered in 1986-87. (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

265. Editing of Latin Texts.
4 units, Spr (Courtney)

270. Latin Prose or Verse Composition.
by arrangement

333A,B. Tacitus Annals I-VI.
5 units, Aut W 2:15-4:05
2 units, Win (Treggiari)

335. Classical Conventions in European Lyric.
4 units, Win (Davus)

343. Augustine, De Civitate Dei.
5 units, Aut (MacCormack) M 2:15-4:05

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.

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.

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 will be made with written epics such as Virgil’s Aeneid and later works. (DR:2)

3-4 units, Spr (Davis)

12. Greek Tragedy: Aeschylus, Sophocles, Euripides—Course reads intensively 12-15 tragedies. Emphasis is on placing the plays in their fifth-century Athenian context and on problems of staging and audience expectations. (DR:2)

3-4 units, Win (McCall)

160. Individual Work.

by arrangement

172. Classical Influences in Modern Literature—Themes from classical myth and history in selected Renaissance and later writers; parallel readings from ancient literature.

3-4 units, Aut (Wigodsky) MWF 1:15

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, this time the oligarchical states, formed around Sparta and Corinth, and after a long war Athens was defeated. This course will study, mainly in translated original sources, the development and interrelationships of democracy and imperialism, with the purpose of identifying the universal principles involved. (DR:3)

3 units, given 1987-88

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, Spr (Raubitschek)

65. Greek Philosophy—(Same as Philosophy 100.) An examination of the philosophies of Plato and Aristotle. Some attention will be given to the pre-Socratic background.

4 units, Win (Roberts) MWF 11

ANCIENT HISTORY

These courses are accepted by the History Department for credit toward a major in History.

101. History of Greece—A survey of the history of ancient Greece from the Bronze Age through the Age of Pericles down to the death of Alexander the Great (323 B.C.). (DR: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 treatment of 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 (Treggiari)

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 (Treggiari)

107. Art, Religion, and Society in Late Antiquity (284-717 AD)—(Same as History 112A.) The period marks a turning point in world history. The key question still is, 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 period of “decline” created concepts and images which shaped European thinking for centuries. Visual and literary documentation will explain how and why this happened. (DR:5)

5 units, given 1987-88

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) TTh 3:15-4:45

160. Individual Work in Ancient History.

by arrangement

182. Rebuilding the Republic: Social Engineering and Moral Revival under Augustus—Founders and re-founders of ancient cities were expected to construct a society as well as a constitution. Augustus’ contemporaries urged him to restore what was believed to be an older Roman morality, to curb unbroken license, to discourage “consumerism” and regulate family life. An elaborate legislative programme followed, which roused considerable opposition and probably enjoyed only limited success. Collo-
quium explores the evidence for Augustus’ legislation and the perceived social problems which he tackled. Sources (inscriptions, jurists, poets, historians) are read in translation. Recommended: 103 or some background in social history, or Latin literature.

4 units, Aut (Treggiari)

Courses at the 200 level are mainly for graduate students.

208. Proseminar in Greek Epigraphy.
4 units, Win (Jameson)

261. Individual Work in Greek History.
by arrangement

262. Individual Work in Roman History.
by arrangement

333A,B. Tacitus Annals I-VI.
5 units, Aut W 2:15-4:05
2 units, Win (Treggiari)

351A,B. Greek Epigrams.
2 units, Win
5 units, Spr (Raubitschek)

RELIGION AND MYTHOLOGY

18. Greek Mythology—Cosmology, the Herakles legend, the Underworld, Platonic mythmaking, 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

ART AND ARCHAEOLOGY

14. Classical Athletics—The origins and the history of competitive sport in the ancient world, from the funeral games for Patroclus (Homer) to the chariot races in the Hippodrome of Constantinople, based on the literary and monumental evidence. Attention is paid to the spirit of competition apart from athletics. Lectures (illustrated) and discussion groups. (DR:5)
3 units, given 1987-88

20. Introduction to Classical Archaeology—Traces the history of archaeological exploration in the Mediterranean from the Renaissance to the present day, and surveys the principal archaeological discoveries of the Greek and Roman world. Great moments of discovery and decipherment are highlighted, and the present state of archaeological research into classical antiquity is discussed. (DR:5)
4 units, given 1987-88

108. Topography and Monuments of Greece—A survey of the principal cities, sanctuaries, and historical places from the Mycenaean era to the Roman period. Designed to familiarize students with the physical setting of Greek history and culture, and to prepare students for travel and study in Greece.
3-4 units, Aut (Munn) MW 2:15-4:05

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 1987-88

119. The Evolution of Civilization and Landscape in the Aegean—(Same as Geology 119.) Studies relationship between cultural history and physical environment in Greece and the Aegean from prehistory to present, focusing on the Bronze Age and Classical period. The influence of land and landscape on economic, social, and political orders are investigated, as are environmental factors conducive to cultural change and cultural continuity. Geological and archaeological evidence is examined and elucidated in the light of classical authors and contemporary practices.
3 units, given 1987-88

120. Greek Vase-Painting—(Same as Art 102.) A survey of Greek vases and their painters from the Protogeometric period onwards. Special attention will be given to the masters of Athenian black-figure and red-figure painting, and to the problems involved in distinguishing individual hands.
4 units, Aut (Maxmin) MW 1-2:15

127. Archaeological Practicum.
2 units, Aut, Win (M.L. Munn) F 2:15-4:05

160. Individual Work in Human Settlement and Landscape in the Aegean.
by arrangement

Courses at the 200 level are mainly for graduate students.

201. Beyond the Development of Attic Black- Figure Painting—(Enroll in Art 201.)
4 units, Spr (Maxmin)

260. Individual Work in Human Settlement in Landscape in the Aegean.
by arrangement

INDO-EUROPEAN LINGUISTICS

240. Elementary Sanskrit.
3 units, Aut (Devine) T 2:15-4:05

5 units, Aut (Devine) given 1987-88

PROGRAM IN THE HISTORY OF SCIENCE

The Classics Department participates in the History of Science Program. For a description
of the program see the section "History of Science Program" in this bulletin.


138A. Ancient Period—(DR:3; also satisfies Area 6 when taken in sequence with 138B.)
4 units, given 1987-88
138B. Middle Ages to Newton—(DR:3; also satisfies Area 6 when taken in sequence with 138A.)
4 units, given 1987-88
138C. Newton to Einstein—(DR:3)
4 units, given 1987-88

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 Research: Donald F. Roberts
Director, John S. Knight Fellowships for Professional Journalists: James V. Risser. Managing Director: Harry N. Press
Director, Mass Media Institute: Jules Dundes
Assistant Professors: Jeremy Cohen, Clifford Nass
Professors (Teaching): Ronald Alexander, Marion Lewenstein, James V. Risser
Associate Professor (Teaching): Kristine Samuelson
Lecturers: Jules Dundes, Harry Press
Consulting Professor: Edwin B. Parker

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). This test requirement may be waived after written petition to the department only in exceptional circumstances when the applicant is prevented from taking the tests.

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 eight 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), communication research, and communication technology. 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 eight core courses
equal 37 units. An additional 13 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 seven 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)

   b) Mass Communication Theory 108 (prerequisite: 1; Statistics; Computer Science)

   c) Research Methods 106 (prerequisite: 1; Statistics; Computer Science)

   d) Introduction to Film and Video 114 (prerequisite: 1 and 100 or consent of instructor)

   e) History of Journalism 140; or History of Film 141 (prerequisite: 1)

   f) Communication Media and the Law 110 (prerequisite: 1)

   g) Interactive Communication Technologies 169 (pre-requisite: 1; Computer Science)

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, Documentary Film Production, and Applied Communication Research. 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: candidates must be enrolled as a major in the department for at least two quarters; they must maintain a high academic performance during their entire program of study. At least 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, 233, 249, 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.

The master's program in Applied Communication Research is a terminal program intended to train communication research practitioners in such fields of application as national development, health, campaign planning and evaluation, and communication and children. This is a quantitatively oriented curriculum that emphasizes the application of communication theory and research to the solution of practical problems. The program consists of a core curriculum in theory and methodology and statistics, an applications course in the specific area of the student's interest (Communication and Development, Health Communication, Communication and Children), directed study in applications of communication theory and research methodology, and an A.M. project.

**DOCTOR OF PHILOSOPHY**

The department offers the Doctor of Philosophy in Communication Theory and Research. Since the program's goal is to train communication scientists, the program is quantitative and behavioral in nature. All students are required to complete a core program in communication theory and research, research methodology, and statistics. Subsequent to completion of the core program, students may emphasize such areas as attitude formation and change, communication and children, 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
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
2. Statistics 160: Introduction to Statistical Methods I
3. Education 250A: Statistical Analysis in Educational Research
4. Education 250B: 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
5. Education 250C: Statistical Analysis in Educational Research II
6. Education 250D: Statistical Analysis in Educational Research
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 (a) individual student needs in order to prepare for preliminary and area examinations, and (b) the requirements of the particular area of emphasis chosen by the student. In rare instances, Ph.D. level courses from other departments may be substituted for part of this requirement. They should be chosen in consultation with the advisor.

Finally, students must complete:

1. Communication 397: First-year Research Project
2. Communication 398: Pre-dissertation Research Project

Depending on the area of Communication study the student chooses to emphasize, additional courses are selected, with the assistance of the advisor, from within the department’s offerings and from other University departments. Requirements vary depending on the area emphasized.

Ph.D. candidacy expires five years after admission to candidacy by the University Committee on the Graduate Division. Reapplication will require reexamination.

Other programs leading toward the Ph.D. and involving communication may be pursued in the Graduate Division Special Programs. These are individually planned for unusually well-qualified students.

Ph.D. MINOR

Candidates for the degree of Doctor of Philosophy in other departments who elect a minor in Communication will be required to complete a minimum of 20 units of graduate courses in the Communication department, including a total of three theory or research methods courses, and will be examined by a representative of this department. The balance among communication theory, methods, and applications courses will be determined by the candidate and his or her senior advisor.

THE INSTITUTE FOR COMMUNICATION RESEARCH

The Institute for Communication Research operates as an office of project research for the faculties of the Department of Communication and other departments, on grants from foundations, communication media, and other agencies, on government grants and contracts, and on its own funds. Research assistantships are often available to qualified Ph.D. students in Communication. Among the qualifications that will be highly valued in applicants are high scholarship, training in the behavioral sciences (including training in statistics and research methodology), and training for or experience with the mass media. For further information write to the Director.

MASS MEDIA INSTITUTE

During the Summer Quarter, the Department of Communication conducts a series of 8-week-long workshop production courses in Film, Radio/Television, Broadcast News, and Journalism. These are designed as pre-professional training courses, and are open to students with junior or higher standing at Stanford and other colleges and universities. Additional courses dealing with Film Aesthetics, New Technologies, Communication Law, and Mass Communication in Society are also offered. Stanford undergraduates may apply a maximum of 12 units to their Communication major requirements.

Information about the Mass Media Institute may be obtained by writing to Jules Dundes, Director, Mass Media Institute, Department of Communication, Stanford University, Stanford, CA 94305.

COURSES

PRIMARILY FOR UNDERGRADUATES

(*Core Courses)

1. Mass Communication and Society—An introduction to human communication theory and to mass communication and its effect on society; the responsibility and ethics of the press; the role of economics and government regulation in determining what the consumer of mass media messages receives. Open to non-majors. (DR 5 units, Aut (Cohen) MTWTh 9 sections by arrangement

100. Editorial Techniques I—A reporting and writing course emphasizing various forms of
101. Film Aesthetics—(Graduate students register for 201.) A theoretical, historical examination of the nature of the film medium. Attention is given to the problems of aesthetics and communication from the viewpoints of the practitioner, the critic, and the audience.

4 units, Spr (Breitrose) given 1987-88
3 units, Sum (Staff)

103. Precision Journalism—(Graduate students register for 203.) A practicum in the use of social science techniques by journalists as a means for accurate reporting about social and political trends. Class project will involve doing a public opinion survey and/or content analysis of public documents. The data will be used to write a series of in-depth news stories. Non-majors may opt to use the data to write a final paper.

4 units, not given 1986-87


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 will be critically evaluated. The class will design and conduct a small communication study. Prerequisites: 1; Statistics, Computer Science.

*4 units, Aut (Nass)

108. Mass Communication Theory—Mass media effects provide greater depth to issues introduced in Communication 1. Models of mass communication, the mass media as organized, and the relationships of mass media with society will be explored. Prerequisites: 1; Statistics; Computer Science.

*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 are used to explore the roles of law on communication and to introduce the application of communication research to law and policy formation. Prerequisite: 1.

*5 units, Win (Cohen)

114. Introduction to Film and Video—Preparation of visual media is explored 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 is examined through viewing and analysis of classical and current films; also explores uses of film and video tape as a tool for the analysis and presentation of cognitive, social and kinesic aspects of culture and as a vehicle for the anthropological research.

5 units, Spr (Gibbs) not given 1986-87

117. 16mm Film Production—A practical, hands on course in 16mm film production to be taken concurrently with Comm. 118 by those seriously interested in pursuing 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) alternate years, given 1987-88

118. Advanced Film Writing and Directing for Documentary Films—Develops writing skills for the pre-production, production and post-production of visual media. Special emphasis on research, treatments and the writing of narration for documentary film. The skills and techniques of directing will be developed and applied in actual production of 16mm films in the film production course, 117, taken concurrently. Prerequisites: successful completion of 114 and consent of instructor.

5 units, Spr (Staff)

131. Media Ethics and Responsibilities—(Graduate students register for 231.) An examination of the performance of the various media of mass communication in the light of ethical standards, employing case studies, text, and discussion sessions. Also such current media problems as the dwindling of the journalistic channels, the changing roles of the media, media accountability, and the relationships between government and the media.

4 units (Rivers) not given 1986-87

136. Broadcast Journalism—(Graduate students register for 236.) An overview of broadcast journalism from newsroom organization to
basic broadcast newswriting skill development.

Additional lab. Prerequisites: 100 or 200.

5 units, Spr (Staff)

139. Literature of the Press—(Graduate students register for 239.) Readings from the writings of journalists, their lives, and work. Several basic readings for all students; 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 (Levenstein)

140. History of American Journalism—(Graduate students register for 240.) Evolution of the democratic mass media in their social, political, economic, technological and professional aspects. (DR:5)

*4 units, Win (Levenstein)

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 film showings


4 units, Spr (Breitrose)

144. Photojournalism and the Art of Documentary—(Same as Undergraduate Special 34. See Innovative Academic courses.) Intended to familiarize students with the work of the world’s greatest documentary photographers and photojournalists and to introduce techniques required to practice photojournalism. Combines the appreciation of the great works within the photographic tradition with the practice of the technical aspects of making a photographic essay.

3 units, Aut, Win, Spr (Davis)

150. Magazine Writing—(Graduate students register for 250.) Practice in writing magazine articles, with emphasis on marketing manuscripts. Conferences. Prerequisite: 100.

4 units, Spr (Rivers)

3 units, Sum (Staff)

157. Public Information Programs— (Graduate students register for 257.) Emphasizes health information programs and their effects on public knowledge, attitude, and behavior; also information programs concerned with energy conservation, environmental protection, educational and occupational opportunity, consumerism, etc. The interplay of research and fieldwork will be analyzed in case studies of successful programs.

3 units, Spr (Staff)

162. Seminar: Media and Politics—(Same as Political Science 194D.) Examines the links between mass media and government, on the one hand, and between media and the individual citizen, on the other. Via of the relevant literature, questions of the role of the organization of the media in the formation of news, biases, and the effects of media on individual “agenda,” attitudes and behaviors are explored.

5 units, Spr (Brody)

169. Interactive Communication Technologies — (Graduate students register for 269.) Surveys the development of videotext, teletext, interactive cable, and microcomputers as communication systems and tools. Analyzes technological, social, economic, and political effects. Compares the American experience with European and Japanese experience. Prerequisite: I; Computer Science.

*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 from the media, and how their behavior is influenced by the media. Prerequisite: Communication 1 or equivalent. (DR:4)

4 units, Win (Roberts)

171. Communication and Children II— (Graduate students register for 271.) Continuation of 170. Open to a limited number of students by consent of instructor.

3 units, Spr (Roberts)

173. Communication and Heath—(Graduate students register for 273.) Seminar on campaigns designed to change information attitudes and behavior with particular reference to health.

4 units, Spr (Flora)

176. International Communication: Structures and Issues—(Graduate students register for 276.) Comparative survey of different 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: Communication 1. Seniors and graduate students in communication and international relations have first priority, with permission of instructor.

4 units, Win (Abel) not given 1986-87
177. Specialized Workshops — (Graduate students register for 277.) One or more classes will be offered in specializations such as Science Writing, Sports Writing, or other areas. Organized around writing projects oriented toward the field of specialization.

177B. Specialized Workshop: Science Writing — (Graduate students register for 277B.)
4 units, Spr (Lewenstein)

178. Media Management — Designed to acquaint students with 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. Examines the interplay between editorial and business decisions.
4 units, Spr (Lewenstein) not given 1986-87

180. Film Criticism — (Graduate students register for 280.) Attempts a critical view of film. Readings and discussion consider models of artistic and literary criticism as points of comparison. The student is introduced to journalistic, psychoanalytical, Marxist, structuralist and semiological approaches. Weekly reviews stress the meaning of the films and a lucid writing style. Prerequisites: 100, and 101 or 141.
4 units, Spr (Breitrose)

185. Internship Experience — Professional experience in the media. Open only to Communication majors.
0 units graduate students; 1-4 units undergraduate students, Aut, Win, Spr (Lewenstein) by arrangement

190. Senior Project — A research project, or production of a finished piece of work in journalism or film. A combination of the senior project and an internship is possible. Senior standing required.
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. Prerequisite: Typing speed of 35 words a minute. For graduate students.
5 units, Aut (Lewenstein)

208. 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.)

203. Precision Journalism — (Graduate section. See 103.)

9 units, Sum (Mayes)

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)

209S. Broadcasting News Workshop — Production and direction of news and documentary television programs. Prerequisite: Consent of instructor.
9 units, Sum (Staff)

210. Communication Media and the Law — (Graduate section. See 110.)

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 — Analysis of the techniques and strategies of films designed to effect attitudinal and behavioral change. Prerequisite: Consent of instructor.
4 units, Aut (Breitrose)

223A. Documentary Film Writing and 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 Writing and 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 Writing and Directing III—Final quarter of study in film writing, producing and directing. Includes further examination of film structures, and practical training in fundraising and distribution. Taken concurrently with 224C. Prerequisite: 223B.
5 units, Spr (Samuelson)

224A. Film Production I—First quarter of a three quarter sequence leading to professional training in motion picture production. Super 8 exercises and a short 16 mm non-synchronous film with sound track comprising narration, music and sound effects. Prerequisite: Concurrent registration in 223A.
5 units, Aut (Alexander) and tutorials by arrangement

224B. Film Production II—Produce a short 16 mm film in color utilizing synchronous sound. Project 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)

230. International Telecommunication Agreements—(Same as Engineering 205.) Examination of the International Telecommunication Union (ITU) as a model for worldwide collaboration in resource allocation, standardization, and planning of services. Interdisciplinary focus on outcomes achieved by voluntary agreement. Case studies of ITU action, particularly in new services. Lectures and study projects.
3 units, Sum (Wallenstein)

231. Media Ethics and Responsibilities — (Graduate section. See 131.)

232. Current Progress in Worldwide Telecommunications—(Same as Engineering 213.) A seminar format survey of trends in worldwide standardized services. Examined are 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. Use Engineering Economic Systems 292.
1-3 units, Win, Spr (Wallenstein) by arrangement

235. Research Methods for Journalists—Course provides a conceptual grounding in research question development appropriate to the specific needs of journalists. Conceptual skill development is integrated with the use of documentary research tools such as the computerized data base, census reports, statistical abstracts and government documents.
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.)

244. Marketing Research Methods—(Same as Business 344.) Helps students determine the applicability and evaluate the use of marketing research; to become familiar with the foundations of disciplined inquiry and inference; and to develop clearer insight into the analytical principles that underly modern marketing research methods. Current concepts and trends in data collection, measurement, scaling, data analysis (including multivariate analyses), and the interpretation of findings from surveys and field experiments.
4 units, Win (Sherrill)

249. Communication Law—(Same as Law 149.) Introduces non-law students to mass communication law and policy, especially legal issues of importance to journalists; access to the media, libel, privacy, shield laws, trial coverage, censorship, obscenity, pornography and antitrust cases; and with the regulation of the tele-communications industry by the FCC.
5 units, Spr (Franklin) MWF 11-12:20

250. Magazine Writing — (Graduate section. See 150.)

251. Communication and Development—A critical review of the literature on the causes of underdevelopment, the nature of development planning, and the potential and practice of media in Third World countries as a tool of transformation.
3-5 units, Aut (Staff)
252. Communication Theory and Social Change—Required for A.M. students in journalism and in Applied Communication Research. Surveys theories of the process and effects of mass communication, and looks at research which applies them to problems of the mass media and social change.
5 units, Win (Reeves)

253. Evaluation Research Methods—(Same as Education 214.) Nature of summative and formative evaluation and evaluation designs, problems of field work, construction of instruments, questions of methodology, data analysis, and utilization of results. Prerequisites: Basic statistics, Communication 206 (or equivalents).
3-5 units, Win (Flora)

257. Public Information Programs — (Graduate section. See 157).

259. Interactive Communication Technologies—(Graduate section. See 169.)

260. Communication and Children I — (Graduate section. See 170.)

261. Communication and Children II — (Graduate section. See 171.)

263. Communication and Health—(Graduate section. See 173.)
4 units, Spr (Flora)

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 (Risser)

276. International Communication: Structures and Issues — (Graduate section. See 176.)

277. Specialized Workshops — (Graduate sections. See 177.)
1-3 units, Aut (Staff)

278. Media Management—(Graduate section. See 178.)

280. Film Criticism — (Graduate section. See 180.)

290. A.M. Project.
4 units, any quarter (Staff) by arrangement

298. Thesis.
6-10 units (Staff) by arrangement

299. Individual Work.
1-4 units, any quarter (Staff) by arrangement

PRIMARILY FOR Ph.D. STUDENTS

311A. Theory of Communication—Approaches to communication theory; seminar and tutorial meetings; extensive reading and papers. Required of all Communication doctoral students; others by consent of instructor.
4-5 units, Aut (Roberts, Nass)

311B. Theory of Communication—Continuation of 311A with emphasis on communication theory. Prerequisite: 311A.
4-5 units, Win (Reeves, Nass)

313. Introduction to the Use of the Computer—Specifically for social science data analysis. Includes a brief discussion of computing concepts, followed by use of WYLBUR and EDIT, text editors on SCIP and LOTS systems; SPSS; and data storage.
1-3 units, Aut (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 noneperiments. 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)

319. Doctoral Research Methods III—Continuation of 318. Selected multivariate models of importance to communication research, non-experimental 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 (Reeves) by arrangement

371. Advanced Communication Theory and Method Seminar II—May be repeated for credit. Topic and instructor change each year. Prerequisite: 311A and 319.
3 units, Win (Staff) by arrangement

372. Advanced Communication Theory and Method Seminar III—May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.
3 units, Win (Staff) 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
COMPARATIVE LITERATURE

Committee in Charge: John Bender, David Wellbery (Co-Chairmen), Russell Berman, N. Gregson Davis, Joseph Frank, John Freccero, René Girard, Herbert Lindenberger, Mary Pratt, William Todd, John Winkler

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 Lindenberger (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: Mary Pratt (Spanish and Portuguese and Comparative Literature), David Wellbery (German Studies and Comparative Literature)

Assistant Professor: Sandra E. Drake (English and Comparative Literature)

The interdepartmental program in Comparative Literature admits students for the Ph.D. It works toward the Ph.D. in individual language departments and, in conjunction with the Humanities Honors Program, offers a concentration in Comparative Literature for undergraduates.

UNDERGRADUATE PROGRAM

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 an average 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 Humanities 194.

4. Course distribution should be designed so that students develop an extensive background (six courses covering a large range of periods) in a single national literature read in the original language. Students may fulfill this requirement through work either in the English department or in one of the language departments.

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 language.

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, junior year; 5 units, autumn; 5 units, winter, senior year). A grade of at least B is required on the essay for graduation with Honors in Humanities.
9. Two courses related to the student's total program, but drawn from disciplines outside literature.

GRADUATE PROGRAM

DOCTOR OF PHILOSOPHY

The Ph.D. program is designed for a small group of students whose linguistic background, breadth of interest in literature, and curiosity about the problems of literary scholarship and theory (including the relation of literature to other disciplines) make this program more appropriate to their needs than the Ph.D. in one of the individual literatures. Students will take courses in at least three literatures (one of which may be English), to be studied in the original languages. The program is designed to encourage familiarity with the major approaches to literary study prevailing today.

Before starting graduate work at Stanford, students should have completed an undergraduate program with a strong background in one literature and some work in a second literature studied in the original language. Since the program demands an advanced knowledge of two foreign languages and a reading knowledge of a third foreign language, students should at the time of application have a sufficiently advanced knowledge of one foreign language so that they will be able to take graduate level courses in that language when they enter the program. They should also be making sufficient progress in the study of a second foreign language so that they will be able to take graduate courses in that language no later than the beginning of the second year, but earlier if possible. Applicants are expected to take an intensive course in the third foreign language before entrance.

A considerable part of a student's work will consist of individual study toward the Ph.D. examination, for which each student uses his or her own reading lists. The examination is centered not on national lines, but on the study of particular periods, genres, and problems of literary study. Students are admitted to the program as Comparative Literature Fellows on a plan which attempts to integrate their financial support and their completion of residence requirements with training as prospective university teachers. Tenure as a Fellow, assuming satisfactory academic progress, will be for a maximum of four years (graduate-level work in literature completed elsewhere being counted as part of this four-year period). The teaching requirement is the same regardless of financial support. For specific teaching requirements, see below. Although financial support is limited to four years, the 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 1987. Completed applications are due January 1, 1987. Because of the special nature of comparative literature studies, the statement of purpose included in the application for admission should contain the following information besides the general plan for graduate work called for on the application:

1. A detailed description of the applicant's present degree of proficiency in each of the languages he or she has studied, indicating the languages in which he or she is prepared to do graduate work at present and outlining plans to meet additional language requirements of the program.

2. A description of the applicant's areas of interest (for instance, theoretical problems, genres, periods) within literary study and the reasons for finding comparative literature more suitable to his or her needs than the study of a single literature. Applicants should also indicate what they think will be their primary field.

Applicants should arrange to have the results of the Graduate Record Examination sent to the Graduate Admissions Office. They should take both the aptitude and achievement parts of the examination. The achievement section should be taken in the primary field in which applicants expect to work within the Comparative Literature program. If the primary field is not that of their undergraduate major, applicants may take the examination in the field of their major.

Recommendations should, if possible, come
from faculty in at least two of the literatures in which the student proposes to work.

Applicants must submit a copy of one of their undergraduate term papers which they consider representative of their best work.

**Requirements**

**Residence**—A candidate for the Ph.D. degree must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the Bachelor of Arts degree three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the Bachelor of Arts degree. The student will be expected to offer at least 72 units of graduate work in addition to the doctoral dissertation. At least three consecutive quarters of course work must be taken at Stanford.

**Languages**—Students must know three foreign languages, two of them sufficiently to qualify for graduate courses in these languages and the third sufficiently to demonstrate ability to read a major author in this language. One of the three languages must be French or German, and one of the other two must be Latin (for which Greek, Chinese, or Japanese may be substituted when appropriate), if the period in which the student concentrates is earlier than the Romantic period. Students’ language preparation must be sufficient before entrance so that they can take a graduate level course in at least one foreign language during their first year and in the second during the second year. Students must demonstrate a reading knowledge of the third foreign language no later than the beginning of the third year.

Of the three literatures in which a student takes courses, no more than two may be in the same department at Stanford. Literatures written in the same language (such as Spanish and Latin-American) are counted as one in the planning of the student’s program. One of the student’s three literatures will be designated as the primary field; the other two as secondary fields.

**Teaching**—All Fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at halftime and one quarter at quarter time. Comparative Literature Fellows must complete what ever pedagogy courses are required by the departments in which they teach.

**Minimum Course Requirements**

1. Comparative Literature 369 and three additional seminars (or courses that assign a long paper) of a primarily comparative nature; at least one of these additional seminars must be on literary theory or criticism.

2. At least three graduate courses in each of two literatures other than the student’s native literature.

3. A sufficient number of courses in the student’s primary field to assure his or her knowledge of the basic works in one national literature from its beginnings until the present day.

Minimum course requirements must be completed before the student is scheduled to take the University oral examination. These requirements are kept to a minimum so that students will have sufficient opportunity to seek out new areas of interest.

**Examination**—The third and last section of the examination 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 colloquium 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—that predict strong promise for their dissertations and future careers as scholars and critics. As soon as the student has completed the qualifying procedures, the chairman will recommend him or her for admission to candidacy for the Ph.D. At this time the student will also be recommended for the A.M. in Comparative Literature if he or she has completed 36 units of work at Stanford and has not already completed an A.M. before entering the program.

Dissertation—The student will present a dissertation proposal as part of the University oral examination. Successful completion of the examination will constitute approval of the proposal. Members of the dissertation reading committee will ordinarily be drawn from the University oral examining committee.

Ph.D. MINOR

Students interested in the minor should apply for admission to the individual departments of literature. They may apply to the 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 are made with written epics such as Virgil's Aeneid and later works.

3-4 units, Spr (Davis)

12. Greek Tragedy: Aeschylus, Sophocles, Euripides—(Enroll in Classics 12.)

3-4 units, Win (McCall)

32A. The Culture of Modernism in Austria and Germany—(Enroll in German Studies 32A.) The birth of modernism in Vienna at the turn of the century and in the Weimar Republic, with emphasis on literature, music, painting, and architecture. The connections to broad intellectual and historical developments. Examination of the works of Hofmannsthal, Mahler, Freud, Schönberg, Kandinsky, Gropius, Brecht, and Mann.

3 units, Win (Wilke)

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, Aut (Andersson)

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, Conrad, Woolf, Faulkner, and selected 19th and 20th century poems.
   5 units, Spr (Lindenberger, Staff)

64. Introduction to Chicano Life and Culture—(Enroll in History 64.)
   5 units, Camarillo, Ibarra-Frausto, Rosaldo

90. Introduction to the Humanities—(Enroll in Humanities 90.) Basic themes and issues of the humanities as treated in important works. Various humanistic disciplines, including texts from the Western Culture courses are re-examined in greater depth. Prerequisite: Completion of the Western Culture requirement. Honors majors given preference in enrollment.
   5 units, Aut (Mueller-Vollmer)
   Spr (Yearley)

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 1987-88

113. Art, Religion and Society in Late Antiquity—(Enroll in History 113.)
   5 units, Aut (MacCormack)

136B. European Thought in the 20th Century—(Enroll in History 136B.)
   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 Tests II; Renaissance to Romantic—(Enroll in Drama 151.) Selected texts from Shakespeare, Jonson, Corneille, Racine, Moliere, Eycherley, Congreve, Sheridan, Goldsmith, Goethe, Schiller, Kleist, Buechner.
   4 units, Win (Rayner)

152. Major Dramatic Tests III: Early Realistic to the Present—(Enroll in Drama 152.) 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 157.) An examination of the dramatic, 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 from which the course proceeds; also explores diversity among the various societies represented.
   4 units, Spr (Richards)

161. Spanish American Literature I—(Enroll in Spanish 161.) Reading major works of Latin American literature.
   3-5 units, Win (Pratt)

163H. Contemporary Issues in Literary Theory—(Enroll in English 163H, Feminist Studies 102.)
   5 units, Win (Gagnier)

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 will address the class.
   5 units, Spr (Felstiner)

165C. The Reciprocal Vision—(Enroll in English 165C.) How Americans and Europeans have perceived and portrayed each other in fictional and non-fictional works from the eighteenth century to the twentieth. Enrollment limited to 15; priority to International Relations majors.
   5 units, Win (Evans)

178. Performance of Lyric Poetry—(Enroll in Asian Languages 178.) The nexus between author and reader in a literary work has become a major point of controversy in contemporary critical theory, one particularly appropriate for investigation from the perspective of performance. This course takes the performance of
literary text as its central task, and 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 students.

3 units, Spr (Hare)

194. Literature and the Humanities—(Enroll in Humanities 194.)
5 units, Spr (Lindenberger)

207. Sense of Identity in Modern Women Writers—(Enroll in Modern Thought and Literature 207.) An examination of French and American female writers whose sense of identity is related to their creativity, sexuality, maternity, work, and social class.
5 units, Spr (Yalom)

211. The Spanish Golden Age—(Enroll in Spanish 211.) An overview of 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)

234D. Critics of America—(Enroll in American Studies 204, English 234D.) A study of writers, part of whose concern was an explicit critical investigation of the culture of the United States. Writers of both the nineteenth and twentieth centuries are included in what concerns, if any, are held in common by the critics. Most likely to read will be de Tocqueville, Whitman, Thoreau, George Santayana, Henry Adams, Daniel Bell, Susan Sontag, Norman Mailer, Gore Vital.
5 units, Spr (Chace)

240. Afro-Hispanic Cultural Worlds: An Introduction—(Enroll in Spanish and Portuguese 240.) An overview of the literature and thought of Black Latin American writers in the Spanish-speaking Americas as well as in Brazil. An introduction to the popular syncretic cultures of these interesting but as yet little-known worlds. Readings in Spanish/Portuguese, and in English translation.
3-5 units, Spr (Wynter)

241-243. The series is designed to acquaint students with the history of German thought from 1750 to the present and its significance for an understanding of modern culture. Authors to be studied include Herder, Hegel, Schiller, Marx, Nietzsche, Freud, Husserl, Wittgenstein, Marcuse, and Adorno. Note: This series will be given in German in alternate years (in German 1986-87).

241. Deutsche Geistesgeschichte I—(Enroll in German Studies 241.) From Lessing to Romanticism. Delineates the conceptual field within which, from the middle to the end of the eighteenth 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 (Mueller-Vollmer)

242. Deutsche Geistesgeschichte II—(Enroll in German Studies 242.) From Hegel to Nietzsche. The outlines of Hegel's phenomenology and his model of historical development as the becoming-conscious of freedom. The transformations of this model in the cultural criticism of Heine, the anthropology of Feuerbach and the dialectical materialism of Marx and Engels. Nietzsche's radical critique of the idea of the nature of man and of his historical self-actualization.
3-5 units, Win (Wilke)

243. Deutsche Geistesgeschichte III—(Enroll in German Studies 243.) From Nietzsche to the present. Texts by Nietzsche, Husserl, Freud, Heidegger, Benjamin, Adorno, and Habermas with special emphasis on aesthetic problems and their relationship to social theory. This introductory course emphasizes the development of the Frankfurt School. Shorter essays on aesthetics will indicate possible applications to literary theory.
3-5 units, Spr (Berman)

246. La Poesia Vanguardista HispanoAmericana—(Enroll in Spanish 246.) Main trends and tendencies in the evolution of Vanguard poetry and poetic theory in Latin America.
3-5 units, Spr (Ruffinelli)

247. Freud and Criticism—(Enroll in German Studies 247.) An examination of selected texts by Freud with reference to issues of interpretation, language, sexuality, and civilizational history. Readings in German and English.
5 units, Win (Berman)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought and Cultural Worlds—(Enroll in Spanish 248, same as African and Afro-American Studies 248.) A general introduction to 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)

3-5 units, Aut (Ruffinelli)
254. Spanish American Writings of the 20's and 30's: Vanguardismo, Regionalismo, Feminismo—(Enroll in Spanish and Portuguese 254.) A study of these three developments in culture, in connection with processes of urbanization, modernization and North American expansionism. 3-5 units, Aut (Pratt)

255A. The Nature of Literature: Japanese and Western Views—(Enroll in Asian Languages 255A.) An attempt to study different attitudes toward literature in Japan and in the West. Among the books to be discussed are Soseki's The Three-Cornered World, Kawabata's Beauty and Sadness, Tanizaki's Some Prefer Nettles, and Mishima's The Temple of the Golden Pavilion. 5 units (Ueda) given 1987-88

255B. Chinese and Western Poetics—(Enroll in Asian Languages 255B.) Study of traditional Chinese theories of literature in comparison with Western ones. Seminar with limited enrollment. 5 units, Win (Staff)

260. Friedrich Holderlin: Philosopher and Poet—(Enroll in German Studies 260.) His thought in relation to German idealist philosophy (Fichte, Schelling, and notably Hegel) and the development of his poetics and poetic discourse. To be read: Hegel, some early writings, and "Preface" to the Phenomenology; Holderlin, major theoretical statements, Hyperion, selected poems from the early period to the late hymns. Open to graduates and advanced graduates. 3-5 units, Spr (Mueller-Vollmer, Foerster)

261. Victorian England—(Enroll in English 261.) The social pleasures of Victorian autobiography. 5 units, Aut (Gagnier)

262. The Symbolist Poets—(Enroll in French 262.) Baudelaire, Mallarmé, Verlaine, Rimbaud, Yeats, George, etc. Lectures and discussions in English, readings in original language and/or bilingual editions. 4 units, Spr (Cohn)

263A. Seminar in Feminist Studies—(Enroll in English 263A, Feminist Studies 103/203.) Advanced course on feminist theory and research. Some of the topics: the politics of sexual identity; race, class and ethnicity as feminist issues; non-academic literary criticism (grounded in movement publications and anthologies). Prerequisite: Written application and permission of instructor. For graduate students. 5 units, Aut (Rich)

265. Figures of Imagination and Desire in Film and Literature—(Enroll in English 265.) Can we imagine narratives without characters or coherent selves at the centers of them? Through an examination of a number of 20th century literary and cinematic works, we explore situations in which characters disperse or fragment themselves, withdraw from expression or scrutiny, or lapse out of existence altogether. What can these acts of self-erasure, self-destruction, or self-proliferation tell us about self-expression in life and in art? 5 units, Aut (Carney)

266. The Culture of Fear in Latin America—(Enroll in Spanish and Portuguese 266.) Explores facets of Latin American cultural production under the restrictive conditions imposed by the authoritarian military regimes of the 1950's and 80's, especially in Brazil and the southern cone. Poetry, novel, lyrics and film will be examined, focusing on the uses of testimony, allegory, parody, and humor and 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, Win (Hollanda, Pratt)

268. E.T.A. Hoffmann—(Enroll in German Studies 268.) Intensive study of Hoffmann's work with special reference to Hoffmann's relation to romantic ideology; narratological questions raised by Hoffmann's texts; and psychological and psychoanalytic readings of Hoffmann. Situates Hoffmann's work in terms of issues in contemporary literary theory. 3-5 units, Aut (Wellbery)

269. Memory and Modernity: Representing the Past and Theorizing Culture Since the French Revolution—(Enroll in French 269.) Evolutions in the forms of social memory under the new conditions of liberal, industrial society since the 19th century. How the new configuration of memory played a role in the generation of modern cultural theory. 19th century literary and historical texts (Flaubert, Musset, Marx, and Michelet), and 20th century theoretical texts (Bakhtin, Bourdieu, Foucault, Derrida, Lyotard). Reading knowledge of French assumed; discussion in English. 4 units, Spr (Terdiman)

276A. European Novel IV: The Realists—(Enroll in German Studies 276A.) Special attention to the longterm repercussions of Romanticism and the struggle to establish a Realist approach in fiction; the transition from Romantic Realism to Positivism and Naturalism, the rise of the
expressions (opera, painting, etc.) of their age. The final approximately 6 works will be drawn from such writers as Balzac, Flaubert, Zola, Dostoevski, Gogol, Turgenev, Tolstoy, Meyer, Stifter, Fontane, Schnitzler, Dickens, Eliot, Trollope, Howells, Caldos.

277. Joseph Conrad—(Enroll in English 277.) Study of some of Conrad’s major works; a little biography and criticism.
5 units, Spr (Watt)

284A. Joyce, Proust, Mann I—(Enroll in German Studies 284A.) Themes, structures and mythopoetic dimensions of the novel in the context of Modernism. Views on Joyce, Proust and Mann as synthesizers and interpreters of the historical situation (“decline of the West,” contending-isms, etc.), forms of consciousness (Bergson, Nietzsche, Freud, Jung, et al.) and artistic expressions (opera, painting, etc.) of their age.
3-5 units, Aut (Gillespie)

285C. Gertrude Stein and Ezra Pound—(Enroll in English 285C.) The "revolution of the word" as conceived by these two great innovators. In the case of Stein, emphasis will be on the early works, Three Lives, The Portraits, Tender Buttons and on the autobiographies (approximately four weeks); in the case of Pound, two weeks on the earlier work, four on the Cantos.
5 units, Win (Perloff)

288C. Yeats and T.S. Eliot—(Enroll in English 288C.)
5 units, Aut (Lindenberger)

291A. Literature of Decadence—(Enroll in German Studies 291A.) Symbolist, fin de siècle, and modernist understandings of the evolution of civilization; the themes of intellectual and spiritual crisis, the "decline of the West," and "art for art's sake" in European poetry, drama, and fiction during the decades 1880-1930; the impact of decadence on modern art and thought ("art nouveau," "Jugendstil," neo-Rosicrucianism, Wagnerism, "dissociation of sensibility," "superman," etc.)
3-5 units, Win (Perloff)

298A. Undergraduate Colloquium: Literature as Institutions—(Enroll in History 298A.)
5 units, Win (Kahn)

300A. Graduate Seminar: Literature as Institutions—(Enroll in Slavic Languages and Literatures 300A.)
4-5 units, Spr (Todd)

303A. Colloquium: Literature and Ideas from Swift to Wollstonecraft—(Enroll in English 303A.)
5 units, Aut (Bender, Carnochan)

304. Colloquium: Romanticism and History—(Enroll in English 304.) Readings of Wordsworth, Byron, Shelley, and Keats in the light of their interpretations and displacements of history. Romantic texts read next to such theorists of history as Burke and Hegel, as well as recent critics working toward a new historical and ideological critique of the period.
5 units, Aut (Lindenberger)

305. Colloquium: Literature of World War I—(Enroll in English 305.)
5 units, Win (Stone)

306. Introduction to Literary Theory and Criticism—(Enroll in Spanish 306.) Initial readings in the major currents of 20th century literary theory and criticism in roughly chronological organization, 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, Aut (Pratt)

306A. Afro-American Women Novelists—(Enroll in English 306.) The emergence and development of Afro-American women’s fiction with emphasis on the modern period in historical context. Issues addressed include how the position in U.S. society of the Afro-American women in particular 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 twenty-five 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: Major Modern Critics—(Enroll in English 307A.) A study of diverse perspectives and systems that have played a seminal role in the development of modern critical theory. Readings include, among others, Frye, Lukács, Benjamin, Auerbach, Barthes and Derrida.
5 units, Aut (Halliburton)

307B. Colloquium: The Poetry of Postmodernism—(Enroll in English 307B.) The theory and practice of postmodern poetry from World War II to the present (from Robert Lowell and Elizabeth Bishop to the "language" and "performance" poets). How and to what extent does the poetry of the second half of our century diverge from the Modernist paradigm? The aim is less to "survey" the field than to understand poetic language, mode, and genre in relation to historical change.
5 units, Spr (Perloff)
329. Rhetoric Semiotics and Contemporary Italian Literature—(Enroll in Italian 329.)
4 units, Spr (Allen)

335. Dante’s Divine Comedy: Inferno—(Enroll in Italian 335.) Intensive study of the first canticle of Dante’s masterpiece.
4 units, Aut (Jacoff)

4 units, Win (Freccero)

337. Dante’s Divine Comedy: Paradiso—(Enroll in Italian 337.) Intensive study of the third and final canticle of Dante’s masterpiece.
4 units, Spr (Freccero)

340. Boccaccio’s Decameron—(Enroll in Italian 340.)
4 units, Spr (Schnapp)

345. Petrarch and Petrarchism—(Enroll in Italian 345.) Readings from the Canzoniere, Epistolae, De Vita Solitaria and Secretum, studied in relation to later developments in Petrarchan poetics in Italy (Ariosto, Gaspara Stampa, Tasso), Spain (Garcilaso, Quevedo, Gongora), England (Sidney, Shakespeare), and France (Ronsard). Major topics: Petrarch and Dante, Petrarch and the aesthetics of fragmentation, Pietro Bembo and the Petrarchan canon.
4 units, Spr (Freccero)

349H. Herder and Humboldt on Language and Culture—(Enroll in German Studies 349H.) An introduction to some of their major writings on the study of language as key to an understanding of culture and society. Their positions are examined in relation to major 18th century theories of language, 19th century linguistics, and to some of the important issues in 20th century theories of culture and of language.
3-5 units, Win (Mueller-Vollmer)

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. Selected topics in literary reinterpretations of ancient myths (e.g., Prometheus, Oedipus, Dionysos, Venus). Remythicizing of the Biblical and Christian past and the Renaissance (e.g., Cain, Satan, Mary Christ; Faust, Hamlet, Don Juan). Dominant archetypes in contemporaneous Romantic fictions.
3-5 units (Gillespie) given 1987-88

350. The Italian Renaissance—(Enroll in Italian 350.)
4 units, Win (Harrison)

352. Seminar: Comedy—(Enroll in Drama 352.)
5 units, Aut (Lyons)

355. Michelangelo: The Poet and the Artist—(Enroll in Italian 355.) An interdisciplinary seminar which examines 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 both in Michelangelo’s poems and his art work. Readings include Plato’s Symposium, Michelangelo’s Poems, and writings by Panofsky. Open to all students.
4 units, Spr (Harrison)

3-5 units, Win (Alegria)

3-5 units, Spr (Alegria)

360A. History of Literary Theory (Ancient)—(Enroll in English 360A.) A graduate reading and lecture course.
5 units, Aut (Trimpi)

360B. History of Literary Theory (Medieval/Renaissance)—(Enroll in English 360B.) A graduate reading and lecture course.
5 units, Win (Trimpi)

5 units, Aut (Berman)

362. Seminar on the Italian Baroque—(Enroll in Italian 362.) An interdisciplinary study of the poetics of the Baroque in literature, theater, architecture, sculpture, painting and music. Special attention is given to the historical context of the counter-Reformation and to the public and political dimensions of the Baroque.
esthetic. Figures studied include Tasso, Marino, Chiabrera, Bernini, Borromini, and Monteverdi.

4 units, Spr (Springer)

369. The Structuralist Paradigm and its Transformation—(Same as English 369, German Studies 346.) The elaboration of the structuralist paradigm in the work of Saussure, Jakobson, and Lévi-Strauss; its redactions in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault).

5 units, Win (Bender, Wellbery)

375. Dostoevsky and French Literature—An exploration of Dostoevsky’s relations with French literature, both as a source of inspiration for his own work and as himself inspiring modern French writers. Notes from Underground and Crime and Punishment are read along with works by Diderot, Balzac, Gide, Camus and Sartre.

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

381. Novels into Film—(Enroll in Italian 381.) A close comparative analysis of five contemporary Italian novels and their film adaptations. Considers questions of broad theoretical interest (narrative structure in fiction and film; point of view; the language of cinema; the limits of cinematic expression) as well as the social and historical context of these exemplary 20th century narratives. Authors for 1986-87 include Lampedusa, Moravia, Bassani, and Levi; directors include Visconti, De Sica, Bertolucci and Rosi. All films are in Italian with English subtitles. Open to all students, including freshmen.

4 units, Win (Springer)

391D. L’art plastique et le récit au 19e siècle—(Enroll in French 391D.)

2 units, Aut (Serres)

391E. Le Temps et le récit au 17e siècle—(Enroll in French 391E.)

2 units, Spr (Serres)

454. Graduate Seminar: Culture and Ideology in 19th Century America—(Enroll in History 454.)

5 units, Spr (Fredrickson)

DRAMA

Emeriti: (Professor) Wendell Cole, Eleanor Prosser, (Associate Professors) Helen W. Schrader, H. Donald Winbigler, Elisabeth Buckingham, (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 Bayner, Sandra L. Richards (Drama and Black Performing Arts), John B. Wilson

Associate Professor (Teaching): Michael Ramsaur

Senior Lecturers: Patricia Ryan, Juan Valenzuela, 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. Students are encouraged to declare their major in their sophomore year.

The core program required of all majors:

1. Acting—Fundamentals of Acting: Drama 120A.
2. Literature and Criticism—Drama 50, Introduction to Drama and Drama 150, 151, 152, Major Dramatic Texts.
3. Theatre History—History of the Theatre: Drama 160 or Drama 161.
4. Design and Production—Introduction to Design and Production: Drama 30, Drama 31, and Drama 32.
5. Drama 170, Introduction to Directing.
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, Drama 39A, Drama 39B, and Drama 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 Theatre History.

Normally the student will prepare the Honors project proposal in Spring Quarter of the junior year. 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 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, State 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 with a letter grade indicator of A−: Drama 30, Drama 31, Drama 32, and two of three specific 130 level courses plus one other course.
   b) The student must have completed work on a significant design project on a Drama Department production or project, or given a special portfolio review by the D/TP faculty.
   c) The student must receive the approval of the D/TP faculty.

4. Dramatic Literature, Criticism, or Theatre History—The student must have taken three courses (two for the theatre history track) in dramatic literature at the 100 level, one of which may be from another department; one course (two in the theatre history track) in theatre history (Drama 160 series); and Drama 50, Introduction to Drama. The student must have the approval of the dramatic literature faculty.

Upon acceptance into the Honors Program and approval of the proposal by the student's advisor and the committee on Academic Policy, the student will be formally admitted to the program and be assigned a second reader. The 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 should extend over at least two academic quarters and must 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 Theatre 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 and has the responsibility to administer all aspects of the production. 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 after the production, a copy of the prompt book and a paper, supporting the honors project, that discusses the pre-production research, the directorial concept, the specific problems encountered during the rehearsal period, and a brief retrospective analysis. The paper will be read by the student’s advisor and a second reader.

In Design or Technical Production—Once the Honors Program 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 stu
dent 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. This paper will be read by the students advisor and second reader for approval.

In Dramatic Literature, Criticism, or Theatre History—In the Spring Quarter of the junior year, the student must submit a research proposal with the endorsement of an advisor from the Drama faculty. The completed honors essay must be submitted to the advisor and second reader no later than the first week of the final quarter before graduation.

Upon successful completion of the project, candidates for Honors will be awarded “Honors,” “High Honors,” or “Highest Honors.”

HUMANITIES

An Honors Program in Humanities is available for majors of this department who wish to supplement their departmental major by a related and carefully guided program of studies. See the section “Humanities Special Programs” for a description of the Honors Program. Students 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.”

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 theatre 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 theatre experience and a sample of their written critical work. Applicants for the program in design and theatre 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.
5. A minimum of four seminars in dramatic literature, theatre history, or critical theory. One of the graduate seminars is to be taken outside of the Department of Drama.
6. Two years in the series in directing. Students in criticism/directing must complete the first-year and second-year workshop in directing (370A, B and 371A, B, C) 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).
4. Graduate Directing Workshop sequence (370A, B).
5. 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).
6. Graduate Design Workshop sequence: Design Tutorials (330); Design Workshop (331A, B, C); two design projects, one in setting (372A) and one in either costume or lighting design (372B).

LANGUAGE REQUIREMENTS

The candidate must demonstrate reading knowledge of two foreign languages in both of
which there is a major body of dramatic literature. The language requirement may be fulfilled in any of the following ways:

1. Achievement of a sufficiently high score (70th percentile) on the foreign language examination prepared by the Educational Testing Service. Latin and Greek are not tested by ETS.
2. A reading examination given each quarter by the various language departments, except for Latin and Greek.
3. Passage with a grade of B or higher of a course in literature numbered 100 or higher in a foreign language department at Stanford.

The requirement in one language is to be met by the end of the first year. The requirement in the other language must be met by the end of the third year.

TEACHING REQUIREMENT

Three quarters of supervised teaching at halftime 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/CритICISM

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 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/TEATRE 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
- Contemporary, 1918 to present

Students in Design/Theatre History will be required to take two examinations in Theatre History (Classical to 18th century; 1800 to present); one in dramatic literature in a period of their choice; and a theoretical design project examination. The core reading list of dramatic texts for each period is available. Each student, however, is to submit a critical bibliography to his or her advisor for approval the quarter prior to the quarter in which the examination is taken.

Students are urged to take examinations as early as possible, e.g., one in the first year, two in the second, and one in the third. At least two examinations—one written and one oral or, in exceptional circumstances, two written—must be completed by the end of the second year of residence. During the first year, the student will select one of the four examination topics on which he or she wishes to be examined orally. If the student’s individual program permits, this departmental oral examination should be completed by the end of the second year, before Application for Candidacy (see below).

A University oral examination is to be taken during Autumn Quarter of the fourth year. This examination will cover (1) the field of 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 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 for-
m: 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.

SUMMER SESSION

A special brochure is available, with full details of courses given in the summer by the Department of Drama.

COURSES

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.

5. Introduction to Black American Drama—Introductory course tracing the development of Black Drama in the United States from 1858 to the present.

4 units, Spr (Richards) MWF 10

20. Introduction to Acting—Exercises and improvisations to develop ease, freedom, and expressiveness on stage in preparation for the study of acting fundamentals. Includes a weekly acting seminar taught by the performance faculty.

3 units, Aut, Win, Spr (Staff) MWF 12:45-2 or MTTh 12:45-2

25. Voice and Speech for the Actor—Introduces relaxation exercises, techniques of breathing and alignment, and standard American pronunciation. For both the actor and the general student who wishes to develop physical and vocal awareness.

3 units, Aut (Ryan) MWF 9

27A,B,C. Movement for Actors.

27A. Basic movement knowledge and skills for the actor. Improvisation will be stressed.

3 units, Aut (Valenzuela) MW 4:15-6:05

27B. Continuation of basic movement and improvisational skills for the actor. Explore the meaning of words, emotions, imagination through poetry and plays.

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

27C. Continuation of basic movement skills with the emphasis on creating a role through movement and words.

3 units, Spr (Valenzuela) 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 have been cast in departmental productions may receive credit for their participation as actors; one unit for Graduate Directing Workshop projects and 1-3 units for major production (the number of units to be determined by the instructor). May be repeated. No more than 10 units, however, may be counted by drama majors toward graduation requirements of 180 units. Prerequisite: Consent of instructor.

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

30. Introduction to Theatrical Design—A lecture-laboratory course to introduce basic skills of visual communication used in producing stage scenery. Covers both design and construction methods.

3 units, Spr (Stewart, Wilson) MWF 11

31. Introduction to Stage Lighting—A lecture-laboratory course introducing the basic theories of stage lighting. The material is approached from both a technical and an aesthetic viewpoint.

3 units, Aut (Ramsaur) TTh 10-12

32. Introduction to Costume Design and Construction.

3 units, Win (Cleveland, Russell) TTh 10-12

33. Drafting for the Theatre.

3 units (Stewart) alternate years, given 1987-88

34. Stage Management Techniques—A general survey lecture class to introduce students to the production process and the wide variety of duties and responsibilities of a stage manager within that process.

2 units, Aut (Stewart) TTh 9

35. Sound Design for the Stage.

2 units (Stewart) alternate years, given 1987-88

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, Win (Wilson) W 1:15-3:05, alternate years, given 1987-88

37. Costume Construction—A practical "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 Theatre—Development of frechand sketch methods in various media used by designers to communicate visual ideas in both color and black and white. Weekly assignments. Given 1987-88.

39A,B,C. Theater Performance: Crew—Students may 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 a student is awarded 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

50. Introduction to Drama—Introduction to major dramatic forms, concentrating on selected masterpieces in order to develop theatrical sensibility in reading dramatic texts. (DR:2)

4 units, Spr (Rayner) MWF 10

59. Shakespeare—(DR:2)

5 units, Win (Lyons) MWF 9

60. Introduction to Theatrical Style—An introductory course in the development of theatrical style and in the major periods of western culture presented through slides, lectures, and discussions. (DR:2)

4 units, Aut (Russell) MWF 1:15


3 units, Spr (Ramsaur) given 1987-88

INTERMEDIATE

Courses number 100-199 are intermediate courses designed primarily for the major but open to all undergraduates who have the necessary prerequisites.

120A,B,C. Fundamentals of Acting—For the student who wishes 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 are stressed. Students should plan to 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

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 practicum in acting Shakespeare, vocal technique, scanning, and delivery.

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

123. Audition Techniques—For the advanced actor.

4 units Aut (Ryan) M 2:15-5:05

124. Psychology and Drama: Identity and Role—(Same as Psychology 170.) Practicum. 4 units, Win (Ryan, Zimbardo) given 1987-88

125. Advanced Voice Workshop—Exercises in vocal characterization, advanced work in breathing, relaxation, and diction.

4 units, Spr (Lyons) MW 10-12

127A,B,C. Advanced Movement.

3 units (Valenzuela)

127A. 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.

130A. Scenic Design I—The beginning designer is guided through the design process from visual concepts and script analysis through presentation. The class concentrates on drafting and model-building as the primary means of expressing design ideas. Ongoing projects. Prerequisite: 30.

4 units, Aut (Wilson) T 1:15-4:05, plus lab by arrangement

130B. Scenic Design II—Advanced problems in the designing of scenery for a variety of stages. Emphasizes mechanical perspec-
practices, resolved with experimentation, drawings, and written reports. Technical directors for major departmental productions may be assigned from this class. Prerequisites: 133A and 133B, or consent of instructor.

1-4 units, any quarter (Staff) by arrangement

134. 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)

135. 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, given 1987-88

150N. Major Dramatic Texts I: Greek to Renaissance—Selected texts from Aeschylus, Sophocles, Euripides, Aristophanes, Plautus, Terence, Seneca, anonymous medieval playwrights, Marlow, early Shakespeare.

4 units, Aut (Rayner) MTWTh 10

151. Major Dramatic Texts II: Renaissance to Romantic—Selected texts from Shakespeare, Jonson, Corneille, Racine, Moliere, Wycherley, Congreve, Sheridan, Goldsmith, Goethe, Schiller, Kleist, Buechner.

4 units, Win (Rayner) MTWTh 10

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.

4 units, Spr (Esslin) MTWTh 10

153. Greek Tragedy—(Same as Classics 12.)

4-5 units, Win (McCall)

154N. American Drama (1920’s-1950’s)—Survey course focusing on the development of American Drama through an analysis of representative works and stylistic devices. (DR:2)

4 units (Richards) alternate years, given 1987-88

155N. American Drama (1960’s to Present)—Survey course 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, will
be integrated into the course in order to better reflect the actual vitality and diversity of American drama.

4 units, Aut (Richards) MWF 1:15

156. American Women Playwrights—Survey course 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) MWF 1:15

157N. Contemporary Black Playwrights—An examination of 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 from which the course precedes; also explores diversity among the various societies represented. (DR:2)

4 units, Spr (Richards) MWF 1:15

158. Bertolt Brecht.

4 units, Win (Esslin) MWF 11

159A,B,C. Shakespeare—(Same as English 173ABC, see Drama 59.)

159A. 5 units, Aut (Rebholz)
159B. 5 units, Win (Riggs)
159C. 5 units, Spr (Ryan)

160. History of Theatre: Classical Greece to the 18th Century—A lecture course 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 Theatre: 19th and 20th Centuries—A lecture course 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—A lecture-survey course in the history of dress in the Western World from ancient times to the present.

4 units, Aut (Russell) MWF 11

170. Introduction toDirecting—Prerequisites: 120A,B,C or consent of instructor.

4 units, Win (Weber) TTh 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 Essay.

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 2:15-4:30

235. Projects in Design and Technical Production.

1-5 units, any quarter (Staff)

240. Workshop in Playwriting.

5 units (Lyons) alternate years, given 1987-88

250. Major Dramatic Texts I—(See Drama 150N.)

4 units, Aut (Rayner) MTWTh 10

251. Major Dramatic Texts II—(See Drama 151.)

4 units (Rayner) MTWTh 10

252. Major Dramatic Texts III—(See Drama 152N.)

4 units, Spr (Esslin) MTWTh 10

254. American Drama (1920's-1950's)—(See Drama 154N.)

4 units (Richards) alternate years, given 1987-88

255. American Drama (1960's-Present)—(See Drama 155N.)

4 units, Aut (Richards) MWF 1:15

256. American Women Playwrights.

4 units, Win (Richards) MWF 1:15
257. Contemporary Black Playwrights.
4 units, Spr (Richards) MWF 1:15

258. Bertolt Brecht.
4 units, Win (Esslin) MWF 11

260. History of Theatre: Classical Greece to the 18th Century.
4 units, Spr (Eddelman) MWF 9

261. History of Theatre: 19th and 20th Centuries.
4 units, Aut (Eddelman) MWF 9

262. History of Costume and Fashion.
4 units, Win (Russell) MWF 11

270. Independent Project in Directing—Prerequisite: 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 (Lyons) TTh 10-12

330. Design Workshop — Advanced course in design for the theatre.
Win (Eddelman, Ramsaur, Russell, Wilson) by arrangement

331A,B,C. Design Project—Design of a full-length production in conjunction with directing project (Drama 372).
5 units, Aut, Win, Spr (Eddelman, Ramsaur, Russell, Wilson) by arrangement

332A.B. Design Project.
(Eddelman, Ramsaur, Russell, Wilson)

350. Seminar in Greek Drama.
5 units (Lyons) alternate years, given 1987-88

351B. Seminar: Pinter, Bond, Stoppard, Churchill—(Same as English 340.)
5 units, Spr (Esslin) MW 2:15-4:05

352. Seminar: Comedy.
5 units, Aut (Lyons) MW 2:15-4:05

353. Seminar: Contemporary German Drama.
5 units, Win (Esslin) MW 2:15-4:05

354A. Seminar: 20th Century Visual Aesthetics—A seminar on the visual aesthetics of the theater during the last 25 years. The emphasis is on European theater companies and scenography design, and, on innovative developments in the United States and Asia. A conceptual approach is taken in analysing contemporary theater.
5 units, Aut (Eddelman) MW 10-12

360. Theatre 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. Directing Workshop I—Investigation of basic directional problems in scenes, using a multi-form theatre space, designing actor/audience relationships and composing modular scenic units. Performances limited to class. Prerequisite: Consent of instructor.
370A. 5 units, Aut (Weber) by arrangement
370B. 5 units, Spr (Weber) by arrangement

371A,B,C. Directing Workshop II—Investigation of basic directorial problems in shorter plays or act units working in a variety of styles, using a multiform theater space. Public performances.
371A. 5 units, Aut (Weber) by arrangement
371B. 5 units, Win (Weber) by arrangement
371C. 5 units, Spr (Weber) by arrangement

5 units, any quarter (Weber) by arrangement

390. Tutorial.
1-4 units, any quarter (Staff) by arrangement

399. Dissertation Research.
any quarter (Staff) by arrangement
352 SCHOOL OF HUMANITIES
AND SCIENCES

CENTER FOR EAST ASIAN STUDIES

Director of the Center: Albert E. Dien
Affiliated Faculty:
Art: John La Plante (on leave Winter), D. Michael Sullivan (Emeritus), Melinda Takeuchi
Asian Languages: Kazuko M. Busbin, S. Wing Chan (Emeritus), Yin Chuang, Albert E. Dien, Thomas W. Hare, Kung-yi Kao, Hiroyasu Kubota, Ian Levy (on leave Spring), James J.Y. Liu, William A. Lyell, Susan K. Matsisoff (on leave Autumn), Kimie Nishimura Nebrig, David S. Nivison (on leave Winter), Hiroshi Sakamoto, Dorothy Shou, Makoto Ueda (on leave Autumn and Winter), John C.Y. Wang
Economics: Masahiko Aoki, John G. Gurley, Lawrence Lau
Education: David Grossman, Robert B. Textor
Food Research Institute: Terry Sicular
History: Prasenjit Duara (Mellon Fellow), Peter Duus (on leave 1986-87), Harold L. Kahn (on leave Spring), Mark I. Mancall, Jeffrey P. Mass (on leave Spring), Lyman P. Van Slyke
Linguistics: William J. Poser (on leave Spring)
Philosophy: David S. Nivison (on leave Winter)
Political Science: Nina Halpern, Nobutaka Ike (Emeritus), John W. Lewis, Robert North (Emeritus), Daniel Okimoto, Kurt Steiner (Emeritus), Robert E. Ward
Religious Studies: Harvey B. Aronson, Carl Bielefeldt, Daniel Gold, Anne Klein, David S. Nivison (on leave Winter), Lee H. Yearley

In addition, a number of other Stanford faculty have some teaching or research interests related to East Asia: Takeshi Amemiya (Economics), Walter F. Falcon (Food Research), William B. Gould (Law), Robert D. Hess (Education), Bruce F. Johnston (Food Research), Dudley Kirk (Emeritus), Food Research, Gerald Meier (Business), Ramon Myers (Hoover Institution), Richard T. Pascale (Business), Sylvia Yanagisako (Anthropology), Pan A. Yotopoulos (Food Research)

The Center for East Asian Studies coordinates all University instructional, research, and special activities related to China and Japan. Faculty and students who share a common interest in the study of East Asia are brought together by the center from a broad range of academic concerns covering nearly every discipline and historical period. In addition to supporting a wide variety of academic and extracurricular activities on the Stanford campus, the center is also involved in programs which link the University’s resources on China and Japan with civic groups, secondary schools, and local colleges in the San Francisco Bay Area. The Stanford 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) if taken previous to 1984-85
   - History 192A, 192B, 192C (Chinese History)
   - History 194, 194A, 194B (Japanese History)

3. **Substantive Concentration:** 30 units—Completion of appropriate coursework focused on a disciplinary or topical theme that may also specify either China or Japan and a particular historical era. The concentration may not include language courses, but literature courses and additional courses in history may be counted. The concentration normally includes coursework in at least two departments. Examples of substantive concentrations include:
   - Traditional Japanese civilization
   - Social transformation of modern China
   - Economic development in East Asia
   - Political economy of postwar Japan
   - Fine arts and literature in Ming-Qing China
   - Culture and society of modern Japan

4. **Senior Essay**—Completion of a paper, approximately 25 typewritten pages in length, to be submitted 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 during the final quarter of the student’s junior year and must be submitted no later than November 1 of his or her senior year. Applicants are expected to meet the same general standards as those seeking admission to the A.M. program: they must submit a written statement of purpose; a Stanford transcript; three letters of recommendation, at least two of which should be from members of their department of concentration; a list of the courses they intend to enroll in to fulfill degree requirements. The decision on admission rests with the A.M. Admissions Committee of the Center for East Asian Studies. Students must meet all requirements for both A.B. and A.M. degrees. They must complete 15 full-time quarters (or the equivalent), or 3 full quarters after completing 180 units for a total of 216 units.

**EAST ASIAN STUDIES THEME HOUSE**

EAST House, located at Governor’s Corner on campus, is an undergraduate residence which houses sixty 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 1987-88 is January 11, 1987.

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 in addition to the third-year level may be applied to the Area Studies Courses requirement discussed below.

Students in the A.M. program are eligible to apply for the Inter-University Language Programs in Taipei and Tokyo. Work completed in one of these programs may be counted toward completion of the A.M. degree's language requirement. Students may also petition to have this work counted for a maximum of three out of the nine area courses required for the degree. For further information see the sections on the "Center for Research in International Studies" in this bulletin.

Area Course Requirement—Students must complete a minimum of nine courses (numbered 100 or above) related to East Asia beyond the courses used to fulfill the third-year level language requirement. An integral part of the program is training in research and a demonstration of research ability in a discipline; three core courses must be within a single department; one of which must be a seminar in which a research paper on China or Japan is written. The six additional area courses may be taken in departments of the students' choosing. Some theory-oriented or methodological courses may be used to meet part of these requirements provided they are demonstrably useful for understanding East Asian problems. Except in unusual circumstances, credit toward the area course requirement will not be given for courses taken prior to entering the A.M. program. Students in this program may, however, take courses for exchange credit at the University of California, Berkeley with the approval of their advisor and the Dean of Graduate Studies.

JOINT DEGREE PROGRAMS

EAST ASIAN STUDIES AND LAW

This joint program grants an A.M. degree in East Asian Studies and a Doctor of Jurisprudence (J.D.) degree. It is designed to train students interested in a career in teaching, research, or the practice of law related to East Asian legal affairs. Interested students must apply separately to the East Asian Studies A.M. Program and to the Stanford School of Law and be accepted by both. Completion of this combined course of study requires approximately four academic years depending upon the student's background and level of training in Chinese or Japanese.

EAST ASIAN STUDIES AND EDUCATION

This joint program grants an A.M. degree in East Asian Studies and a secondary school teaching credential in social studies. To be eligible for this program, students should apply first to the A.M. program in East Asian Studies and then apply to the Stanford Teacher Education Program during their first year at Stanford. Completion of this program requires two years including at least one summer of study when beginning the education component of the program.
Qualified graduate students may apply for A.M. degrees within the Food Research Institute and the Medical School.

A Master of Arts degree may be awarded by the Food Research Institute to students who complete 25 units of work in the Institute with an average grade of B or better, and who complete at least 45 units of approved work in courses numbered 100 or above with an average grade of B or better. The master's program of course work is designed at the outset of the program to equip students with specific skills and is not encouraged for those desiring a Ph.D. from the Food Research Institute. Applications should be made to the Chairman, Graduate Instruction Committee, Food Research Institute.

EAST ASIAN STUDIES AND HEALTH SERVICES RESEARCH

The Master of Science degree in Health Services Research is an interdisciplinary program training students in research and analytic skills for careers in the growing health industry as innovative health planners, system analysts and 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 catalog. For a fuller description of the courses below, also refer to the individual departmental listings.

ANTHROPOLOGY

8. Introduction to China. 5 units (Wolf) given 1987-88
21. The World Outside the West: Change and Tradition Before the Age of European Imperialism. 5 units, Aut (Fox, Roberts, Van Slyke)
22. The World Outside the West in the Age of European Imperialism. 5 units, Win (Collier, Abernathy, Van Slyke)
117. Traditional Chinese Society. 5 units, Win (Skinner) MWF 10
118. Communist Chinese Society 5 units, Spr (Skinner)
121. Japanese Society and Culture. 5 units (Befu) given 1987-88
123. Cultural Background of Japanese Economic Organization. 5 units, Aut (Befu)
125. Japanese Culture through Novels and Films—(Same as Asian Languages 125.) 5 units (Befu) given 1988-89
143. Kinship and Social Organization. 5 units (Collier) given 1987-88
5 units (Skinner) given 1987-88

ART

2. Ideas and Forms in Asian Art.
4 units, Aut (LaPlante, Takeuchi)

4 units (Takeuchi) not given 1986-87

20. Introduction to the Art of Asia (to 600 A.D.)
4 units, Aut (LaPlante)

22. Introduction to the Art of Asia (14th Century to the Present).
4 units, Spr (LaPlante)

128A/228A. Ritual Bronzes of Ancient China.
4 units, Win (LaPlante) not given 1986-87

128B/228B. Chinese Ceramics.
4 units, Spr (LaPlante)

128D/228D. Architecture and Gardens of Japan.
4 units (La Plante)

128E/228E. Japanese Ceramics.
4 units, Win (La Plante) given 1987-88

129A/229A. Arts of Japan I.
4 units, Win (Takeuchi)

129B/229B. Arts of Japan II.
4 units, Spr (Takeuchi)

4 units (Takeuchi) not given 1986-87

129G. Japanese Buddhist Art.
4 units (Takeuchi) not given 1986-87

4 units, Aut (Takeuchi)

ASIAN LANGUAGES
NOT REQUIRING KNOWLEDGE OF AN ASIAN LANGUAGE

46. Introduction to Chinese Philosophy — (Same as Philosophy 46, Religious Studies 55.)
4 units, Spr (Nivison) section 1, MWF 10; section 2, MWF 1:15, 2:15; Th 2:15;
section 3, MWF 2:15; section 4, T 2:15, Th 2:15-4:05

91. Traditional East Asian Civilization: China.
5 units, Aut (Lyell) MWTThF 10

92/192. Traditional East Asian Civilization: Japan.
5 units, Win (Hare) MWTThF 10

110. Japanese-Western Literary and Cultural Interaction.
3 units, Aut (Ueda) given 1987-88

114. Haiku.
3 units, Aut (Ueda) given 1988-89

131. Chinese Poetry and Drama in Translation.
4 units, Aut (Staff) MWF 11

4 units, Win (Wang) given 1987-88

133. Modern Chinese Literature in Translation.
4 units, Spr (Lyell) MWF 11

4 units, Aut (Levy) TTh 3:15
plus discussion section by arrangement

137. Classics of Japanese Literature in Translation II.
4 units, Win (Matisoff) MWF 1:15

4 units, Spr (Ueda) MWF 1:15

144. Confucianism Since Wang Yang-ming—
(Same as Philosophy 124, Religious Studies 154.)
4-5 units, Spr (Nivison) given 1987-88

152. Nomad Empires of Inner Asia—(Same as History 195.)
5 units, Spr (Dien) MWF 11

4 units, Spr (Wang) MWF 11

197/297. Images of Women in Modern Japanese Literature.
3 units, Aut (Ueda) given 1987-88
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Time and Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>255A</td>
<td>The Nature of Literature: Japanese and Western Views.</td>
<td>5 units, Win (Ueda)</td>
<td>given 1987-88</td>
</tr>
<tr>
<td>255B</td>
<td>Chinese and Western Poetics.</td>
<td>5 units, Win (Liu)</td>
<td>T 2:15-4:05</td>
</tr>
</tbody>
</table>

### CHINESE

1. **First-Year Modern Chinese.**
   - 5 units, Aut (Kao, Shou): Section 1 MTWThF 9
   - Section 2 MTWThF 10: Section 3 MTWThF 1:15

2. **Second-Year Modern Chinese.**
   - 5 units, Win (Kao, Shou): Section 1 MTWThF 9
   - Section 2 MTWThF 10: Section 3 MTWThF 1:15

3. **Intensive First-Year Modern Chinese.**
   - 12 units, Sum (Staff) MTWThF 8-12

4. **Second-Year Modern Chinese.**
   - 5 units, Aut (Chuang) MTWThF 9
   - Section 2 MTWThF 10: Section 3 MTWThF 1:15

5. **Intensive Second-Year Modern Chinese.**
   - 12 units, Sum (Staff) MTWThF 8-12

6. **Intermediate Conversation.**
   - 2 units, Aut (Shou) TTh 11
   - Section 2 MTWThF 10: Section 3 MTWThF 1:15

7. **Chinese Calligraphy.**
   - 1-2 units, Spr (Chuang) TTh 1:15

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### ADVANCED

1. **Third-Year Chinese (Modern).**
   - 101. 5 units, Aut (Chuang) MTWThF 11
   - 102. 5 units, Win (Lyell) MTWThF 11
   - 103. 5 units, Spr (Chuang) MTWThF 11

2. **Intensive Modern Chinese.**
   - 12 units, Sum (Staff) MTWThF 9-12

3. **Third-Year Chinese (Classical).**
   - 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

4. **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

5. **Business Chinese.**
   - 131. 2 units, Aut (Kao, Staff) by arrangement
   - 132. 2 units, Win (Kao, Staff) by arrangement
   - 133. 2 units, Spr (Kao, Staff) by arrangement

6. **Directed Reading in Chinese.**
   - units to be arranged, Aut, Win, Spr (Staff) by arrangement

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### PROSEMINAR

1. **Proseminars.**
     - 201. 5 units, Aut (Dien) W 2:15-4:05
     - 202. 5 units, Win (Dien) W 2:15-4:05

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### JAPANESE

1. **First-Year Modern Japanese.**
   - 1. 5 units, Aut (Kao, Staff) by arrangement
   - 1. 5 units, Spr (Kao, Staff) by arrangement

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### EAST ASIAN STUDIES

1. **Modern Chinese Literature.**
     - 201. 5 units, Aut (Dien) W 2:15-4:05
     - 202. 5 units, Win (Dien) W 2:15-4:05

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### LITERATURE

1. **Fourth-Year Modern Chinese.**
   - 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

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###叫igraphy

   - 1 units, Spr (Chuang) TTh 1:15

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### LITERATURE

1. **Modern Chinese Literature.**
     - 241. Short Story.
       - 5 units, Aut (Lyell) MWF 9
       - 5 units, Win (Chuang) MWF 11
       - 5 units, Spr (Chuang) MWF 11

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### LITERATURE

1. **Modern Chinese Literature.**
     - 4 units, Aut (Liu) MWF 11
     - 4 units, Win (Liu) MWF 11

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### LITERATURE

1. **Traditional Chinese Fiction.**
     - 4 units, Aut, Win (Wang) TTh 11-12:15

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### LITERATURE

1. Chinese Drama.
   - 4 units, Spr (Wang) given 1987-88

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### LITERATURE

1. The Structure of Modern Chinese.
   - 4 units, Spr (Kao) given 1987-88

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### LITERATURE

   - 4 units, Spr (Kao) by arrangement

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### LITERATURE

1. Seminar in Confucian Ethics—(Same as Religious Studies 238, Philosophy 331.)
   - 5 units (Nivison) not given 1986-87

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### LITERATURE

1. Seminar in Modern Chinese Literature.
   - 5 units, Win (Lyell) TTh 1:15

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### LITERATURE

   - 5 units, Spr (Liu) given 1987-88

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### LITERATURE

1. First-Year Modern Japanese.
   - 1. 5 units, Aut (Sakamoto, Nebrig, Busbin); Section 1 MTWThF 9: Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 1:15
2. 5 units, Win (Sakamoto, Nebrig, Busbin); Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 1:15

3. 5 units, Spr (Sakamoto, Nebrig, Busbin); Section 1 MTWThF 9; Section 2 MTWThF 10; Section 3 MTWThF 11; Section 4 MTWThF 1:15

5. Intensive First-Year Modern Japanese. 12 units, Sum (Staff) MTWThF 8-12


7/107. 3 units, Aut (Busbin) MWF 1:15
8/108. 3 units, Win (Busbin) MWF 1:15
9/109. 3 units, Spr (Busbin) MWF 1:15


21. 5 units, Aut (Kubota) MTWThF 9
Sec. 2 (Busbin) MWF 11-12:20
22. 5 units, Win (Kubota) MTWThF 9
Sec. 2 (Busbin) MWF 11-12:20
23. 5 units, Spr (Kubota) MTWThF 9
Sec. 2 (Busbin) MWF 11-12:20

25. Intensive Second-Year Modern Japanese. 12 units, Sum (Staff) MTWThF 8-12

27,28,29. Conversation I.

27. 2 units, Aut (Sakamoto) TTh 1:15
28. 2 units, Win (Sakamoto) TTh 1:15
29. 2 units, Spr (Sakamoto) TTh 1:15

ADVANCED

101,102,103. Modern Written Japanese.

101. 5 units, Aut (Kubota) 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. 12 units, Sum (Staff) MTWThF 9-12

121,122,123. Conversation II.

121. 2 units, Aut (Kubota) TTh 1:15
122. 2 units, Win (Kubota) TTh 1:15
123. 2 units, Spr (Kubota) TTh 1:15

units to be arranged, Aut, Win, Spr (Staff) by arrangement

201,302. Proseminar.

201. 5 units, Win (Matisoff) given 1987-88
202. 5 units, Spr (Hare) given 1987-88

211,212,213. Advanced Modern Japanese.

211. Essays and Scholarly Articles.
5 units, Aut (Levy) TTh 12:30-1:45
212. Newspaper Articles.
5 units, Win (Levy) MW 12:30-1:45

213. Fiction.
5 units, Spr (Matisoff) TTh 11-12:15


246. 5 units, Aut (Hare) MW 11-12:50
247. 5 units, Win (Hare) MW 11-12:50
248. 5 units, Spr (Hare) MW 11-12:50

250. Introduction to Kambun.
4 units, Spr (Ueda) MW 2:15-3:30

251. Graduate Seminar: Japanese Historical Texts—(Same as History 498.)
5 units, Spr (Mass) given 1987-88

4 units, Spr (Ueda) given 1987-88

277. Classic Japan —(Same as 177 with additional work requiring knowledge of the language.)
4 units, Aut (Hare) MW 10

4 units, Win (Levy) given 1988-89

4 units, Win (Levy) W 3:15

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

286. The Structure of Japanese.
4 units, Aut (Poser) given 1987-88

294. Major Haiku Poets.
4 units, Aut (Ueda) given 1987-88

296. Readings in Modern Japanese Literature.
4 units, Aut (Ueda) given 1987-88

298. Translation Workshop.
4 units, Spr (Ueda) given 1987-88

396. Seminar in Modern Japanese Literature.
5 units, Win (Ueda) given 1987-88

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

ECONOMICS

120. The Marxian and Radical Tradition.
5 units, Aut (Gurley)

121/221. Economic Development in China—(Same as Food Research Institute 148.)
5 units, Aut (Sicular) MW 10-11:50

5 units, Aut (Aoki)

5 units, Spr (Aoki)
EDUCATION

161. Introduction to Teaching and Learning in Asia.
3 units, Spr (Herring) by arrangement

217S. Teaching a Global Perspective: Cross-Cultural Approaches.
4 units, Aut (Grossman) MW 3:15-5:05

1 unit (lecture only) or 4 units (lecture plus workshop) Aut, Win, Spr (Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor) lecture W 7:30-9:30 p.m., workshops by arrangement

306C. Education and Sociocultural Change.
3-5 units, Spr (Staff) TTh 2:15-4:05

FOOD RESEARCH INSTITUTE

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

5 units, Spr (Sicular) TTh 10-11:50

3 units, Aut (Reynolds, Sicular, Yotopoulos) by arrangement

HISTORY

21. The World Outside the West: Change & Tradition Before the Age of European Imperialism.
5 units, Aut (Roberts, Fox, Van Slyke)

22. The World Outside the West in the Age of European Imperialism.
5 units, Win (Abernethy, Collier, Van Slyke)

117. History of International Communism—(Same as Political Science 132.)
5 units, Win (Dallin)

192A. China from Earliest Times to the 9th Century—(Same as Asian Languages 156.)
3 units, Aut (Dien, Kahn)

192B. China from the 9th to the 19th Centuries.
5 units, Win (Kahn)

192C. Modern China: 19th and 20th Centuries.
5 units, Spr (Van Slyke)

194A. Medieval and Early Modern Japan, 1336-1800.
5 units, Aut (Mass)

298A. Undergraduate Colloquium: Visions of Utopia: (Travellers to China.)
5 units, Win (Kahn)

299. Undergraduate Colloquium: The Institutions of Modern Japan.
5 units, Win (Mass)

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)

490A. Graduate Seminar: Modern China.
5 units, Win (Van Slyke)

LAW

251. Comparative Law—(Open to graduate students in other departments.)
3 units, Aut (Merryman)

316. Law in Radically Different Cultures—(Same as Anthropology 157/257.)
3 units, Win, plus 3 units, Spr (Gibbs, Barton, Merryman)

PHILOSOPHY

46. Introduction to Chinese Philosophy —(Same as Asian Languages 46.)
4 units, Spr (Nivision) MW 10, 1:15, or 2:15, T 2:15-4:05

331. Seminar in Confucian Ethics —(Same as Asian Languages 331, Religious Studies 238.)
3-5 units, Spr (Nivison) MW 4:15-5:30

POLITICAL SCIENCE

20. Introduction to Comparative Politics.
5 units, Spr (Halpern)

114. Theoretical Approaches to Japanese Politics.
5 units, Win (Okimoto)

5 units, Aut (Halpern)

138A. Seminar: Arms Control and Disarmament.
5 units, Win (Lewis, Blacker)

138B. Seminar: Arms Control and Disarmament.
5 units, Spr (Lewis, Blacker)

138D. Topics in Arms Control.
5 units, Aut (Lewis)

139. Seminar: Chinese Foreign Policy.
5 units, Win (Halpern)

139A. Japanese Foreign Policy.
5 units, Aut (Okimoto)

215A. Japan’s Political Economy.
5 units, Aut (Okimoto)
5 units, Win (Okimoto)

225. Seminar: The Political Economy of Reform in Socialist Countries.
5 units, Spr (Halpern)

RELIIGIOUS STUDIES

1C. Comparative Religious Thought.
3-5 units, Win (Foard) MWF 9

1D. Religions of the East. (2 sections)
3-4 units, Win (Bielefeldt) MWF 10
Spr (Foard) MWF 9

1E. Eastern and Western Conceptions of the Self.
4 units, Spr (Yearley) MWF 11

3-5 units, Aut (Klein) MWF 10

18. Zen Buddhism.
3-4 units, Spr (Bielefeldt) MWF 10

55. Introduction to Chinese Philosophy — (Same as Philosophy 46, Asian Languages 46.)
4 units, Spr (Nivison) section 1, MWF 10:
section 2, MWF 1:15; section 3, MWF 2:15;
section 4, T 2:15, Th 2:15-4:05

150. Systems of Buddhist Thought.
5 units, Spr (Bielefeldt) MWF 1:15

5 units, Aut (Bielefeldt) MW 2:15-4:05

235. Tibetan Wisdom Texts.
5 units, Win (Klein) MW 2:15-4:05

5 units, Win (Bielefeldt) by arrangement

ECONOMICS

Emeriti: (Professors) Moses Abramovitz, Bernard F. Haley, Tibor Scitovsky, Edward S. Shaw

Chairman: Nathan Rosenberg
Vice Chairman: John Shoven


Associate Professors: Timothy F. Bresnahan, Thomas E. MacCurdy

Assistant Professors: Julie L. Anderson, Douglas B. Bernheim, Gregory Clark, Steven N. Durlauf, George Evans, Michael H. Riordan, Robert W. Staiger, Frank A. Wolak

Courtesy Professors: Brian Arthur (Food Research Institute), David Baron, David Kreps, John Roberts, Robert Wilson (Graduate School of Business), A. Mitchell Polinsky (Law School), John Ferejohn (Political Science)

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)

ECONOMICS AND FACILITIES

The department's purposes are to acquaint students with the economic aspects of modern society, to familiarize them with techniques for the analysis of contemporary economic problems, and to develop in them an ability to exercise judgment in evaluating public policy. There is training for the general student as well as for those who plan careers as economists in civil service, private enterprise, teaching, or research. Associated with the department are the Research Center in Economic Growth in Encina Hall, for research and graduate training in problems of economic growth in both industrialized and developing countries, and comparable facilities in Encina Hall for mathematical economics and econometrics.

The University Library is well supplied with literature in all fields of economics. The Hopkins Transportation Library holds invaluable material on transportation problems, and there are special collections on the institutions and commerce of Latin America, the Orient, and Pacific Coast development. Advanced students have access to the Hoover Institution, with its comprehensive collections of original and secondary materials on many foreign nations. The
Food Research Library in Encina Hall is particularly valuable for International Trade and Economic Development.

Qualified graduate students in economics are given the opportunity for training and research in the special fields of the Food Research Institute. A few undergraduate courses are also conducted by the Institute.

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 thirty 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.

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) 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.

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. An average grade 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 Un-
dergraduate Studies for the Economics De-
partment.
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 re-
quires a higher level of quantitative proficiency
and includes two new courses (103 and 104)
using quantitative tools to analyse 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 require-
ment as listed in (3) above under the old require-
ments and includes a new course (101) on Eco-

donomic 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 Math-
ematics 43.
2. Core requirement—Economics 1, 51Q, 52,
101.
3. Upper division requirement—15 units from
economics courses numbered between 100
and 167, excluding 101-104 and 151-152.

ECONOMIC PERSPECTIVES
AND POLICIES
Course Work Requirements
1. Quantitative requirement—Same as under
old requirements, item (3).
2. Core requirement—Economics 1, 51, 52,
101.
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 require-
ments, excluding 101 and 103-104.
4. Economics 188. Seminar research paper (3
units). This will be a substantial paper to be
written after the quantitative and core re-
quirements 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 re-
quired 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 comple-
tion of a thesis of very high quality.

The Honors Program II requires an especial-
ly 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 re-
quirements of the Bachelor of Arts in Eco-
nomics.

Additional requirements of the Honors Pro-
gram I are:
1. An average grade in economics courses of
at least 3.5.
2. Submission of an honors thesis of very
high quality. This thesis will normally be
written under the direction of a member
of the Economics Department (or a mem-
ber 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 Pro-
gram II are:
1. Completion of 15 units of economics courses numbered 100 or above in addition to the units ordinarily required for the Bachelor of Arts in Economics.

2. Grade average in economics of at least 3.7.

3. Submission of two term papers of very high quality. These will ordinarily have been written in economics courses. They must have been read and graded by a faculty member in economics before being submitted. The original papers must be submitted.

Prospective candidates of Honors Program I should advise the Departmental Director of the Honors Program of their interest and plans at least three quarters before their graduation. At that time, or subsequently, the Director will assist students, if necessary, in finding appropriate thesis advisors. Admission to this program is not automatic and may have to be restricted if there are too many applicants.

Prospective candidates for Honors Program II are also encouraged to inform the Departmental Director of the Honors Program before the end of the junior year. Applications for Honors under this program may be made at any time up to the end of the second full week of the quarter 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 an average grade in economics courses of approximately one “A” grade for every two “B” grades or better. For intelligent program planning, students are strongly urged to seek admission to the program prior to the end of the third quarter of their junior year and must apply prior to the end of the second full week of the quarter preceding the quarter in which the student will graduate. 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, in the final analysis it is the responsibility of students to plan their studies so that these objectives are served.

A student who has been admitted to graduate standing in economics does not automatically become a candidate for a graduate degree. Rather, admission carries with it the expectation that students are preparing themselves for the Doctor of Philosophy degree. Admission to candidacy and recommendation for the degree (and for the Master of Arts degree) occur subsequently, upon satisfaction of departmental requirements outlined below. 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 cannot be completed within a four-year program.

Questions and petitions concerning admission to the program or the program itself should be addressed to the Director of Graduate Studies, who together with his administrative assistants and the Graduate Studies Committee, of which he is chairman, has departmental responsibility for administering the graduate program. Students approaching their dissertation research are obliged to seek among the regular members of the Economics Department faculty a principal advisor who will supervise that research. Officers and members of the Graduate Economics Society actively participate in advising entering students and, in addition, provide an important channel through which student interests within the department are represented.

MASTER OF ARTS

The Department of Economics does not admit students who plan to terminate their graduate study with a Master of Arts degree. Students may (but need not) elect this degree in preparation for their Doctor of Philosophy degree in economics. Students who have been advanced to Ph.D. candidacy in other departments of the University, may, however, be admitted to the A.M. program in economics. Students terminating their graduate study 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 in Economics. Economics 1, 51, and 52, which are required for the A.B. degree in economics, cannot be used to satisfy the basic 45 units. Likewise, no more than three courses from among 102, 111, 118, 141, 145, 148, 157, and 165 can be used to satisfy the basic 45 units. 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. An average grade of "B" or better shall have been received for the first 45 units of course work completed and for additional units approved by the department. A grade 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 addition 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 grade of “B” on the appropriate examination. Successful candidates are expected to show distinction in at least one field of economics. Comprehensive examination papers become a part of each student’s permanent file. 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
   - 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 course offerings, exclusive of the 200 or above level by the Economics Department, approved by the Director of Graduate Studies, and passed by grades “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 a grade of “C” or better or its equivalent (as judged by an examination administered by the department upon entrance). This standard should be satisfied as soon as possible after first graduate registration and those with little previous mathematical background are advised to register their first Autumn Quarter for Mathematics 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 a grade 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 a grade 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 a grade 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 Study 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 economic 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 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 will qualify in three fields of economics, one of which must be either "Price and Allocation Theory," or "Theory of Income and Economic Fluctuations. Qualification in these fields is tested in the departmental comprehensive written examinations that are given once annually. The standard of achievement in these examinations is the same for minor as for major candidates.
ATTENTION IS CALLED TO A JOINT PROGRAM. THE DEPARTMENT OF ECONOMICS AND THE STANFORD LAW SCHOOL OFFER A JOINT PROGRAM LEADING TO THE DOCTOR OF PHILOSOPHY IN ECONOMICS AND THE J.D. DEGREE IN LAW.

IN THE ABOVE CASE, THE STUDENT'S PROGRAM OBJECTIVES MUST CLEARLY JUSTIFY SUCH A JOINT PROGRAM; DECISIONS BY THE DEPARTMENTAL GRADUATE STUDIES COMMITTEE WILL GOVERN. 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.


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 $6120 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 $2495 PLUS AN ALLOWANCE FOR TUITION. IN THE CASE OF TEACHING ASSISTANTS, STUDENTS ARE CURRENTLY RECEIVING $2495 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, Win, Spr (Boskin, Wright, Gurley) 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. Prerequisites: 1; Math 43 or equivalent. (DR:5)

5 units, Aut (Staff) MTWThF

Spr (Wolack)

51. Same as 51Q except that calculus is not used. (DR:5)

5 units, Aut (Sundstrom) MTWThF

Win (Staff)

Spr (Sundstrom)

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. (Maybe taken as 152 by graduate students.) Prerequisite: 51.

5 units, Aut (Durlave) MTWThF

Win (Taylor)

Spr (Hall)

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, Win, Spr (Staff)
Introduction to Cost Accounting—(Graduate students register for 191.) The use of internal financial data for managerial decision-making. Students who have had or are now taking a college-level cost accounting course may not enroll. Prerequisite: 90 or Industrial Engineering 133.
5 units, Win, Spr (Staff)

Economic Theory in Historical Perspective—The historical development of economic theory from several perspectives. The main focus is on the progress of analytic clarification and elaboration. Some attention is given to 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. Special emphasis is placed on the following topics. Mercantilists 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 in growth models, and recent controversies in capital theory. Prerequisites: 51 and 52.
5 units, given 1987-88

5 units, Aut (Starrett)
Win (Clark)
Spr (Fuchs)

Introduction to Econometrics—Review of probability, random variables, distribution theory, theory of estimation, and hypothesis testing. Introduction to simple and multiple regression analysis. Applications to economics. Students without computer experience should plan to acquire it early in the quarter. Prerequisites: Statistics 60 or the equivalent.
5 units, Aut (Lau) MTWThF
Win (Durlauf)

Applied Microeconomic Analysis—Construction and use of computerized econometric models for analysing macro-economic fluctuations, preparing and evaluating forecasts, and appraising quantitative policies for stability and growth. Students will use computer software to construct and simulate econometric models as a term project. Assessment is based on both the common assignments and the project. Limited Enrollment with priority for students enrolled in the "Quantitative Economics" track of the major. Prerequisites: 52 and 102.
5 units, Win (Hickman) MTWThF
Spr (Evans)

Commodity Futures Markets and Prices—(Same as Food Research Institute 105.) Description of the uses and functioning of commodity futures markets. Topics include 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

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usefulness, market performance issues and measures, and the importance of speculation. Prerequisite: 1 for economic majors.

5 units, Win (Peck) MW 10-11:50

111. Money and Banking—An investigation of financial processes with emphasis on the role of the banking sector and monetary policy. Implications for economic growth and stability are developed in the light of modern theory. Prerequisites: 51 and 52.

5 units, Aut (Gurley) MTWThF

112. Introduction to Financial Decisions—(Same as Industrial Engineering 235.) Focuses on 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, Win (Hodder, Keeley) MWF 9-10

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—Survey of growth and development in Western Europe from 1750 to World War II. Comparative approach, with primary but not exclusive emphasis on British, French and German experience. Special reference to general theories of growth, the role of the state in economic development, and the response of labor movements to industrialization. Prerequisites: 51 and 52.

5 unit, Spr (Clark)

116. American Economic History—Covers the history of American economy from colonial times to present, with greatest emphasis on years between the Revolution and World War II. The application of economic analysis to historical issues is stressed. Topics include 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. Prerequisite: 1.

5 units, Spr (David, Wright) MTWThF

117. U.S. Economy in the 20th Century—Examines 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 1987-88

118. The Economics of Development—The state of underdevelopment and the dynamics of development are at the heart of international (and within-country) conflicts between the rich and the poor. Examines the process of economic development in an international perspective. Focal point is the experience of developing countries since World War II. Discussed 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. The impact of certain aspects of development on societal values and institutions receives special attention. 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 broad diversity of experience. Case studies of specific countries are used as a point of departure to illustrate the systematic components of the experience of economic development and those of population growth. The implications are drawn in terms of alternative structures of development, the timing of the demographic transition, income distribution, employment and migration. The interactions and possible causal effects between economic development and population growth are discussed.

5 units, Win (Yotopoulos) TTh 1:15-3:05

120. The Marxian and Radical Tradition—The economic theories of Marx, Lenin, and Mao, and the application of the theories to current economic problems. Prerequisite: 1.

( DR:3)

5 units, Aut (Gurley)

121. Economic Development in China—(Same as Food Research Institute 148.) Graduates students register for 221.) Examines the structure and development of China's economy, with primary emphasis on the People's Republic. Topics include the economy legacy of the late Qing and Republican periods; China's development strategy; planning and resource
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 a labor supply, the role of international trade and investment, and the uneven character of the development process. Various theoretical approaches to the analysis are examined, including Classical, Schumpeterian, and Keynesian, with main focus on Marxist theory and recent elaborations and extensions of that theory. Reference to relevant historical case studies. Prerequisites: 51 and 52.

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

123. Economic Development in Latin America—(Same as Food Research Institute 218.) (Open to advanced undergraduate students, with the consent of instructor.) Examination of 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. Particular attention to the analysis of interdependence among countries with different economic and social structures as 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) given 1987-88

124. Japanese Economy—Describes structures, behavior, and performances of various Japanese economic institutions, such as households, employment and corporate structure: corporate grouping, financial intermediaries, public sector, and external sector. Comparison with equivalent American institutions emphasized. Discusses the cultural, social, and international context of contemporary economic problems and policy issues. Elementary knowledge of economic theory required.

5 units, Aut (Aoki)

128. Marketing, Consumption, and Price Analysis—(Same as Food Research Institute 120.) Survey of approaches used in the analysis of agricultural commodity prices and markets. Topics include consumer demand, spatial and temporal aspects of prices, market structure considerations, and commodity modeling. Links to microeconomic theory are drawn and emphasis is placed on policy contexts.

5 units, Aut (Peck) TTh 10-11:50

129. Analysis and Management of Development Projects—(Same as Food Research Institute 129.) Broad overview of 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 are used to compare financial and economic decision criteria. Hands-on exercises with data drawn from LDC agricultural projects emphasized throughout. Extensive use of microcomputers and project planning, spreadsheet and database management software is required.

5 units, Win (Gotsch) MW 1:15-3:05

132. Application of Linear Programming to Agricultural Systems—(Same as Food Research Institute 130.) Concentrates on developing application skills including exercises in mixed integer, multi-period, quadratic and risk programming. Producer-consumer models are also examined. Computer home work exercises analyze issues such as agrarian reform, water resource development, technology choice and allocation of research resources. Model manipulation and data problems are stressed throughout. Prerequisite: One course in microeconomic theory.

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


5 units, Win (Arthur) 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 will be 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 (Bernheim, Shoven) MTWThF

142. European Agricultural Policy—(Same as Food Research Institute 146.) An analytical approach to the development of agricultural policy in Europe, with particular reference to the Common Agricultural Policy of the European Community, and its relationship to agricultural and food problems of member states. Topics include the agricultural trade relationships between the EC and other advanced countries, trade agreements between EC and developing countries, and the question of enlargement of the community to include Spain and Portugal. Agricultural policies will be discussed in the context of general economic, political, and institutional development. Prerequisite: 51, 52 for economics majors.
3 units, given 1987-88

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 structure and characteristics of farm and processing units, the role of agriculture in American economic development, government policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States agriculture. Emphasis is on policy alternatives rather than on farm management. Prerequisite: 1 for economics majors.
4-5 units, Aut (Falcon) MWF 9

5 units, Spr (Roberts) MTWThF

5 units, given 1987-88

148. Economics of Urban Problems.—Application of elementary tools of economic policy issues in areas such as poverty, employment, education, housing, urban transportation and the local public sector. Prerequisite: 51.
5 units (Staff) MTWThF

149. The Modern Firm in Theory and Practice—Review of elements of the production theory. Decision-making of the firm on product diversification, advertisement, integration vs. disintegration, investment, corporate financing, and employment structure. Review of alternative hypothesis concerning the objective of the firm, Game-theoretic approach to law and economies of the firm. Efficiency implications of different institutional frameworks of corporate structures and industrial relations in American, British, German, and Japanese. Prerequisite: 51.
5 units, given 1987-88

150. Economics and Public Policy—The relationship between economic analysis and economic policies. Examines economic rationales for public policies; methods and techniques of policy evaluation, and the role of benefit-cost analysis; economic models of political processes, and their connection to the analysis of economic policymaking; and the relationship of income distribution issues to policy choice. The purpose is to understand how economic analysis is done, and why the political process regards it as useful but not as necessarily determinative of policy choices. Readings include the theoretical foundations of economic policy analysis and policy decisions, and analysis of the adoption and implementations of program in a variety of policy areas. Prerequisites: 51, 52 (52 may be taken concurrently).
5 units, Win (Noll)

151. Economic Analysis I—(See 51.)

152. Economic Analysis II—(See 52.)

154. Economics of Legal Rules and Institutions—Analyzes how legal rules (such as property rights) should be designed and enforced in externality situations. The Coase theorem on social costs; private versus public enforcement of law; the tradeoff between the certainty and severity of punishment; and ex ante versus ex post sanctions (when the external harm is statistically uncertain). Applications to pollution control; automobile accidents; the criminal justice system; consumer products liability, land use regulation; and medical malpractice. Prerequisite: 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. Particular emphasis on analyzing the ability of market
mechanism to make socially rational decisions especially in the light of the importance on intertemporal considerations, uncertainty and other market imperfections. Prerequisite: 51 and a first course in differential calculus.

5 units, Spr (Sweeney) MTWThF

15.6. Economics of Health and Medical Care — (Graduate students register for 256; same as Health Services Research 256.) Description of problems and institutions, review of analytical studies, and discussion of policy issues. Topics include mortality and morbidity, physicians and other personnel, hospitals, the drug industry, national health insurance and health maintenance organizations. Open to graduate students, undergraduate economics majors (seniors and juniors), or by permission of instructor. Preparation in micro theory and some statistics desirable. Prerequisite: 51 plus some background in math or statistics.

5 units, Win (Fuchs) TTh 10-11:50

15.7. Theory of Firms and Imperfect Markets—Designed to extend and develop 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. Subjects covered 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 (Aoki)

15.8. Social Control of Industry—Building on the framework developed in Economics 157, this course considers the history, economics and legal background of those institutions under which U.S. industry is subject to government control. The two principal subjects are antitrust law and economics and the economics and practice of public utility regulation in the communications, transportation, and energy sectors. The effects of licensing are considered. Emphasis is on application of economic concepts in evaluating the performance and policies of government agencies. Prerequisite: 157.

5 units, Staff

15.9. Power, Conflict and Cooperation in Economic and Social Systems — A game theoretic perspective on the analysis of conflict resolution in the economic and political spheres. Reviews some basic concepts of Game Theory: game description, strategies, the role of information, cooperatives vs. non-cooperative games, extensive and normal forms, and coalitions. Provides an elementary exposition of a sample of solution concepts: Minimax, Equilibrium, Core, Bargaining Theory and Shapley value. Concrete examples are used in analyzing such diverse problems as 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. Prerequisites: 51 and one course in calculus, or the consent of instructor.

5 units, (Staff)

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 (Anderson) MTWThF

166. International Trade Policy — (Same as Food Research Institute 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

170. Intermediate Econometrics I—(Graduate students register for 270.) Introduction to theory of probability, random variables, and distribution. Theory of Estimation and Hypothesis Testing. Prerequisites: Mathematics 43 or equivalent.

5 units, Aut (Amemiya)


5 units, Win (Lau)


5 units, Spr (Lau)

180. Mathematics for Economists—Training in areas of mathematics which have frequent
applicability to economic problems. Intended for students who have already had some calculus but lack a strong mathematical background. Topics 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 are discussed. Prerequisites: 51 and Mathematics 41 or the equivalent.

5 units, Aut (Pereira) MTWThF

181. Optimization and Economic Analysis—The development of optimization techniques, including calculus, linear and nonlinear programming, the calculus of variations, and control theory. Emphasis on concepts and results rather than techniques and proofs. Examples include static and dynamic theories of the household and the firm, and problems in aggregative planning and control. Prerequisites: 51, 180 or Mathematics 43 or equivalent.

5 units, Win (Pereira) 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: neoclassical, 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, 102, and one course in calculus.

5 units, Spr (Arrow)

188. Senior Research Paper. 3 units, Aut (Staiger)

Win, Spr (Staiger, Evans)

190. Introduction to Accounting—(See 90.)

191. Introduction to Cost Accounting—(See 91.)

199D. Directed Reading—Honors. Entails 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.)

1-10 units, Aut (Staiger)

Win, Spr (Staiger, Evans)

(register for at least 1 unit for at least 1 quarter)

PRIMARILY FOR GRADUATE STUDENTS


by arrangement.


by arrangement


by arrangement.

A. CORE THEORY CURRICULUM


5 units, Aut (Staff)

203. Price and Allocation Theory II—Different forms of competitive and monopolistic behavior; their effect on efficiency of economic organization. Prerequisite: 202.

5 units, Win (Bernheim)


5 units, Spr (Starrett)


5 units, Aut (Taylor)


5 units, Win (Evans, Hall)

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 three courses listed below.

200. Topics in the History of Economic Thought — Focus on 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 is studied both in terms of internal development and changing external economic conditions.

5 units (Staff)

219. Value, Distribution, and Growth — A discussion of some conceptual and analytical problems concerning the determination of value, price, distribution, and accumulation in the capitalist economy. Their background in the development of economic thought is the main focus and starting point for a systematic examination of the meaning, significance, and analytic solutions of these problems. Relevant elements of Classical and Marxian economic theory are developed and compared with the approaches of Neo-Keynesian and Neoclassical theories.

5 units, given 1987-88

220. Marxian Economic Theory — A systematic examination of 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 are presented and discussed.

5 units, given 1987-88

395 A,B,C. Seminar in Alternative Approaches to Economic Analysis.
10 units (Staff) by arrangement

C. ECONOMIC DEVELOPMENT

To receive credit in the field of Economic Development students must complete 215 and 216, or 217.


5 units, Spr (Andersn)


5 units, (Staff)

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, Win (McKinnon)

218. Japanese Economic Model — Theoretical and empirical analysis of various Japanese economic institutions and mechanisms in comparative perspectives. Topics include shopfloor practice and inter-departmental coordination at the Japanese firm viewed as an information system; the Japanese firm as a coalition of the body of stockholders and the body of employees and its behavior as cooperative game solution; subcontracting relations and efficiency implication of business reciprocity; insurance and monitoring functions of corporate grouping and the role of bank; political economy of public finance, indicative planning, and industrial policy.

5 units, Spr (Aoki)

221. Economic Development in China.

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

10 units (Staff) by arrangement

D. ECONOMIC HISTORY

Requirements for the Field of Economic History: Comprehensive exam in Spring based on material from at least two courses chosen from 224, 225, 226 and 227. Students must submit one research paper in addition to taking the written comprehensive exam, on a subject approved by one of the faculty teaching any of the following four courses.

224. Science and Technology in Economic Growth — An examination of the roles played by the growth of scientific knowledge and technical progress in the development of industrial societies. Particular attention is paid to under-
standing 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, given 1987-88

225. Technology, Economy and Society—Determinants and consequences of the diffusion of technological innovations in the economic history of the West from the ninth to the nineteenth centuries. Selected "clusters" of technical innovations will be examined for the light they throw upon the determinants of the rate and bias of innovative activity, economic and cultural conditions governing diffusion, and the problems of identifying and measuring the primary and second-order economic consequences of new modes of production and warfare. Innovation-clusters considered 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, 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 eleventh to the twentieth centuries, with primary emphasis from the Industrial Revolution to the First World War. Concentrates on the experiences of Britain, France, Germany, and other continental countries, roughly 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 — Institutions as sets of rules, compliance procedures, or moral and ethical norms that affect the behavior of individuals. The functioning of selected institutional arrangements in the economic life of western societies from Classical Antiquity to the era of industrial capitalism. Concepts from modern economics, political science, and organization theory are brought to bear on the questions of how institutions affect efficiency and distribution, and how they evolve in response to economic forces. The historical experience includes clan institutions and corporate kinship organizations, slavery in Classical Antiquity and in the New World, vassalage and feudal organization, villeinage and manorialism, agrarian village communes, usufruct rights, land tenure, and land ownership, medieval guilds, the modern conjugal family, the nation-state, joint stock companies and corporations, master-servant relationships and wage contracts.

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. Economics 265 (International Finance) and Economics 217 (Money and Finance in Economic Development) are recommended.


5 units, Win (Durlauf)


5 units, Spr (Taylor)

330A,B,C. Seminar in Monetary Theory and Institutions. 10 units, (Staff) by arrangement

F. PUBLIC FINANCE

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 such as saving, investment, labor supply, etc.; alternative policies and methods of evaluation. A workshop format combining student research, faculty presentations and guest speakers. Prerequisite: 241 or consent of instructor.

245 10 units (Shoven) by arrangement

344A,B,C. Seminar in Law and Economics.
6 units, Aut, Win, Spr (Polinsky)
by arrangement

G. ECONOMICS OF LABOR

To receive credit for the labor field, students must complete 246 and 247.

5 units, Aut (Pencave)

5 units, Win (MaCurdy)

249. Economic Demography—(Same as Food Research Institute 287.) The effects of demographic changes on individual and collective economic welfare; and economic theories of demographic decision making. Topics include overlapping generations models; economic lifecycle analysis; economic implications of changes in fertility and mortality; demography of the labor market; stable population theory; and economic theories of fertility.
5 units, given 1987-88

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 (Bresnahan)
258. 5 units, Win (Noll)

259. Economics of the Firm: Comparative Analysis—Although examples are drawn from American, Western as well as Eastern European, Japanese, and Chinese practices, the main orientation is theoretical. Topics include the price mechanism (market) vs. the quantity mechanism (organization) under increasing returns, externalities, asymmetric information, and risk; comparative analysis of diverse decision-making and information structures of the firm: vertical integration vs. dis-integration: centralization (cooperative lab) vs. decentralization (Schumpeterian competition) in innovation: roles of planning and industrial policy in diverse social contexts. Prerequisite: 202, 203, and 180 or equivalents.
5 units, given 1987-88

260. Special Topics in Industrial Organization and Regulation—Focused, in-depth study of issues of current research and policy interest, such as 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. Special attention to significant research issues that remain unresolved and on promising ways to attack them.
5 units, Spr (Noll, Riordan)

261. Allocation and Structural Change Under Increasing Returns—(Same as Food Research Institute 226.) Increasing returns: sources, evi-

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

355. Workshop in Industrial Organization, Regulation, and Applied Microeconomics—A working seminar focusing on current research in the field, including seminars by visitors, presentations by students, and structured discussions of recent papers. Students are required to write original research paper, make a formal seminar presentation, and lead a structured discussion.

10 units, Aut, Win, Spr (Noll, Riordan) by arrangement


10 units (David, Landau, Rosenberg) by arrangement

358A,B,C. Workshop in Political Economics and Collective Choice—(Same as Political Science 380ABC.) A multidisciplinary working seminar on current topics in mechanisms of social choice, political processes, and the politics of economic policy. Offered in collaboration with the Graduate School of Business and the Department of Political Science. Participating students are required to undertake an original research project, approved by the instructors.

10 units (Baron, Bendor, Ferejohn, Noll)

I. INTERNATIONAL ECONOMICS

To receive credit for the international field, students must complete 265 and 266 for which one term paper is required. Students wishing to specialize further in the field are strongly advised to take 267, whose topics may vary somewhat depending on research interests of instructor. Further complementary courses are 217 (development finance) and 234 (macroeconomics). Selected courses in Economics of Industry sometimes cover trade-related problems.

265. International Finance—Exchange rates and use of national monies in international trade. Hedging and speculation. Balance of payments adjustments. Monetary and fiscal policies in open economies. Prerequisites: 204 and 212 or consent of instructor.

5 units, Aut (McKinnon)

266. International Trade Theory—Determinants of trade and comparative advantage. Income distribution and the gains from trade. Commercial policies including the analysis of tariffs and quotas. Empirical examples from advanced and poor countries. Prerequisite:

5 units, Win (Staiger)

267. Special Topics in International Economics—The world dollar standard and U.S. monetary policy. Monetary unions. Eurocurrencies, the international capital market. Portfolio models of exchange and interest rate determination. Labor migration. Tax harmonization, and other topics of current research interest. Prerequisites: 265 and 266.

5 units, Spr (McKinnon)

365A,B,C. Seminar in International Economics.

10 units (Staff) by arrangement

J. ECONOMETRICS

Among the courses listed, an examination in 273, 274 will satisfy the field requirement.

270. Intermediate Econometrics—(See 170.)

271. Intermediate Econometrics II—(See 171.)

272. Intermediate Econometrics III—(See 172.)

273. Econometrics I—Includes a review of classical least squares theory, problems pertaining to serial correlation of the residual, autoregressive models, distributed-lag models, and other single-equation methods and problems. Selected applications in economics. Prerequisites: Mathematics 113, Statistics 219 and 220, or the equivalent.

5 units, Aut (Amemiya)


5 units, Win (Wolack)

275. Econometrics III—Continuation of 275. Discusses nonlinear models; probit, logit, and Tobit models; disequilibrium models; frontiers in econometrics.

5 units, Spr (Amemiya)
276. Topics in Time Series Analysis—(Same as Business 606.) Topics include spectral analysis, Kalman filtering, optimal control, prediction theory, vector autoregressions. Emphasis on applications to macroeconomic and financial time series. Prerequisite: Consult with instructor.

5 units, Aut (Sargent)

270A,B,C. Seminar in Econometrics. 10 units, (Staff) by arrangement

K. MATHEMATICAL ECONOMICS*

Field I: Theory of Choice—Requirements are two of the following three courses.


5 units, Aut (Staff) given 1987-88

281. The Economics of Uncertainty—A systematic examination of the implications of uncertainty on microeconomic behavior using axioms of choice under uncertainty and the expected utility theory. Topics include optimal static and dynamic portfolio choices, insurance, the effect of uncertainty on savings and production decisions, stochastic stability of markets, and general equilibrium and welfare considerations under uncertainty. Prerequisites: 181, Statistics 116, or equivalents.

5 units, Spr (Staff)

282. Theory of Information and Organization — (Same as Operations Research 363.) Examines the role of information in the design of various economic organizations, including teams and markets, among others; problems of coordination and incentives under incomplete information; search, signaling, and related phenomena.

5 units, Win (Arrow)

Field II: General Theory—Requirements are two courses chosen from 283, 284, 287 and 288.


5 units, Aut (Kurz)


5 units, Win (Staff)

285. The Distribution of Income and Wealth —(See 185.)


5 units (Staff)

289. Selected Topics in Mathematical Economics and Game Theory—Topics for each year to be announced.

5 units

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, 289, Business 363, or consent of instructor.

5 units, Spr (Wilson)

385A,B,C. Seminar in Mathematical Economics.

10 units, (Staff) by arrangement

386A,B. Interdisciplinary Seminar in Decision Analysis—(Same as Business 494A,B,C, Operations Research 366A,B, Psychology 283A,B.) 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.

3-6 units, Aut, Win (Arrow, Tversky, Wilson) by arrangement

387. Interdisciplinary Seminar in Equity and Social Choice Theory.

3 units, Win (Ferejohn, Hammond, Suppes) by arrangement
**ENGLISH**


Chairman: Albert J. Gelpi

Vice Chairman: Thomas C. Moser

Director of Creative Writing Program: Nancy H. Packer

Director of Freshman English Program: Nancy H. Packer (Autumn), Charles N. Fifer (Winter, Spring)


Associate Professors: George H. Brown, Terry Castle (on leave 1986-87), W. S. DiPiero (on leave Autumn), Jay Fliegelman (on leave Autumn), Barbara Charlesworth Gelpi

Assistant Professors: Frank Donoghue, Sandra E. Drake, Regenia Gagnier, Mary F. Wack

Professor (Teaching): Larry Friedlander

Lecturers: Michelle Carter, Jane Curry, John Daniel, Ehud Havazelet, Laura Marelo, Kent Nussey, Charles Wasserburg

Visiting Professor: Grace Paley

Andrew W. Mellon Fellows: Joseph Grigely, David Cameron Miller

Acting Instructor: Thomas C. Moser, Jr.

**OFFERINGS**

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 requirements 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 three levels of facility expected in second-year college courses in a foreign language. As a minimum, the requirement may be fulfilled by passing a fourth-quarter foreign language course other than a "conversation" course or by demonstrating equivalent knowledge. English majors are strongly urged to continue with literature courses in whatever language or languages they study. English majors who already possess the necessary language skills are strongly urged to satisfy this requirement by taking a 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):

A) Language: English 101, 102, 160A, 200A, 201, 205; Linguistics 1, 70, 73.


G) American Literature before 1900: English 120,* 121, 122, 134C, 160C, 239*.


P) Poetry: English 92, 150, 160P.

In addition, students must elect two additional courses in English or American literature from those offered by the English Department (excluding only English 1-2-3 or advanced composition courses). In place of one of these courses, students may choose one course in a foreign literature read in the original language.

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.

Major in English with a Creative Writing Emphasis—This major is designed for students who wish to gain a basic knowledge of the English literary tradition as a whole and at the same time develop skills in the writing of poetry or fiction. Students must choose one course from each of the nine areas A-P listed above. In addition, students with this major are required to take the following: for fiction writers, "Fiction Writing" (English 90), "Development of the Short Story" (English 137), plus two quarters of "Intermediate Fiction Writing" (English 190) or of a more advanced writing course, all with grades of B or better; for poets, "Reading and Writing Poetry" (English 92), one course in poetry (to be approved by the person in charge of the poetry program of creative writing), plus two quarters of "Intermediate Poetry Writing" (English 192) or of a more advanced writing course, all with grades of B or better.

Major in English with Interdisciplinary Emphasis—This is a major 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 fifteen 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 English 111 and English 112.

b) Students electing an emphasis in English and American Literature from the Enlightenment to the present must take English 110.

4. Three elective 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 (English 197), a Senior Independent Essay (English 199), and Individual Research paper (English 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).

EXTENDED MAJORS

English and French Literatures—This major provides a focus in English literature with additional work in French literature, read in the original. Candidates for the A.B. in English and French Literatures complete nine courses in English, one from each of the areas A-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.

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-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.

**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-P, and a coherent program of four courses in German literature, read in the original, with approval by the departments involved as specified above.

**English and Spanish or Spanish-American Literatures**—Candidates for the A.B. in this major must complete nine courses in English, including one from each of the nine areas A-P, and a coherent program of four courses in Spanish or Spanish-American literature, totaling at least twenty units and read in the original. The program of each student must be approved by the departments involved as specified above.

**OPPORTUNITIES FOR ADVANCED WORK**

**HONORS PROGRAM IN ENGLISH**

Students who wish to undertake a more intensive and extensive program of study in English literature, including seminars and independent research, are invited to apply for the Honors Program in the winter of their junior year. Application consists of completing a form and submitting a sample of critical writing. Admission will be selective. Provisional admission will be announced in early March. Permission to continue in the program is contingent upon successful completion of the Junior Honors Seminar and submission, by June 1, of a Senior Honors Essay proposal (with bibliography).

In the Autumn and Winter Quarters of their senior year (or their two penultimate quarters), candidates for Honors will write a Senior Honors Essay under the guidance of a faculty advisor. They should register for English 197, for a total of ten units. Honors candidates are urged to take no more than 15 units of work during these two quarters. The deadline for submission of the Honors Essay is the last day of Winter Quarter. Candidates for Honors will also register in the Autumn Quarter of their senior year for the Senior Honors Seminar, which will focus on a close reading of literary texts. In exceptional cases, English 100A-H may meet one of the Honors Seminar requirements.

Students in the Honors Program will complete the following program:

- **Area requirements (A through P)** — nine courses
- **Junior and Senior Honors Seminar** — two courses
- **Senior Honors Essay** — 10 units

The Director of the Honors Program may, in special cases, modify these requirements.

Students electing the major in English with an Interdisciplinary Emphasis will substitute the Junior Honors Seminar for one of the courses in (2) and the Senior Honors Seminar for one of the courses in (4) and will write the Senior Honors Essay.

**Note**—Exceptional English majors who are not in the Honors Program but who elect Senior Independent Study (199) may apply in their senior year for departmental “Honors,” if their program of study has been approximately equivalent to that required of regular honors students.

**INDIVIDUAL RESEARCH**

Students taking 100 or 200 level courses may, with the consent of the instructor, write a follow-up 5 unit paper based on the course material and due no later than the end of the succeeding quarter (register for 194). Only students who have successfully completed the initial course and who have applied for the follow-up course before the end of the quarter in which they took the initial course are eligible. The research paper is written under the direct supervision of the professor; it must be submitted first in a preliminary draft and subsequently in a final version.

**INTEGRATED WORK**

Students taking (either simultaneously or consecutively) two or three courses which have a clear thematic or historical relationship to each other may, with the consent of the relevant instructors, write one large-scale paper integrating the material in the courses in question.

**SENIOR INDEPENDENT STUDY**

Open, on approval by the department, to seniors majoring in English who wish to work throughout the year on a critical or scholarly essay of about 10,000 words (See “Note” number “Honors Program in English”). Applicants should contact an advisor in the department.

**HONORS PROGRAM IN HUMANITIES**

An Honors Program in Humanities is available for majors of this department who wish to supplement their departmental major by a related and carefully guided program of studies. See the section “Humanities Special Programs” for a description of the Honors Program.
dents wishing to take the Comparative Literature option within the Honors Program in Humanities should see the section "Comparative Literature."

VISITING STUDENTS

Students who do not wish to become candidates for a graduate degree, but who are qualified to meet the standards of admission to a master's or Ph.D. program, may apply to the Graduate Admissions Office, Stanford University for admission as non-matriculated students for a period of not more than three consecutive quarters. Each quarter they may take up to three English courses numbered 101 to 299, or two such courses and (with the permission of the instructor) one English course numbered above 300. Such students are not eligible to apply for admission to the Ph.D. program.

TEACHING CREDENTIALS

1. Single Subject Teaching Credential (Secondary). For information concerning the requirements for this credential, consult the School of Education. Undergraduates who are interested in preparing to teach English in public secondary schools should give first priority to the departmental requirements for the A.B. with a major in English.

2. Community College Instructor Credential. Candidates who successfully complete the requirements for the A.M. degree in English will thereby qualify for the State of California Community College Instructor Credential.

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 (B average) 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; Eighteenth Century and Romantic; Victorian and Modern; American. With the approval of the committee, the student may write off one field on the basis of evidence of substantial work done in that field during the student's senior year. The program should contain a mixture of survey and specialized courses chosen to guarantee familiarity with a reasonable proportion of works on the Reading List for Doctoral Candidates. Normally, no more than two courses taken outside the department may be counted toward the degree, but the Graduate Studies Committee will consider exceptions.

Candidates 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 masters 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 of 3.5 grade point in the major is required of those applying for the coterminal 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 further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements for the course are outlined in the School of Education section.

Candidates for the Master of Arts in Teaching may also qualify for the State of California Community College Instructor Credential by completing additional units of academic work at the graduate level. For further information consult the Credentials Administrator, Room 110, School of Education, early in the Autumn Quarter.

DOCTOR OF PHILOSOPHY

University regulations regarding this degree are discussed in the “Degrees” section in this bulletin. The following departmental requirements, dealing with such matters as residence, dissertation, and examinations, are in addition to the University's basic requirements for the doctorate.

A candidate for the Ph.D. degree must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the bachelor's degree. He or she will be expected to offer at least 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.

Requirements of the Ph.D. program in English literature are as follows:

1. A five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.
2. A minimum of six courses for a letter grade from the graduate colloquia and graduate seminars, of which at least three must be graduate seminars. These colloquia and seminars should be from different genres and periods as approved by the advisor.
3. 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 student’s record in the first quarter at Stanford. 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 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).

Requirements of the Ph.D. program in English and American literature are as follows:

1. A five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.

2. A minimum of 35 units of graduate courses in American literature and 35 units in English. Among these, a minimum of six courses for a letter grade from the graduate colloquia and graduate seminars, of which three must be in American literature, and of which at least three must be graduate seminars. The colloquia and seminars should be in different genres and periods as approved by the advisor.

3. A 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).

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 for the Ph.D. in English and Comparative Literature are as follows:

1. Qualification: (See paragraph 7 under requirements of the Ph.D. program in English
Literature. For qualifications in the doctoral program in English and Comparative Literature candidates are not held responsible for literature before 1350.

2. A knowledge of the basic structure of the English language and of Chaucer. This requirement may be met by examination, or by taking ten units of courses chosen from among those offered in linguistics, English philology, and early and middle English literature including Chaucer. No particular courses are required of all students.

3. A 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.

Requirements of the Ph.D. program in English and Linguistics are as follows:

1. A five-unit course in Old English, a five-unit course in Middle English, and English 102 (History of the English Language) for five units.

2. A minimum of three seminars in different genres and periods as approved by the advisor. The student will normally take a total of six courses from the graduate colloquia and graduate seminars.

3. A 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. This examination will cover the field of concentration (as defined by the student and the student's advisor). Topics for the colloquy will include at least one on applications of linguistics to literary studies. Half of the question period will be devoted to literature, and half to linguistics and its application to literature.

Language Requirements—All candidates for the Ph.D. degree (except those in English and Comparative Literature and in English Philology, for whom special language requirements prevail) must demonstrate a reading knowledge of two foreign languages. Candidates in the earlier periods must offer Latin and one of the following languages: Greek, French, German, Italian, or Spanish. In some instances they may be required to offer a third language. Candidates in the later period (i.e., after the Renaissance) must offer either Latin or French or German as one language, and may choose the second language from the following: Greek, Latin, French, German, Italian, Spanish. In all cases the choice of languages offered must have the approval of the candidate's advisor. Any substitution of another language must be approved by the Graduate Studies Committee.
The Graduate Studies Committee will not accept courses taken as an undergraduate in satisfaction of the language requirement for doctoral candidates. For students coming to doctoral work at Stanford from graduate work done elsewhere, satisfaction of a foreign language requirement accepted at the other institution will normally be accepted here.

The candidate must satisfy one language requirement by the end of the first year (that is, before registration in the following year), and the other by the end of the third year.

Foreign language requirements for the Ph.D. may be fulfilled in any of the following ways:

1. Achievement of a sufficiently high score (70th percentile) on the foreign language examination prepared by the Educational Testing Service. Latin and Greek are not tested by ETS.

2. A reading examination given each quarter by the various language departments, except for Latin and Greek.

3. For Latin and Greek, an examination by the English Department. The Latin examination will be given before registration in the Autumn Quarter in order to permit those who need the course to register for Latin 3. It will also be given in the eighth week of the Winter and Spring Quarters, along with other departmental examinations for languages not tested by the Educational Testing Service.

4. Passage with a grade of B or higher of a course in literature numbered 100 or higher in a foreign language department at Stanford. As an alternative for Latin, French, and Spanish, passage of Latin 51 and 52, French 10 and Spanish 15, respectively, with a grade of B or higher.

Dissertation—As early as possible during their graduate study, Ph.D. candidates will be expected to find a topic requiring extensive original research and to seek out a member of the department as his or her advisor. The advisor will request the chairman to appoint a committee to supervise the dissertation. Candidates should take this crucial step as early in their graduate careers as possible. The committee may well advise extra preparation within or outside the department, and time should be allowed for such work.

Immediately after the dissertation topic has been approved by the advisor, the candidate should file a formal application for candidacy as prescribed by the University. Ph.D. dissertations must be completed and approved within five years from the date of that application. Candidates taking more than five years will be required to reignstate 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.

GRADUATE PROGRAM IN MODERN THOUGHT AND LITERATURE

Stanford also offers a Ph.D. degree in Modern Thought and Literature. Under this program students devote approximately half of their time to a modern literature from the Enlightenment to the present, and the other half in interdisciplinary studies. Students interested should see the section “Modern Thought and Literature” and consult Professor David Halliburton 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: 40-49, 140-149, 240-249, 340-349
Poetry: 50-59, 150-159, 250-259, 350-359
Topic Courses: 60-69, 161-169, 186-189, 260-269, 360-369
Author Courses: 70-79, 170-179, 270-279, 370-379
Seminars for English Majors: 160A-J and 160P
Graduate Colloquia: 300-307
Overseas Campus Courses: 80-89, 180-185
Writing Courses, Workshops, Individual Study, etc.: 90-99, 190-199, 290-299, 300-399
INTRODUCTORY AND DESIGNED PRIMARILY 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. Freshman English—The successful completion in proper sequence of English 1 and 2 satisfies the University Writing Requirement. All courses involve reading texts and reviewing writing techniques. In the first quarter, students will concentrate on finding an appropriate thesis, and developing and organizing ideas. In the second quarter, students will concentrate on style and diction and on preparing and writing a research paper. A variety of workshops are offered.

1A. Writing Workshops: Thematic—These courses focus on a subject matter that reflects the instructor's special interest or expertise. The writing will be largely based on discussions arising from a body of reading on the subject matter.

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

1B. Writing Workshops: Prose Writing—These courses focus directly on student writing with special texts used as examples of different kinds of writing.

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

1C. Writing Workshops: Tutorial—Focus on individual conferences. In addition to one class meeting a week to discuss general writing techniques, all students meet once a week with the instructor to discuss their own writing.

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

1D. Critical Reading and Writing—(Same as Center for Teaching and Learning 8.) This course focuses on reading as well as writing and each week students meet four times in class and once in tutorial.

5 units, Sum (Staff)

3. The Third Quarter—A writing course designed primarily for students who have completed the two-quarter requirement during the autumn and winter quarters and who wish further writing instruction.

3 units, Spr (Staff)

4. Directed Writing—For students who have been exempted from or have completed the Writing Requirement and wish further work in writing. Taught partly by the tutorial method, tailored to the individual student's needs.

3 units, Aut (Staff)

5. Introduction to Literature—Specifically designed for area 2 of the Distribution Requirement, this course seeks to enrich students' understanding and appreciation of literature by introducing them to some of the essential tools and concepts used in textual analysis. The reading list will include masterpieces chosen from a wide variety of literary genres, historical periods, and national literatures. (DR:2)

3 units, Win (Evans)

7. Literature and the Arts in Western Culture—This Western Culture sequence emphasizes literature and the creative imagination as part of the western tradition. The lectures explore literature in its cultural context and include sessions on art, music, and drama. Students meet three times weekly for lectures and once weekly in two-hour seminar discussion groups. The course moves chronologically from antiquity to the present day, setting works in their original historical and intellectual perspective. Besides developing critical and analytical skills, this course stresses the techniques and practices of good writing. All seminar instructors are experienced writing teachers, and student essays receive close attention. Students who elect other courses to satisfy the Writing Requirement are eligible to request this Western Culture track for the usual 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 concurrently in additional class sessions and conferences 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). 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.

7. Antiquity and the Middle Ages— Begins with the Hebrew Bible and continues to the dawn of the Renaissance, covering such writers as Homer, Sophocles, Plato, the Beowulf poet, Dante, Boccaccio, and Chaucer. (DR:1)

8 units, Aut (Howard, Staff) lectures plus sections

8. Renaissance and Enlightenment—Readings stretch from the Renaissance to the Enlightenment and include texts by Machiavelli, More, Bacon, Shakespeare, Milton, Swift, Voltaire, and Wordsworth. (DR:1)

8 units, Win (Rebholz, Staff) lectures plus sections

5 units, Spr (Friedlander, Staff)
lectures plus section

10, 11, 12. Masterpieces of English and American Literature—Courses offering an in-depth study of selected works by major English and American writers from the medieval to modern periods.

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.) Designed as an introduction to the works of three of the greatest English writers: Chaucer, Shakespeare, and Milton. (DR:2)

3 units, Win (Howard)

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.) Designed as an introduction to literary masterpieces written in English between 1700 and the present. Divided about equally between poetry and fiction, with some drama. (DR:2)

3 units, Spr (Polhemus)

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, Spr (A. Gelpi)

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 (Friedlander)

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 the careful reading of a variety of poems, with special 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 (Rebholz)

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 (Wack)

68. American Indian Mythology, Legend, and Lore—(English majors and other students taking the course for 5 units, register for 168.) Introduction to American Indian oral tradition, centering upon an investigation of the nature of native American prose and poetry, and especially the relationship between oral tradition and writing. (DR:2*)

3 units, Spr (Fields)

73. Shakespeare—(Same as Drama 59.) A reading of representative comedies, histories, and tragedies. Designed for the general student as well as the prospective English major. (DR:2)

3 units, Win (Lyons)

90. Fiction Writing—Basic problems of narrative and imaginative writing. Prerequisite: completion of the writing requirement.

5 units, Aut, Win, Spr (Carter, Havazelet, Marello, Nussey)

92. Reading and Writing Poetry—An introductory course in 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.

101. Linguistics and Literature—(Same as Linguistics 71B.) 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 structures of English, with
some attention to the use of regional and social dialects in literature. (Area: A) (DR:4)  
5 units, Spr (Heath)

102. The History of the English Language—Studies in the evolution of the English language as a medium of literary expression. (Area A) (DR:4)  
5 units, Win (Brown)

110. Masterpieces of English Literature I: Chaucer, Shakespeare, Milton, and Their Contemporaries—(See 10.)  
5 units, Win (Howard)

111. Masterpieces of English Literature II: From the Enlightenment to the Modern Period—(See 11.)  
5 units, Spr (Polhemus)

112. Masterpieces of American Literature—(See 12.)  
5 units, Spr (A. Gelpi)

113, 117. English Literature—A basic survey.  
113. The Renaissance. (Area C)  
5 units, Aut (Ryan)

117. Romantic and Victorian Literature—A survey of the Romantic and Victorian temperament as revealed in a diverse variety of literary forms: poetry, the novel, essays, and epistles. Selected authors include Wordsworth, Byron, Keats, Dickens, Tennyson, Emily Bronte, and Thomas Hardy. (Area: F)  
5 units, Spr (Grigely)

120. American Historical Novel—Introduction to the historical novels of Cooper, Hawthorne, Melville, James, Twain, Wharton, Cather, Faulkner, and Janet Lewis. (Area: G or H) (DR:2)  
5 units, Win (Dekker)

121. American Literature and Culture to 1855—(Same as American Studies 50.) (Area: G)  
5 units, Win (Fliegelman)

122. American Literature, 1855-1917—(Area: G)  
5 units, Aut (Moser)

123. American Literature, 1917 to the Present—(Area: H)  
5 units, Spr (Fields)

130. The Novel—(See 30.)  
5 units, Spr (Watt)

131B. The 18th-Century British Novel—(Area: E)  
5 units, Spr (Donoghue)

5 units, Spr (Gagnier)

133. The 20th-Century English Novel. (Area: H) (DR:2)  
5 units, Win (Polhemus)

134C. American Fiction: Romance to Realism—(Area: G)  
5 units, Aut (Halliburton)

137. Development of the Short Story—Required of creative writing students in fiction. Reading and discussion of American, British, and Continental short stories, with emphasis on changes and developments in the form. (Area: H) (DR:2)  
5 units, Spr (Packer)

140. Drama—(See 40.)  
5 units, Aut (Friedlander)

143. Restoration and 18th-Century Drama—(Area: E)  
5 units, Aut (Donoghue)

150. Poetry and Poetics—(See 50.) (Area: F)  
5 units, Aut (Rich)  
Win (Di Piero)  
Spr (Rebholz)

151. Renaissance Poetry: Intentions, Structures and Styles—(Area: C)  
5 units, Win (Trimpi)

154. Major Romantic Poets—Explore some of the assumptions of English Romanticism through selected readings from the works of Blake, Wordsworth, Coleridge, Byron, Shelley and Keats. (Area: F)  
5 units, Win (Dekker)

5 units, Aut (A. Gelpi)

160A-H,J,P. Seminars for English Majors—Seminars on the scholarly and critical study of literary texts; strongly recommended for English majors. English 160A-H and P satisfy the appropriate area requirements A-H (see program for major in English, above). The subject matter of English 160A is mainly linguistic studies; of English 160B, medieval literature; of English 160A-H, Renaissance literature and so on. The subject matter of English 160J, which counts as one of two required electives (see program for major in English above), is mainly the theory of literary genres. Preference given to English majors; seniors given preference in select seminars. Sign up at the English Department. (Instructors: Felstiner, Friedlander, Grigely, Guerard, Heath, Miller, Perloff, Pol

Win (Di Piero)  
Spr (Rebholz)

151. Renaissance Poetry: Intentions, Structures and Styles—(Area: C)  
5 units, Win (Trimpi)

154. Major Romantic Poets—Explore some of the assumptions of English Romanticism through selected readings from the works of Blake, Wordsworth, Coleridge, Byron, Shelley and Keats. (Area: F)  
5 units, Win (Dekker)

5 units, Aut (A. Gelpi)

160A-H,J,P. Seminars for English Majors—Seminars on the scholarly and critical study of literary texts; strongly recommended for English majors. English 160A-H and P satisfy the appropriate area requirements A-H (see program for major in English, above). The subject matter of English 160A is mainly linguistic studies; of English 160B, medieval literature; of English 160A-H, Renaissance literature and so on. The subject matter of English 160J, which counts as one of two required electives (see program for major in English above), is mainly the theory of literary genres. Preference given to English majors; seniors given preference in select seminars. Sign up at the English Department. (Instructors: Felstiner, Friedlander, Grigely, Guerard, Heath, Miller, Perloff, Pol
Consult the Time Schedule for specific openings. (Area: As indicated)

5 units, Aut, Win, Spr

161A. The Afro-American Novel—(Same as African and Afro-American Studies 161A.) By reading a range of Afro-American novels, by both men and women, in historical context, examine ways in which Afro-American writers have used and adapted the novel genre to interpret various aspects of the Afro-American experience. (Area: H) (DR:2)

5 units, Aut (Drake)

162G. The Caribbean-Americas: An Introduction to Their Literature, Thought and Cultural Worlds—(Same as African and Afro-American Studies 248, Spanish and Portuguese 248.)

5 units, Aut (Wynter)

163G. Sense of Identity in Modern Writers—(Enroll in Modern Thought and Literature 207.) An examination of French and American female writers whose sense of identity is related to their creativity, sexuality, maternity, work and social class.

5 units, Spr (Yalom)

164B. Arthurian Literature—(See 64B.)

5 units, Win (Wack)

165A. Literature of the Holocaust—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 will address the class.

5 units, Spr (Felstiner)

166. American Indian Mythology, Legend and Lore—(See 66.)

5 units, Spr (Field)

171A. Chaucer’s Canterbury Tales—(Area: B)

5 units, Spr (Moser, Jr.)

171B. Chaucer’s Troilus and the Dream Poems—(Area: B)

5 units, Aut (Wack)

172. Milton—(Area: C)

5 units, Spr (Evans)

173A. Shakespeare—(Same as Drama 159A.) Intensive study of the following plays: Henry IV: Part One, Henry V, As You Like It, Twelfth Night, Measure for Measure, Hamlet, King Lear, The Tempest. (Area: D)

5 units, Aut (Rebholz)

173B. Shakespeare—(Same as Drama 159B.)

Richard II, A Midsummer Night’s Dream, Henry IV: Part One, As You Like It, Hamlet, King Lear, Antony and Cleopatra, The Winter’s Tale. (Area: D)

5 units, Win (Riggs)

173C. Shakespeare—(Same as Drama 159C.)

Richard III, The Merchant of Venice, Henry IV: Part One, As You Like It, Troilus and Cressida, Othello, Macbeth, The Winter’s Tale. (Area: D)

5 units, Spr (Ryan)

174. Johnson and His Contemporaries—(Area: E)

5 units, Win (Fifer)

179B. Faulkner—(Area: H)

5 units, Spr (Moser)

186. Childhood and Literature—Historical survey of literature for children plus discussion in detail of selected 19th and 20th century works. Relevant philosophical and critical writings are read. Children’s literature is studied in the context of cultural history and changing concepts of childhood and also enjoyed for its own sake.

5 units, Spr (Curry)

190. Intermediate Fiction Writing—Intermediate course. May be taken twice. Prerequisite: 90.

5 units, Aut, Win, Spr (Carter, Havazelet, Marello, Nussey, Paley, Sorrentino)

191. Expository Writing—Advanced course in composition open to both undergraduates and graduates. Taught through tutorials and partly through short lectures and general discussion. Although in every quarter there is general instruction in writing and any student may enroll, each quarter the course has a special emphasis.

191A. Writing About Science.

3 units, Win (Joly)

191B. Writing About Social Sciences.

3 units, Win (Matthies)

191C. Writing About Business.

3 units, Spr (Harvey)

191D. Writing About Law.

3 units, Aut (Johnstone)

191E. Advanced General Composition.

3 units, Spr (Murray)

192. Intermediate Poetry Writing—Intermediate course. 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—In any quarter a group of undergraduates (at least three but preferably more) who wish in the following quarter to study a subject or an area not covered by regular courses may plan an informal seminar and approach a member of the department to supervise it. A syllabus for the course should be submitted to the director of undergraduate advising at least two weeks before the end of the quarter. No more than five units of credit will be given for English 195 and/or English 198 in any one quarter. English 195 may not be used to fulfill departmental area or elective requirements without permission.

any quarter, by arrangement

196A. Junior Honors Seminar—Required of all juniors in the English Honors Program.  
5 units, Spr (Wack)

196B. Senior Honors Seminar—Required of all seniors in the English Honors Program.  
5 units, Aut (Ruotolo)

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 will be given for English 195 and/or English 198 in any one quarter. English 195 may not be used to fulfill departmental area or elective requirements without permission. Group seminars are not considered appropriate to English 198.

any quarter, by arrangement

199. Senior Independent Study—Open, on approval by the department, to seniors majoring in English who wish to work throughout the year on a critical or scholarly essay of about 10,000 words (See “Note” under “Honors Program in English”). Applicants should submit (1) a sample of their expository prose and (2) a proposed topic for independent study to the secretary of the department before preregistration in May of their junior year. Each student who is accepted will be assigned to an instructor, with whom he or she will prepare an appropriate reading list before the end of the Spring Quarter.  
10-15 units (for the entire year)  
Aut, Win, Spr (Staff)

200. Old Norse-Icelandic—(Same as German 205A/305A.) (Area: A)  
5 units, Win (Gade)

200B. Advanced Old Norse—(Same as German 205B/305B.)  
5 units, Spr (Beck)

201. Old Saxon—(Same as German 207/307.) (Area: A)  
5 units, Win (Robinson)

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)

209. Introduction to Paleography and Codicology—(Same as Classics 177.) Introduction to the study of late antique and medieval manuscripts in Latin, of medieval Latin and vernacular scripts, and of the materials and composition of the medieval book.

5 units, Spr (Brown)

211. Readings in Middle English—Study of the language and dialects of Middle English and reading in the various genres of prose and poetry. (Area: B)  
5 units, Aut (Howard)

216. The Romantic Age: Revolution and Revival.  
216A. The Generation of Wordsworth and Austen—Major poems and prose works of the period 1789-1815 studied in relation to primitivism in literature and religion, the writer as propagandist for revolution and reaction, the development of distinctively “Romantic” literary genres, the survival of “Augustan” forms and values. (Area: F)  
5 units, Spr (Dekker)

216B. Byron, Shelley, Keats and Their Contemporaries—Literary works of the decade 1814-1824 placed in the context of post-Napoleonic radical politics, the rise of feminism, changes in aesthetic theory, the subjective reconstruction of ancient, medieval, and “Oriental” civilizations. (Area: F)  
5 units, Aut (Grigely)

234D. Critics of America—(Same as American Studies 204.) A study of some nineteenth and twentieth century writers, part of whose concern was an explicit, critical investigation of the culture of the United States. We will see what concerns, if any, are held in common by the
critics. Authors most likely read include de Tocqueville, Whitman, Thoreau, George Santayana, Henry Adams Daniel Bell, Susan Sontag, Norman Mailer, Gore Vidal.

3 units, Spr (Chace)

239. American Short Fiction—(Area: G or H)
5 units, Win (Fields)

261. Victorian England—The social pleasures of Victorian autobiography. Permission of instructor required. (Area :F)
5 units, Aut (Gagnier)

263A. Seminar in Feminist Studies— (Same as Feminist Studies 103/203.) Advanced course on feminist theory and research. Some of the topics are the politics of sexual identity; race, class and ethnicity as feminist issues; non-academic literary criticism (grounded in movement publications and anthologies). Prerequisites: For undergraduates, Feminist Studies 101 and 102; for graduate students, written application and permission of instructor.
5 units, Aut (Rich)

265. Figures of Imagination and Desire in Film and Literature—Can we imagine narratives without characters or coherent selves at the centers of them? Through an examination of a number of 20th-century literary and cinematic works, we explore situations in which characters disperse or fragment themselves, withdraw from expression or scrutiny, or lapse out of existence altogether. What can these acts of self-erasure, self-destruction, or self-proliferation tell us about self-expression in life and in art?
5 units, Aut (Carney) T 3:15-5:05, film MW 7-9 p.m.

270A. Beowulf—Reading and critical analysis of Beowulf. Prerequisite: 205 or its equivalent. (Area: B)
5 units, Win (Brown)

277. Joseph Conrad—Study of some of Conrad's major works; a little biography and criticism. (Area: H)
5 units, Spr (Watt)

285C. Gertrude Stein and Ezra Pound—The "revolution of the word" as conceived by these two great innovators. In the case of Stein, the emphasis will be on the early works—Three Lives, the Portraits, Tender Buttons, and on the autobiographies (approximately four weeks); in the case of Pound, two weeks on the earlier work, four on the Cantos. (Area: H)
5 units, Win (Perloff)

288A. Joyce—(Area: H)
5 units, Win (Chace)

288C. Yeats and T.S. Eliot—(Area: H)
5 units, Aut (Lindenberger)

290. Advanced Fiction Writing—Advanced course. Prerequisites: 90 and 190 and submission of manuscript.
5 units, Aut (Carter)

291. Generative Devices in Fiction Writing— A course for writers who would like to explore the uses of preconceived and formal literary devices in the making of fiction. Fold-ins, cut-ups, word repetition, vowel excision, finite vocabularies, and word games are some of the devices to be employed. Prerequisite: An advanced course in fiction writing, at Stanford or elsewhere, and submission of a manuscript by December 10.
5 units, Win (Sorrentino)

292. Advanced Poetry Writing—(For undergraduates, selected by the instructor.) Promising student poets will 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, wherever possible, the fabric of their mastery. Student work will also be examined. Prerequisite: 90 and 190 and submission of manuscript.
5 units, Win (Carter)

293B. Fiction Writing and the American Experience—An examination of the relationship of the writer to his or her environment. An exploration of the peculiar posture of the writer in society, and how writers, constrained by their visions of America, managed to turn these visions into art. Prerequisites: 90 and 190 and submission of manuscript.
5 units, Spr (Havazelet)

303A. Colloquium: Literature and Ideas from Swift to Wollstonecraft.
5 units, Aut (Bender, Carnochan)

303B. Colloquium: The Age of Sensibility or the Age of Johnson—Examination of selected works in later 18th-century British literature in light of antithetical characterizations of that period in literary history. Texts include examples of sentimental and gothic fiction, and writings by Johnson and his circle.
5 units, Win (Donoghue)
304. Colloquium: Romanticism and History—Readings of Wordsworth, Byron, Shelley, and Keats in the light of their interpretations and displacements of history. Romantic texts will be read next to such theorists of history as Burke, Hegel, and recent critics now working toward a new historical and ideological critique of the period.
5 units, Aut (Lindenberger)

305. Colloquium: Literature of World War I. 5 units, Win (Stone)

306. Colloquium: Afro-American Women Novelists—A study of the emergence and development of Afro-American women's fiction with emphasis on the modern period in historical context. Some of the issues addressed are 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. Novelists include Zora Neale Hurston, Toni Morrison, Alice Walker and Gloria Brewster.
5 units, Win (Drake)

307A. Colloquium: Major Modern Critics—A study of diverse perspectives and systems that have played a seminal role in the development of modern critical theory. Readings include, among others, Frye, Lukács, Benjamin, Auerbach, Barthes and Derrida.
5 units, Aut (Halliburton)

307B. Colloquium: The Poetry of Postmodernism—The theory and practice of postmodern poetry from World War II to the present (from Robert Lowell and Elizabeth Bishop to the "language" and "performance" poets). The course poses the question: how and to what extent does the poetry of the second half of our century diverges from the Modernist paradigm? The aim is less to "survey" the field than to understand poetic language, mode, and genre in relation to historical change.
5 units, Spr (Perloff)

5 units, Win (Howard)

313. Seminar: Modern Literary Research, 1750 to the Present—Examination of 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. A close study of several short works representative of major period and national circumstances focuses discussion of different models of contextual criticism. Topics include 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)

5 units, Aut (Wack)

340. Seminar: Pinter, Bond, Stoppard and Churchill—(Same as Drama 351B.)
5 units, Spr (Esslin)

360A. History of Literary Theory (Ancient)—A graduate reading and lecture course.
5 units, Aut (Trimpi)

360B. History of Literary Theory (Medieval/Renaissance)—A graduate reading and lecture course.
5 units, Win (Trimpi)

361. Seminar: The Modern Tradition—(Same as German Studies 390A.) An inquiry into conceptualizations of modernity, modernism, and modernization in terms of cultural criticism and social theory. Topics include diachronic designations with reference to tradition and postmodernism; the institutional status of culture, modern identity and the confrontation with alterity. Readings by figures such as Marx, Weber, DuBois, Hoggart, Thompson, Adorno, Habermas, Baudrillard, Kristeva, Lyotard.
5 units, Aut (Berman) MW 1:15-3:05

365B. Seminar: American Literature and Culture in the 1840s.
5 units, Spr (Fliegelman)

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 redactions in the work of Lacau, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault).
5 units, Win (Bender, Wellbery)

371. Seminar: Chaucer's Early Works in Relation to His Times.
5 units, Spr (Howard)

373. Seminar: Shakespeare—An examination of Shakespeare's attitudes towards history, especially that of government and warfare, with careful attention to those plays which have historical sources.
5 units, Win (Rebholz)
374. Seminar: Ben Jonson. 5 units, Aut (Riggs)

376. Seminar: Milton. 5 units, Spr (Evans)

378. Seminar: Jane Austen—Careful reading of all the novels; some attention to juvenilia, biography, and critical works. 5 units, Win (Watt)

385D. Seminar: Henry James and the Romance Tradition—A reading of a half dozen of James's novels and novellas (including Portrait of a Lady, The Bostonians, and The Golden Bowl), Hawthorne, and various prefaces and critical essays. Pertinent fictional and critical works by Hawthorne, Howells, and Stevenson. 5 units, Aut (Dekker)

388F. Seminar: Joyce's Finnegans Wake. 5 units, Spr (Polhemus)

38SC. Seminar: Flan O'Brien and Samuel Beckett—Writings of two Irish masters of late modernist fiction. Readings chosen from O'Brien's At Swim-Two-Birds, The Third Policeman, The Dalkey Archive, The Hard Life, and shorter works; Beckett's Murphy, Watt, the "French Trilogy" How It Is, and later works. 5 units, Win (Sorrentino)

390. Graduate Fiction Writing — A workshop designed primarily for graduate students enrolled in the Writing Program. May be repeated for credit. Prerequisite: Consent of instructor. 3-5 units, Aut (Packer)

391. Advanced Work in Writing and Criticism. any quarter, by arrangement

392. Graduate Poetry Writing—A workshop designed primarily for graduate students enrolled in the Writing Program. May be repeated for credit. Prerequisite: Consent of instructor. 3-5 units, Aut (Fields)

394. Independent Study—Preparation for qualifying examination and for the Ph.D. oral examination. Pass/No Credit only. any quarter, by arrangement

395. Ad Hoc Graduate Seminars—Three but preferably more graduate students who wish in the following quarter to study a subject or an area not covered by regular courses and seminars may plan an informal seminar and approach a suitable member of the department to supervise it, either on a graded or Pass/No Credit basis. any quarter, by arrangement

396. Introduction to Graduate Study—A required course for first-year graduate students in English, Modern Thought and Literature, and Comparative Literature who will be teaching in the Freshman English program providing instruction in teaching—especially leading a section and evaluating essays and examinations—and a broad introduction to the opportunities and responsibilities of graduate study. Meets weekly. Assigned brief readings and a short final paper. Offered on a Pass/No Credit basis only. 2 units, Aut (Moser, Packer)

397A. 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. At the beginning of the quarter, the apprentice sits in on classes, conferences, tutorials; at the end, 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 rhetoric and pedagogy. Each student designs a two-quarter syllabus in preparation for teaching English 1 and English 2. Offered on a Pass/No Credit basis only. 5 units, Aut (Packer)

397B. Teachers Workshop I—A seminar for second-year students who will be teaching composition. (Second-year students are advised to enroll in this course and to take during their first quarter of teaching only one literature course.) 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. Meets one hour a week, at noon. 5 units, Win (Fifer)

397C. Teachers Workshop II—A seminar for second-year students teaching the second quarter of composition focusing on the second-quarter syllabus. Students will 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 1986-87

63. 20th-Century American Women Poets.
64. The English Bible as Literature.
64A. The Biblical Presence in Modern Poetry.
79. Fitzgerald and Hemingway.
105. Linguistic Approaches to Point of View in Fiction—(Same as Linguistics 72.)
115. Restoration and 18th-Century Literature.
119. Modern British Literature.
126. American Fiction, 1940 to the Present.
128. Reflections on the American Condition—(Same as History 174, American Studies 100.)
131A. The 18th Century English Novel.
139. Detective Fiction.
142. Medieval and Renaissance Drama.
153. Visions and Transformations.
158A. Plath, Sexton, Rich.
160B. Seminar for English Majors: Medieval Literature.
160C. Seminar for English Majors: Renaissance.
160E. Seminar for English Majors: 18th Century.
160J. Seminar for English Majors: Literary Genre.
161. Afro-American Literature.
161B. Afro-American Poetry.
161F. The Harlem Renaissance.
162A. Chicano Literature.
162B. Chicano Literature: Creative Writing for Bilingual Students.
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.
164. The English Bible as Literature.
164A. The Biblical Presence in Modern Poetry.
166. Modern Literature in English from Africa.
167A. The Literature of Fantasy.
167B. Modern British Comic Fiction.
169B. Toward an Understanding of Modernism.
174. Swift.
175. Swift and Pope.
177. Virginia Woolf.
177A. The Brontes and Elizabeth Gaskell.
179. Hawthorne and Melville.
179A. Fitzgerald and Hemingway.
202. Topics in the History of the English Language.
212A. Medieval to Renaissance: The Development of Literary Forms.
212B. Medieval to Renaissance: The Development of Literary Forms—(Continuation of 212A.)
214. Representations of Women in 18th-Century Literature—(Same as Feminist Studies 161.)
217A. The Bloomsbury Group.
227. Modern Southern Writers.
234. American Fiction and Prose.
234A. Colonial American Prose.
234C. American Fiction: Romance to Realism.
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.
263B. Gender and Interpretation.
FEMINIST STUDIES

Chair: Diane Middlebrook

Program Committee: Jane Collier, Regenia Gagnier, Kerry Hosley, Carolyn Lougee, Nel Noddings, Patricia Polhemus, Marilyn Yalom, Karie Youngdahl

Resources Faculty and Staff: Beverly Allen (French & Italian), Beatriz Arias (Education), Anne Arvin (Medicine), Barbara Babcock (Law), Patricia Barchas (Sociology), James Baron (Graduate School of Business), Russell Berman (German Studies), Helen Blau (Pharmacology), Judith Brown (History), Albert Camarillo (History), Terry Castle (English), Elizabeth Cohen (Education and Sociology), Jane Collier (Anthropology), Carol Conell (Sociology), Wanda Corn (Art), Carl Degler (History), Carl Djerassi (Chemistry), Sanford Dornbusch (Sociology), Sandra Drake (English), John Dupre (Philosophy), Shirley Feldman (Psychology), John Felstiner (English), Estelle Freedman (History), Regina Gagnier (English), Hester Gelber (Religious Studies), Barbara Gelpi (English), Raymond Giraud (French and Italian), Anne Klein (Religious Studies), Nancy Kollmann (History), Anneliese Korner (Psychiatry), Herbert Leiderman (Psychiatry), Suzanne Lewis (Art), Jancy Limpert (Physical Education), Iris Litt (Adolescent Medicine), Carolyn Lougee (History), Eleanor Maccoby (Psychology), Joanne Martin (Business), Judith Martin (Family, Community and Preventive Medicine), Sherri Matteo (Psychology), Diane Middlebrook (English), Pauline Newman-Gordon (French and Italian), Nel Noddings (Education), Mary Pratt (Spanish and Portuguese), Deborah Rhode (Law), Sandra Richards (Drama), Jennifer Ring (Political Science), Jean Roberts (Philosophy), Douglas Russell (Drama), Joel Samoff (Education), Londa Schiebinger (Values, Technology, Science and Society), Marion Smith (Neurology), Susan Stephens (Classics), Kathryn Strachota (German Studies), Myra Strober (Education), Madeline Sutherland (Spanish and Portuguese), Ann Swidler (Sociology), Joan Talbert (Education), Susan Treggiari (Classics), Elizabeth Traugott (English and Linguistics), David Tyack (History and Education), Mary Wack (English), Michael Wald (Law), David Wellbery (German Studies), Jack Winkler (Classics), Sylvia Wynter (Spanish and Portuguese, and Afro-American Studies), Marilyn Yalom (Modern
Feminist Studies is an interdisciplinary program that investigates the significance of gender difference in all areas of human life. Feminist analysis is based on the assumption that gender is a crucial factor in the organization of our personal lives and our social institutions. It focuses on how gender inequality is created and perpetuated. The courses offered by the program utilize interdisciplinary feminist perspectives to expand and reevaluate the assumptions at work in traditional disciplines in the investigation of personal lives, 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 prize for the best undergraduate essay on women, gender or feminism. Essays should reach the office of the Feminist Studies Office by April 15: essays completed during the remainder of Spring Quarter may be submitted for consideration the following year.

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 GPA B+ or better in their coursework in Feminist Studies. Normally, students would apply for Honors Certification in the junior year, or, at latest, in Fall Quarter of the senior year. To apply, students should design a project in consultation with all three of their major advisors, one of whom must be the Chair of the Program. A written proposal signed by all three advisors, describing the project and including the number of units to be awarded, must be submitted to the academic program coordinator of the Individually Designed Majors Program, who will forward it to the Dean’s Advisory Committee on Individually Designed Majors for final approval. In order for an honors proposal to be considered during a particular month, it must be turned in at the Undergraduate Advising Center by the first of the month (excluding July, August, and September) by 5 p.m.

Requirements—For approved honors projects, it is understood that the units will be taken over and above the program already approved for the major; i.e., in addition to those units which will comprise the body of the major.
In addition to completing all the units proposed, the student will submit, in the senior year, *two preliminary drafts*, and then a final draft of a thesis based on substantial research. For students graduating in June, the first draft is due by the end of January, the second by mid-March, and the final draft by mid-April. In order for the honors to be granted, the student's three advisors must read the 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 a grade 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 the student 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 a GPA 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 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 140, 142, 148, 167, 168.

FOCUS
Of the seven courses not part of the core, at least five should reflect a particular thematic focus, and all seven should be chosen in consultation with the student’s advisor.

1. At least three of the focus courses should be feminist studies courses or courses selected from the list of approved courses in other departments and programs (see below).
2. At least one focus course should be offered by a department or interdepartmental program as an initiation into the practice of study in the field: a major survey, methodology or theory course.

The following thematic clusters illustrate foci that individual students can design, in consultation with the advisor:

Sex and Gender
Women in Language and Symbol
Race, Class, and Sex
Women and Work
Feminist Perspectives on Science, Health, and the Environment
Women and Society: the 19th Century
Women and Society: the 20th Century

PRACTICUM
The practicum, taken for 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, a SWOPSI 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, Aut (Collier) MW 1:15-3:05

102. Contemporary Issues in Feminist Theory—(Same as English 163H.) Undergraduate seminar explores some of the most recent developments of feminist theory, including both political and methodological concerns.
5 units, Win (Gagnier) TTh 1:15-3:05

103/203. Seminar in Feminist Studies—(Same as English 263A.) Advanced course on feminist theory and research exemplifying feminist methodologies in both traditional and emerging disciplines. Topics will include the politics of sexual identity; race, class and ethnicity as feminist issues; non-academic literary criticism grounded in movement publications and anthologies. For undergraduates: Prerequisite is Feminist Studies 101.) (Graduate students register for 203 with written application and permission of instructor.)
5 units, Aut (Rich) MW 1:15-3:05

103/203. Seminar in Feminist Studies—(Same as English 263A.) Advanced course on feminist theory and research exemplifying feminist methodologies in both traditional and emerging disciplines. Topics will include the politics of sexual identity; race, class and ethnicity as feminist issues; non-academic literary criticism grounded in movement publications and anthologies. For undergraduates: Prerequisite is Feminist Studies 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—(Same as Psychology 119.) An examination and analysis of 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, Win (Matteo) W 3:15-5:15
GROUP 2: APPROVED COURSES
IN DEPARTMENTS

HUMANITIES

ART
 Spr (Wright)

ASIAN LANGUAGES
Feminist Studies 167. Japanese Women Writers—(Same as Asian Languages 181.) Examination of 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 which will be reading in translation.
 4 units, Win (Matisoff)

DRAMA
155N. American Drama (1960’s to Present)—Survey course 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, will be integrated into the course in order to better reflect the actual vitality and diversity of American drama.
 4 units, Aut (Richards) MWF 1:15

156. American Women Playwrights—Survey course 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.
 4 units, Win (Richards) MWF 1:15

ENGLISH
160F. Love in 19th Century Literature.
 5 units, Win (Pelhemus) MW 11-12:30

 5 units, Win (Drake) MW 1:15-3:05

FRENCH
138/217. Female Saints.
 4 units, Spr (Cazelles)

185/285. Simone de Beauvoir.
 4 units (Giraud) alternate years, given 1987-88

296. Feminist Attitudes in France.
 4 units, Spr (Newman-Gordon)

ITALIAN
Italian 281/381. Novels Into Film—A close comparative analysis of five contemporary Italian novels and their film adaptations. Considers questions of broad theoretical interest (narrative structure in fiction and film; point of view; the language of cinema; the limits of cinematic expression), as well as the social and historical context of these exemplary 20th-Century narratives. Authors include Lampedusa, Moravia, Bassani, and Levi; directors include Visconti, De Sica, Bertolucci, and Rosi. All films will be in Italian with English subtitles. Conducted in English.
 4 units, Win (Springer) TTh 11-12:15

PHILOSOPHY
Feminist Studies 151. Feminism and Political Theory—(Same as Philosophy 177.) Considers what various political theories (liberal, Marxist, socialist) have had to say about the role of women, as well as feminist criticisms of those theories. Also looks at more concrete political/ethical problems which have been of particular concern to feminists, e.g. affirmative action, pornography, abortion.
 Spr (Roberts, Dupre) TTh 11-12:15

167. Gender and Bias in the Philosophy of Biology—Organized around feminist critiques of biological theorizing developed in the last ten years, including: models of human evolution (“Man-the-Hunter” vs. “Woman-the-Gatherer”); the supposed influence of sex hormones on gender, sociobiological theory, and (perhaps) evolutionary theory. The feminist critiques raise such philosophical questions as the character of observation, concept formation; the character of explanatory models; reasoning, data, and evidence; and reductionism.
 4 units, Aut (Doell, Longino) MW 10-11:30

RELIGIOUS STUDIES
Feminist Studies 150. The Virgin Mary and Images of Power—(Same as Religious Studies 234B.) The Virgin Mary and her role as feminine ideal for men and women during the Middle Ages, Renaissance, and beyond.
 4 units, Aut (Geiber) MW 4:15-6:05

SOCIAL SCIENCE
ANTHROPOLOGY
 Spr (Weston)

*Feminist Studies 140. Sex Roles and Society—(Same as Anthropology 11.) Examines 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 are shaped by particular forms of social life. (DR:5*)

3-5 units, Win (Collier) MW 1:15-3:05

144. Family and Kinship Organization—(Same as Anthropology 244.) Seminar on the major issues anthropologists have confronted in the comparative study of family and kinship. Competing theoretical frameworks will be evaluated through an examination of topics such as descent, marriage, gender, domestic groups, and kinship change. Prerequisite: graduate standing in Anthropology or consent of instructor.

5 units, Win (Yanagisako) TTh 1:15

EDUCATION

Feminist Studies 127. Feminist Perspectives on Ethics and Education—(Same as Education 276.) Ethics in education from a transformative perspective of feminism. (There are, of course, other points of view that are called "feminist"). After reading and discussing background material we will concentrate on the problems of ethics and evil with particular attention to their significance for education.

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

Feminist Studies 130. Sex and Education—(Same as Education 170, Sociology 112.) Gender as a critical variable in educational institutions and labor markets. Interdisciplinary approach to issues such as 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, Spr (Tabbert, Staff)

Feminist Studies 138. Women and Development in Africa—(Same as Education 175, Anthropology 109, African and Afro-American Studies 175X.) Explores the diverse roles of women across the African continent, relating them to problems of development. Using an interdisciplinary approach, the course will link women to historical and contemporary conditions of African societies.

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

HISTORY

Feminist Studies 121. U.S. Women's History 1620 to 1870—(Same as History 173A.) This first quarter of a two-quarter survey of U.S. women's history explores women's relation to the economy, the family and state, changing ideals of womanhood; class, race and ethnic variations in female experience. Covers 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)

Feminist Studies 122. U.S. Women's History 1870-1985—(Same as History 173B.) This second quarter of a two-quarter survey explores the transformation of Victorian womanhood in the late nineteenth-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)

*162A. Race, Ethnicity and Gender in American Urban Society: History and Public Policy. 5 units, Win (Camarillo)

263. Undergraduate Colloquium: Women in America—Selected aspects of women's history in the U.S. from the 19th Century to the present. Readings include material from psychology, sociology, and economics as well as history and literature.

5 units, Spr (Degler) T 2-4

265A/365A. Undergraduate Colloquium: History of Sexuality in America—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.) Considers 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 both traditional political theory and contemporary American feminist theory.

5 units, Win (Ring)

PSYCHOLOGY

Feminist Studies 126. The Psychology of Women—(Same as Psychology 116.) Theories of the psychological development of women: investigation of biological and cultural influences on personality and behavior.

3 units, Aut (Matteo) TTh 10-11:15
**Feminist Studies 146. Women and Health**—(Same as Psychology 123.) Emphasis on the health concerns of women and includes such topics as menstrual cycle disorders, contraception, infertility, pregnancy, menopause; eating disorders, occupational health problems, stress management; addictive disorders; rheumatoid arthritis; aging, exercise and nutrition. Interactions between women and the health care system are also considered.

3 units, Win (Matteo) TTh 10-11:15

**Psychology 230. Sex Roles and Socialization.**

4 units, Spr (Nolen-Hoeksema) TTh 2:15-3:45

**SOCIOPY**

**Feminist Studies 123. Female Tragedies and Their Avoidance**—(Same as Sociology 113.) Course emphasizes the vicious circles that surround women who must make choices as they mature, develop social ties, work and age.

5 units, Aut (Dornbusch) M 2:15-5:05

**APPROVED COURSES IN OTHER PROGRAMS**

**FAMILY, COMMUNITY AND PREVENTIVE MEDICINE**

**210. Women and Health**—Topics of interest to women, both as healthcare consumers and providers. Examination of 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 (Martin, Defoseph, Grudzen, Berlin)

**HUMAN BIOLOGY**

**128. Biosocial Aspects of Sexually Transmitted Diseases**—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 units, Win (Schoolnick, Cerel) TTh 3-5

**150A. Biosocial Aspects of Birth Control**—(Same as Chemistry 137A.) Problems of introducing a new, practical birth control agent or procedure which involves legal, political, cultural and economic factors in addition to the purely biological ones.

6 units, Win (Djerassi) TTh 1:15-4:05

**MODERN THOUGHT AND LITERATURE**

**Feminist Studies 165. Sense of Identity in Modern Women Writers**—(Same as Modern Thought and Literature 207.) An examination of female writers whose sense of identity is related to their creativity, sexuality, maternity, and social class. Includes works by Simone de Beauvoir, Violette Le duc, Marguerite Duras, Sylvia Plath, Tillie Olsen, Maxine Hong Kingston, Paule Marshall, and Margaret Atwood.

5 units, Spr (Yalom)
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 equivalent of 3.2. Prerequisites for admission include Economics 51 and 52 and, typically, one course in quantitative methods. Students are strongly urged to seek admission to the program prior to the end of the third quarter of their junior year. Application should be made to the Chairman of the Institute's Graduate Instruction Committee. In addition to meeting the requirements for the Bachelor of Arts, students are required to complete the requirements for the Master of Arts as stated below.

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 an average grade of "B" or better and who complete at least 45 units of approved work in courses numbered 100 or above in the first four quarters at Stanford, with an average grade of "B" or better. The master's program 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: (a) by completion with passing grade of an approved course for the language concerned, or (b) by passing a special reading examination, to be given by a qualified member of the Food Research Institute or of the relevant language department.

At least two years (6 full quarters) of graduate registration in the Institute program is required of each Ph.D. candidate.

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 $6100 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. 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 strat-
Commodity Futures Markets and Prices—(Same as Economics 107.) (Graduate students register for 205.) Description of the uses and functioning of commodity futures markets. Topics include 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

Human Nutrition—(Same as Human Biology 120.) An introduction to human nutrition including the function, digestion, absorption and metabolism of nutrients, dietary recommendations and standards, and a general overview of national and international nutrition problems. Prerequisite: Human Biology core or consent of instructor.

4 units, Aut (Bray, Martorell) MWF 10-11:50

Marketing, Consumption, and Price Analysis—(Same as Economics 128.) (Graduate students register for 220.) Survey of approaches used in the analysis of agricultural commodity prices and markets. Topics include consumer demand, spatial and temporal aspects of prices, market structure considerations, and commodity modeling. Links to microeconomic theory are drawn and emphasis is placed on policy contexts.

5 units, Aut (Peck) TTh 10-11:50

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 broad diversity of experience. Case studies of specific countries are used as a point of departure to illustrate the systematic components of the experience of economic development and those of population growth. The implications are drawn in terms of alternative structures of development, the timing of the demographic transition, income distribution, employment and migration. The interactions and possible causal effects between economic development and population growth are discussed.

5 units, Win (Yotopoulos) TTh 1:15-3:05

Analysis and Management of Development Projects—(Same as Economics 129.) (Graduate students register for 229.) Broad overview of contemporary techniques and experiences in appraising, implementing and managing development projects. Three modules: project planning and scheduling using CPM and PERT methods; theory, calculation and use of conventional appraisal criteria such as net present value, benefit-cost ratio and internal rate of return; and development of database systems for project monitoring and evaluation. Partial budgeting techniques used to compare financial and economic decision criteria. Hands-on exercises with data drawn from LDC agricultural projects emphasized throughout. Extensive use of microcomputers and project planning, spreadsheet and database management software required.

5 units, Win (Gotsch) MW 1:15-3:05

Application of Linear Programming to Agricultural Systems—(Same as Economics 132.) (Graduate students register for 230.) Course concentrates on developing application skills. Includes exercises in mixed integer, multi-period, quadratic and risk programming. Producer-consumer models are also examined. Computer homework exercises analyze issues such as agrarian reform, water resource development, technology choice and allocation of research resources. Model manipulation and data problems are stressed throughout. Prerequisite: One course in microeconomic theory.

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


5 units, Win (Arthur) MW 10-11:50

Determinants of Human Population Processes—(Same as Human Biology 137.) (Graduate students register for 237.) Biological and social factors affecting fertility, morbidity, and mortality. Combines demographic, anthropometric and epidemiological approaches. Examples drawn primarily from developing countries.

5 units, Aut (John) TTh 1:15-3:05

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 structure and characteristics of farm and processing units, the role of agriculture in American economic development, government policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States agriculture. Emphasis is on policy alternatives rather than on farm management.

4-5 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 United States is increasingly shaped by both 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 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. European Agricultural Policy—(Same as Economics 142.) (Graduate students register for 246.) An analytical approach to the development of agricultural policy in Europe, with particular reference to the Common Agricultural Policy of the European Community, and its relationship to agricultural and food problems of member-states. Topics include the agricultural trade relationships between the EC and other advanced countries, trade agreements between EC and developing countries, and the question of enlargement of the community to include Spain and Portugal. Agricultural policies will be discussed in the context of general economic, political, and institutional development. Prerequisite: Economics 51.

3-5 units, Win (Josling) given 1987-88

148. Economic Development in China—(Same as Economics 121.) (Graduate students register for 248.) Examines the structure and development of China's economy, with primary emphasis on 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 (Sicular) MW 10-11:50

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.) An examination of 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. Particular attention to the analysis of interdependence among countries with different economic and social structures such as the U.S., Mexico, Central America, and the Caribbean. Seminar with research papers.

5 units, Spr (Reynolds) given 1987-88

220. Marketing Consumption and Price Analysis—(See 120.)

221. Economics of Production—An examination of production theory with emphasis on 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. Prerequisites: Economics 202 or Business 603 or consent of instructor.

5 units, Win (Archibald) TTh 11:30-1

224. Economic Development: Theory and Empirical Research—Differences between competing paradigms in economic development, such as the orthodox and the structuralist, examined from the point of view of 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. Historical and current experiences of particular countries also examined. Prerequisite: Advanced microeconomic theory, preferably Economics 202-203.
5 units, Spr (Sicular) TTh 10-11:50

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

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. Determinants of Human Population Processes—(See 137.)

244. Economics of American Agriculture: Structure and Policy—(See 144.)


246. European Agricultural Policy—(See 146.)

3 units, Aut (Josling) Th 3:15-5:05

248. Economic Development in China—(See 148.)

250. Nutritional Problems of Developing Nations—(Same as Anthropology 250, Human Biology 110.) The various malnutrition syndromes common in developing countries with emphasis upon protein- calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations. Detailed consideration is given to effects of malnutrition throughout the life cycle, from fetal growth to fertility, with assessment of societal cost of malnutrition and its effects on learning, productivity, and other aspects of national development. Undergraduate prerequisite: 119 or equivalent.
5 units, Win (Martorell) TTh 10-11:30

251. Food and Nutrition Strategies in Development—Examines major policy issues related to raising food consumption levels and improving nutritional status of populations in developing countries, assessing both production- and consumption-oriented policies and programs, and problems of determining an appropriate balance between income-generating activities and social services. Principal focus on low-income developing countries. Economic, technical, institutional, and political factors that influence design and implementation of food and nutrition strategies and problems of restructuring growth to achieve broad participation in gains in productivity and income are discussed.
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, with emphasis on the economic analysis of such problems and of the variety of proposed and possible solutions. The implications of the domestic policies of the major trading countries on agricultural markets in particular as regards staple food products. Emphasis given 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) TTh 3:15-5:05

5 units, Aut (John) W 3:15-5:05

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) given 1987-88

288. Colloquium on Population Studies—(See 188.)
305. Seminar: Commodity Price Analysis—Students prepare a discussion and a paper analyzing some aspect of commodity market and/or price behavior. Prerequisites: 205 and 220 or their equivalent.
3-5 units, Spr (Peck) 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, Sicular, Yotopoulos) T 3:15-5:05

3 units, Spr (Josting, Pearson) TTh 3:15-5:05

386. Seminar: Demography—Prepares students for comprehensive examination and dissertations in the demography field.
3 units, Aut (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

FRENCH AND ITALIAN

Emeriti: (Professors) Raymond D. Giraud, Roberto B. Sangiorgi, Leo Weinstein
Chairman: Alphonse Juilland
Vice Chairmen: Marc Bertrand, Brigitte Cazelles (French Division); John Freccero (Italian Division)

French Division
Professors: Marc Bertrand (on leave Spring), Robert G. Cohn (Tours, Autumn), Jean-Pierre Dupuy, René Girard (on leave Autumn, Winter, Spring), Ralph M. Hester, Alphonse Juillard, Pauline Newman-Gordon, Michel Serres
Associate Professor: Brigitte Cazelles
Professor (Teaching): John G. Barson
Senior Lecturers: Marguerite Bauer, Clio P. Dorr, Hélène Fredrickson, Nelee Langmuir, Michelle Morran, Jacqueline Ollivier
Lecturer: Mary Jane Parrine (Curator, Romance Languages and Humanities, on leave 1986-87)
Visiting Professors: Jean-Marie Apostolidès (Winter), Gérard Ferreyrolles (Autumn), Henri Godard (Spring)

Italian Division
Professor: John Freccero
Associate Professor: Jeffrey Schnapp (Director, Undergraduate Program, on leave Autumn)
Assistant Professor: Beverly Allen (on leave Autumn, Winter), Robert Harrison, Carolyn Springer
Senior Lecturers: Maria Devine, Leda S. Mussio, Annamaria Napolitano, Leopoldina Viggiano
Lecturers: Carla Riga, Giovanni Tempesta
Visiting Professors: Guelfo Frulla (Autumn)

The department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy in French and in Italian.

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.

Candidates specializing in literature or language are expected to take at least three advanced language courses (123, 124, 125), the introductory series to French literature (130,
131, 132) and three advanced courses (numbered above 132) in different periods of literature. Students may then select one of the three following areas of specialization to complete their A.B. in French.

**SPECIALIZATION IN LITERATURE**

Majors concentrating in literature must take in addition a minimum of six literature or civilization electives numbered above 132. Students who intend to pursue graduate studies are urged to take courses in all periods of French literature. They should note that most graduate schools require proficiency in at least one additional modern language.

**SPECIALIZATION IN LANGUAGE**

Majors primarily interested in language and culture must take in addition six of the following courses:

- Séminaire sur des problèmes contemporains
- Prononciation et Phonétique
- Civilisation I: 17th-18th siècles
- Civilisation II: 19th-20th siècles
- French Historical Grammar
- Old French
- Analyses du discours littéraire
- Methods of Teaching French
- Business French

**SPECIALIZATION IN FRENCH STUDIES**

The aim of this program is to enable students to pursue a broadly based major by combining the study of French language, culture, and literature with such fields as art, communication, drama, economics, history, linguistics, music, philosophy and political science.

Requirements: (a) 32 units of French courses beyond French 120; (b) a coherent program of 28 units of approved courses outside the department which contain a significant component of French material. Study programs are formulated in quarterly consultation with a designated advisor who will help students choose from approved courses in the various fields indicated above. The advisor may also approve courses offered at the Stanford Program in Paris, as well as at Tours. Students are strongly encouraged to participate in at least one Stanford Overseas Program in France.

**HONORS PROGRAMS**

**FRENCH**

In addition to the basic undergraduate program, qualified French majors in their junior year may apply for admission to an Honors Program in French. A "B" average in French courses is required; other prerequisites include having completed at least two courses of the language-composition series, French 123, 124, 125, and two of the literature series, French 130, 131, 132. Juniors may apply while still taking the second course of these two series. Ideally, then, the Honors program could be established by Spring Quarter of the junior year. The student's application must include a proposal and general outline of a senior essay, which will be accredited between 9 and 12 academic units, at the student's option: it may be either in English or French depending upon the student's preference and his or her advisor's recommendation. Honors program students also fulfill all regular requirements for the A.B. in French.

**HUMANITIES**

For majors who wish to supplement their departmental major by a related program of studies. See the "Humanities Special Programs" section.

**EXTENDED MAJORS**

French and English Literatures—In addition to the requirements for the A.B. in French Literature, candidates should complete four English literature courses numbered 100 or above, and related to their French courses. However, two English literature courses can count toward the four electives in French.

French and Italian Literatures—In addition to reading proficiency in Italian, candidates should satisfy requirements similar to those stated in the previous paragraph.

English and French, and Italian and French—English majors and Italian majors interested in a combined degree with French literature should refer to "Extended Majors" in the English and Italian sections.

**LA MAISON FRANÇAISE**

The "Maison Française" located at 610 Mayfield, is an undergraduate residence which offers a wide variety of opportunities for students to expand their knowledge, understanding and appreciation of French language and culture. In-house seminars on French culture, arts and civilization are offered when possible. Assignment is made through the regular undergraduate housing draw.

**DEPARTMENTAL PROGRAM AT THE UNIVERSITY OF PARIS**

Each year, French majors in their sophomore or junior year, graduate students, as well as other students with an adequate command of the French language, may apply for the departmental program at the University of Paris during the following Autumn and Winter Quarters. If desired, studies may be continued during
Spring Quarter. Students live in residence halls or with private families and attend courses at the University of Paris. A faculty supervisor accompanies the group and offers a supplementary program of studies. Forms and information may be obtained from the Overseas Studies office.

INTENSIVE LANGUAGE WORK AT STANFORD IN FRANCE

Students attending Stanford in France, in Tours, have the opportunity to take courses in French language, literature, conversation, and civilization. All students will be required to take a language course for the first quarter, and possibly the second quarter of the session overseas. All courses in language bear the designation French 70, 80, or 90. Assignment to a particular level is made by the director and language faculty at the campus.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the “School of Education” section of this bulletin and the Credential Administrator, School of Education.

GRADUATE PROGRAMS

Applicants should read carefully the general regulations governing advanced degrees (see the “Degrees” section in this bulletin). They should have preparation equivalent to an undergraduate major in French with a minimum average grade of “B” and should also have reached a high level of speaking proficiency, to be demonstrated either in a personal interview or by a tape recording sent to the department. Previous study of a language other than French is highly desirable.

In addition to the Ph.D., the department offers two different kinds of master’s programs and participates with the School of Education in its Master of Arts in Teaching program.

Visiting Students—Students who are not candidates for a graduate degree but meet the standards of admission to a master’s or Ph.D. program may apply to the Graduate Admissions Office for admission as non-matriculated students for a period of not more than three consecutive quarters. Each quarter they may take up to three courses numbered 200-299 or two such courses and (with the permission of the instructor) one course numbered 300.

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered jointly by this department and the School of Education. The degree is intended for candidates who have a teaching credential 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.

MASTER OF ARTS IN FRENCH (TERMINAL PROGRAM)

The Master of Arts provides a combination of language, literature, civilization, and methodology courses designed to prepare secondary school, junior college, or college teachers. Candidates must complete a minimum of 36 units of graduate work, with a “B” average, and pass a final examination. To fulfill the requirements in one year, they should enroll for an average of 12 units per quarter.

Candidates for this degree are not eligible for financial aid.

The basic course program, intended for those who plan to teach French (modifications are possible for those who do not), is as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 200. Analyses du discours littéraire</td>
<td>4</td>
</tr>
<tr>
<td>French 201. Prononciation et Phonétique</td>
<td>4</td>
</tr>
<tr>
<td>French 203. Grammaire historique de la langue française: phonologie</td>
<td>4</td>
</tr>
<tr>
<td>French 210. Old French</td>
<td>4</td>
</tr>
<tr>
<td>French 290. Civilisation I: 17\textsuperscript{e}-18\textsuperscript{e} siècles</td>
<td>4</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>French 291. Civilisation II: 19\textsuperscript{e}-20\textsuperscript{e} siècles</td>
<td>4</td>
</tr>
<tr>
<td>French 293. Methods of Teaching French or Education 383. Recent Developments in Foreign Language Education</td>
<td>4</td>
</tr>
<tr>
<td>Four literature courses numbered 200</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
</tr>
</tbody>
</table>

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 forty-eight 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 works other than those covered in the candidate's work. Questions will be asked relating to both literature, language and civilization.

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

The Master of Arts in French is required of all Ph.D. candidates. Doctoral candidates must apply for A.M. candidacy. Upon successful completion of a minimum of 36 graduate units and of the Ph.D. qualifying examination, all candidates will receive an A.M.

Normally the Ph.D. program should be completed in four years. The first and second years should be devoted to full-time study; the third and fourth years to study, teaching and dissertation work.

The Ph.D. graduate in French Literature is expected to have attained a reasonable mastery of the literature and the language. Students will emphasize some areas or centuries rather than others, but knowledge of the whole field should be well advanced at the time of graduation. A primary goal of the program is excellence in the art of writing scholarly articles and books. The department also emphasizes competence in the teaching of language and literature.

All candidates, regardless of their field of specialization, are expected to fulfill the following general requirements:

1. Course requirements—A total of no fewer than 72 units of graduate work, preferably to be completed by the end of the second year. Additional units of graduate courses, seminars, or individual work in the candidate's major or minor field are strongly recommended and will be determined according to the advisor's (or advisory committee's) judgment and the candidate's needs. French 200, Analyses du discours littéraire, and one philology course are to be among the 72 required units.

By the end of their studies, doctoral candidates must have acquired competency in Latin and in a second Romance language equivalent to one year of college. Satisfactory completion of the Latin requirement is a prerequisite for the required Philology course. The second Romance language can be replaced by another upon petition to the Faculty Council. The requirement may be satisfied by course work, by examination, or by proof that equivalent study has been completed.

All candidates, regardless of their area of specialization, must take in the department at least ten literature courses exclusive of directed reading, covering four centuries

(For the purpose of this requirement the Middle Ages count as a century).

2. Examinations—The Ph.D. qualifying examination 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 knowledge of the literary, cultural, and social history of the period. For works of the Middle Ages or Twentieth Century, three successive centuries must be represented including that of the candidate's specialization.

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 "Degrees" section of this bulletin for graduate school administrative details.)

3. Dissertation—The doctoral dissertation should demonstrate ability to carry out research, organize, and present the results in publishable form. The scope of the dissertation should be such that it could be completed in one to one-and-one-half years of full-time work. However, the department will encourage, in appropriate cases, projects requiring more time for completion. Various kinds of dissertations are acceptable to the department; for example, a historical study of a particular phenomenon, the dis-
cussion of one or more representative works of a genre, a comparative study, etc.
4. Teaching experience—Ph.D. Candidates, whatever their sources of financial support, are expected to demonstrate pedagogical proficiency by teaching under supervision three quarters at one-half time.

Note—A new Ph.D. track is about to be initiated which will combine regular literary courses with an interdisciplinary and theoretical emphasis. It will include one full year of residence in Paris in conjunction with the Paris Overseas Program. Students will have an opportunity to study with internationally known thinkers and scholars, both at Stanford and at Paris. Interested students should contact: Professor René Girard, French and Italian, Stanford University, Stanford, CA 94305.

JOINT DEGREES AND MINORS
A candidate may also take a joint degree in French and Humanities (for a description of this program, see the section “Humanities Special Programs”). Minors are possible in Medieval Studies, in Linguistics, in Comparative Literature, in Modern Thought, and in departments offering related courses such as history, history of art, music, philosophy, social thought, etc.

Students interested in a joint degree or a minor should plan their course of study with their advisor(s). Joint degrees and minors usually require 24 additional units. By carefully planning their programs, students may complete their course work for the Ph.D. and the minor in a total of nine quarters.

Ph.D. MINOR IN FRENCH LITERATURE
The department offers a minor in French Literature to students from other departments.

The requirements for a graduate minor in French Literature are:
1. A sound reading knowledge of French.
2. A minimum of 24 units of course work (six courses) covering at least two centuries or two genres (poetry, fiction, theater, or other prose) or a combination of both.

EXCHANGE WITH THE ECOLE NORMALE SUPERIEURE
The department has an annual exchange with the Paris Ecoles Normales Supérieures. Every year two of the French doctoral candidates spend the academic year at the Ecoles in Paris.

ITALIAN DIVISION

OFFERINGS AND FACILITIES
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 are an honors program in the Humanities (see “Humanities Special Programs”), 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 at the Villa il Salviatino in Florence, Stanford in Italy affords both undergraduate and graduate students the opportunity for intensive study of Italian language, culture and literature. Information on the Florence program is available at the Overseas Studies Office, Room 112, Old Union.

LA CASA ITALIANA
The Casa Italiana, located at 562 Mayfield, is an undergraduate residence devoted to developing an awareness of Italian language and culture. It works closely with the Italian Cultural Institute in San Francisco and with other local cultural organizations. It often hosts visiting
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 first two quarters of the intermediate-level survey sequence (Italian 227 and 228).
   b) Italian 129 ("Introduzione alla storia italiana").
   c) One of the advanced language courses; that is, 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 grade average 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 Courses and Degrees 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 “B” average, and pass a final examination. To fulfill the requirements in one year, they should enroll for an average of 12 units per quarter.

The basic course program is as follows:
9 graduate courses in Italian. One course may be in a related field. There is the option of substituting a master’s thesis for two literature courses.

Total units ................................................. 36

Reading knowledge of a second Romance language, to be demonstrated by passing an examination, is required. Recommended: French.

Requirements for the completion of the A.M. include a comprehensive literature and language examination, which will be administered two weeks before the end of the Spring Quarter. An oral examination will follow within a week of the written exam.

All candidates are required to teach at least one Italian language course under departmental supervision in order to gain teaching experience. The program director reserves the right to waive this requirement for those candidates who have prior teaching experience in Italian.

Limited financial aid is available in the form of teaching assistantships.

Applications for admission 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 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 Literary Theory, History, the History of Science, Philosophy, Religion, Art History, Medieval or Renaissance Studies, Classics, French, Comparative Literature, Linguistics, Feminist Studies and Film.

The program is founded on the belief that this sort of balance between period specialization and interdisciplinary breadth is not only desirable, but also essential in a small field such as Italian studies, particularly so given the diversity of the Italian literary canon (extending, as it does, over a wide variety of disciplines).

Students admitted into the Ph.D. program in Italian work closely with their faculty advisor in structuring a plan of study appropriate to their needs and interests. Such a plan will usually involve a mix of courses taken within the Italian program, courses taken in other departments, and of independent work done under the supervision of a member of the Italian faculty. Students are admitted into the program as Italian Fellows on a fellowship plan which integrates 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 third or fourth years of study, students may pursue dissertation research and independent work at the Stanford campus in Florence under the supervision of a member of the Italian faculty. The Florence center, located in the outskirts of the city, 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: a) take the oral qualifying exam (equivalent to the Master's exam), and b) 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 M.A. 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 if careful advance planning is not done.

Ph.D. MINOR IN ITALIAN LITERATURE

A minor in Italian Literature is offered for students from other departments. The requirements for a graduate minor are: a) a minimum of 24 units of graduate course work in Italian literature, and b) a sound reading knowledge of the Italian language.
## COURSES

### FRENCH DIVISION

**Note**—Since unavoidable changes often have to be made in literature course offerings after *Courses & Degrees* has gone to print, students are advised to consult regularly the department bulletin board regarding course changes.

Students interested in languages not listed by a specific language department should contact the Special Language Program, Department of Linguistics.

### FIRST- AND SECOND-YEAR LANGUAGE

**Note**—Students registering for the first time in a first- or second-year course must take a placement test if they have had any training in French before entering Stanford. The test will be given Friday, September 26.

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


   5 units, Aut, Win, Spr (Staff) MTWThF

3. **First-Year Conversation**—Cours de conversation au niveau linguistique du Frangais 2. Prerequisite: 1 or equivalent. Course offered on a Pass/No Credit basis only.

   2 units, Aut, Win, Spr (Staff)

4. **First-Year French (Part 3)**—Continuation du Frangais 2. Conclusion de 1'etude de la Srammaire elementaire. Acquisition de tours idiomatiques. Expression individuelle orale et ecrite. Quelques lectures d'extraits litteraires.

   5 units, Aut, Win, Spr (Staff) MTWThF

5. **Intensive French for Beginners**—An accelerated first-year French course in which either 2 or 3 quarters of French may be covered. Course offers preparation in speaking, writing, and reading the language. All in French method is used. Written exercises, compositions, conversational drills, as well as daily work in the language laboratory are also an integral part of the course. See Summer Session Bulletin for details. (No auditors permitted.)

   8-12 units, Sum (Staff)

6. **Reading French**—An accelerated course designed specifically for the acquisition of reading ability. Primarily intended for graduate students seeking to meet the University reading requirement for advanced degrees. Also open to seniors. No auditors permitted.

   4 units, Aut (Staff)

7. **20C. Second-Year Conversation**—Le franc.ais dans les situations de la vie de tous les jours. Prerequisite: French 3 or equivalent. Course offered on a Pass/No Credit basis only.

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

8. **21R. Grammar Review**—Basic French grammar with specific emphasis on written expression with some training in speaking. Offered for students with previous training in French either in high school (3-5 years) or in other universities, whose progress would be best served by a concentrated review of first-year material.

   3 units, Aut, Win (Staff)


   4 units, Aut, Win, Spr (Staff) MTWTh

10. **Second-Year French (Part 2)**—Continuation du Frangais 22. Partant de lectures groupées selon des themes de portee universelle, les etudiants discuteront les idees et leurs points de vue personnels. Continuation de la grammaire essentielle.

    4 units, Aut, Win, Spr (Staff) MTWTh


    4-5 units, Aut, Win, Spr (Staff) MTWTh

12. **Intensive Intermediate French**—(Equivalent to both French 22 and 23.) A complete
grammar review offered in conjunction with reading of selected French texts. Classroom discussions, entirely in French, focus both on the reading material and on topics of current interest. Written exercises, oral reports, written compositions, and work in the language laboratory are included. Prerequisite: One year of college French or equivalent preparation. No auditors permitted.

6-8 units, Sum (Staff) MTWTh

29. Business French—Designed for students interested in business who need to acquire the necessary skills to function and communicate in the French-speaking business world. These skills are developed through readings and acquisition of specialized vocabulary, discussions, written work, including translations and business letters. Prerequisite: 22, or equivalent.

3-4 units, Aut, Win, Spr (Morran)

30C. Conversation and Culture—La France vue par des écrivains français et étrangers. Présentation et discussion des opinions. Prerequisite: French 23 or equivalent. May be repeated once for credit after an interval of two quarters. Course offered on a Pass/No Credit basis only.

2 units, Aut, Win, Spr (Staff)

UNDERGRADUATE SEMINARS

61. French Culture—Grande tendances de l'histoire sociale et culturelle de la France du Moyen Age à nos jours.

3 units, Aut (Staff)


3 units, not given 1986-87

63. French Theater Workshop—Réalisation d'une pièce; interprétation, techniques, mise-en-scène, décor.

3 units, Spr (Staff)

STANFORD PROGRAM IN TOURS

70, 90, 90. Intensive and Accelerated French—Given only at Stanford in France.

5 or more units, Aut, Win, Spr (Staff)

THIRD- AND FOURTH-YEAR LANGUAGE

Auditing is not permitted in participation language courses except in special cases.

120. Séminaire sur des problèmes contemporains—Conversation et discussion sur des problèmes actuels à partir de journaux, revues ou films français. Prerequisite: 24 or equivalent.

May be repeated once for credit after an interval of two quarters.

3 units, Aut, Win, Spr (Staff)

121. Prononciation et Phonétique—(Graduate students register for 201.)

4 units, Aut (Juilland)

122. Poetry Translation as Art Form—(Graduate students register for 205.)

4 units, Win (Newman-Gordon)

123. Composition, grammaire et étude de textes—Langue orale et écrite, grammaire descriptive, analyse grammaticale, composition, explication de textes. Prerequisite: 24 or equivalent.

4 units, Aut, Win, Spr (Staff)

124. Langue, style et écriture—Continuation du Français 123. Le commentaire littéraire, les styles de la critique, composition.

4 units, Win, Spr (Staff)

125. Cours avancé de français—Exercice de style, traduction et explication de texte: enrichissement du vocabulaire. Prerequisites: 123 and 124 or equivalent.

4 units, Spr (Staff)


3-4 units, Aut, Spr (Morran)

LITERATURE


4 units, Spr (Cohn)

130. French Literature I: Middle Ages and Renaissance—Etude générale de la littérature française de l'époque médiévale jusqu'à l'essai philosophique du 16e siècle (Chanson de Roland, Chrétien de Troyes, poètes du 16e siècle, Rabelais, Montaigne). Prerequisite: 24 or equivalent. (DR:2)

4 units, Spr (Cohn)

131. French Literature II: 17th and 18th Centuries—Etude générale de la littérature française 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—Etude de la littérature française du Romantisme à nos jours. Prerequisite: 24 or equivalent. (DR:2)

4 units, Win (Weinstein)

Note—Prerequisites for the following courses are normally 130, 131, or 132, or equivalent.
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>201</td>
<td>Prononciation et Phonétique — Etude théorique et travaux correctifs, articulation, rythme, intonation, timbre, quantité, graphie traditionnelle et voyelle instable, liaison et enchaînement, graphie phonétique</td>
<td>4</td>
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<td>Grammaire historique de la langue française: phonologie</td>
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<td>Win (Staff)</td>
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<td>205</td>
<td>Poetry Translation as Art Form</td>
<td>4</td>
<td>Win (Newman-Gordon)</td>
<td>The translation of poetry will be studied as an art form, comparing five or six renditions of major French Poets in English (Baudelaire, Rimbaud, Valéry, Apollinaire, Eluard, etc.)</td>
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<tr>
<td>210</td>
<td>Old French—Introduction to the grammar and documents of Old French, with particular emphasis on the early period</td>
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<td>The Symbolist Poets—Baudelaire, Mallarmé, Verlaine, Rimbaud, Yeats, George, etc. Lectures and discussions in English, readings in original language and/or bilingual editions</td>
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<tr>
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<td>Memory and Modernity: Representing the Past and Theorizing Culture Since the French Revolution—Evolutions in the form of social memory under the new conditions of liberal, industrial society since the 19th century. How the new configuration of memory played a role in the generation of modern cultural theory. Readings in 19th century literary and historical texts (Flaubert, Musset, Marx, and Michelet) and 20th century theoretical texts (Bakhtin, Bourdieu, Foucault, Derrida, Lyotard). Reading knowledge of French assumed; discussion in English</td>
<td>4</td>
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<td>Le Surréalisme—Une définition du Surréalisme à travers les Manifestes d'André Breton. Etude de poèmes et de romans par A Breton, Soupault, Eluard, Aragon, J. Cracq</td>
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<td>Win (Newman-Gordon)</td>
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<td>Win (Apostolides)</td>
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<td>Mimesis, Sacrifice and Literature</td>
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</table>
CIVILISATION FRANÇAISE

Approches: civilisation matérielle et modes de vie; Etat et classes sociales; culture savante et traditions populaires; idéologies et mentalités.

291. Civilisation II—19e-20e siècles.
4 units, Win (Bertrand)

GRADUATE

4 units, Aut (Hester)

335. Molière.
4 units, Aut (Ferreyrolles)

363. Mallarmé.
4 units, Win (Cohn)

371. La Grande Génération—Une étude de quelques oeuvres poétiques et en prose qui se situent dans la deuxième génération symboliste en France (Valéry, Claudel, Pégy, Alain Fournier, Gide, Froust).
4 units, Spr (Newman-Gordon)

375. Dostoievsky and French Literature—(Enroll in Comparative Literature 375.) Dostoievsky's relations with French literature, both as a source of inspiration for his own work and as himself inspiring modern French writers. Notes from the Underground and Crime and Punishment are read along with works by Diderot, Balzac, Gide, Camus and Sartre.
5 units, Win (Frank)

391D. L'Art plastique et le récit au 19e siècle.
2 units, Aut (Serres)

391E. Le Temps et le récit au 17e siècle.
2 units, Spr (Serres)

398. Tutorials—Initiated by a professor. Tutorials are intended for at least three (but preferably more) graduate students who wish to study on an informal basis a subject or an area not covered by regular courses.
4 units, Aut, Win, Spr, by arrangement

399. Individual Work—Exclusively for graduate students in French working on thesis or engaged in special work. See instructor for section number.
1-12 units, any quarter (Staff).
by arrangement

OFFERED BUT NOT DURING 1986-87

105. The Writings of Albert Camus.
108/298. Myth and the Bible.
110. Contemporary French Literature and Thought.
114. The French Novel.
114A. The 19th Century French Novel.
114C. The Contemporary French Novel.
115. Introduction to Existentialism.
117A,B/297A,B. Mythology and Christianity.
135. Le Roman arthurien.
139. Chrétien de Troyes.
140. Renaissance I.
150. Romanciers et Prosateurs du 17e siècle.
151. 17th Century Literature.
152. Grands Auteurs du 17e siècle.
153. Corneille et Racine: le théâtre tragique.
161. Romans du 18e siècle.
163. Marivaux et Beaumarchais.
164. Introduction to the Philosophy of the Enlightenment.
170. Le Romantisme.
171. Le Roman au 19e siècle.
173. Symbolism.
175. Le Théâtre au 19e siècle.
180. La Poésie française - 20e siècle.
181. Le Théâtre de 1945 au présent.
182. Le Roman au 20e siècle.
185. Simone de Beauvoir.
191. The Idea of Revolution in Modern French Literature.
192/292. French Women Poets.
194. The European Novel.
196. The Literature of Decolonization.
204. Introduction to Rumanian.
211. Old Provençal.
212. Littérature médiévale I: 11e—13e siècles.
214. L'Epopeée.
216. Medieval Drama.
219. Special Topics on Medieval Literature.
230. Introduction au 17e siècle.
234. Racine.
237. Les Moralistes français.
240. Grands Textes des lumières.
241. Le Roman au 18e siècle.
243. Voltaire et l'idéologie bourgeoise.
244. Rousseau.
270. Le Roman 1898-1950.
280. Individu et société dans le roman contemporain.
281. Le Théâtre de 1945 au présent.
282. Structuralism and Post-Structuralism.
283. Le Théâtre contemporain.
284. Simone de Beauvoir.
286A. The Literature of Decolonization.
287. Roland Barthes.
290. Civilisation I.
294. The European Novel.
312. Fabliaux.
313. Courtly Love.
314. French Epics.
315. The Grail.
316. French Lyric Poetry.
317. French Medieval Drama.
318. Chronicles.
319. Special Topics on Medieval Literature.
320. Poésie de la Renaissance I.
322. Rabelais.
323. Montaigne.
324. Renaissance Prose.
325. Le 17e siècle.
326. Le Théâtre classique.
327. Poésie de Malherbe à la Fontaine.
328. Racine.
329. Molière.
330. Pascal.
346. Diderot.
351. Le Romantisme.
352. Balzac.
353. Stendhal.
354. Flaubert.
355. Zola.
360. Baudelaire.
361. Rimbaud.
362. Ideology of Literature from Romanticism to the Present.
365. Théories critiques au 19e siècle.
372. Proust.
373. Apollinaire—Alcools et Calligrammes.
374. Valéry.
380. Le Nouveau Roman et après.
383. La Querelle des Anciens et des Modernes.
385. Points de vue critiques au 20e siècle de Valéry à la Nouvelle Critique.
390. Théorie de la poésie.
393. La Poésie au 20e siècle.
396. Freud and Literary Theory.
397. Colloquium on Research Methods in French and Italian Studies.

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. Major 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 (Schnapp) given 1987-88

240. Boccaccio's Decameron—(Graduate students should register for 340.) Boccaccio's masterpiece studied with particular attention to its representation of 14th century Italy and against the background of such precedents as the Gesta Romanorum and the Novellino. Major 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, Spr (Schnapp)
248. Machiavelli—(Graduate students should register for 348.) An in-depth introduction to Machiavelli's works, including The Prince, the Discourses, the Dialogo della lingua, and the theatrical works, with particular attention to 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, Sanzaro, Michelangelo. Open to all students, including freshmen.
4 units, Win (Harrison)

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 such 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 (Allen) not given 1986-87

281. Novels into Film—(Graduate students should register for 381.) A close comparative analysis of five contemporary Italian novels and their film adaptations. Considers questions of broad theoretical interest (narrative structure in fiction and film; point of view; the language of cinema; the limits of cinematic expression), as well as the social and historical context of these exemplary 20th century narratives. Authors for '86-'87 will include Lampedusa, Moravia, Bassani, and Levi; directors will include Visconti, De Sica, Bertolucci and Rosi. All films will be in Italian with English subtitles. Open to all students, including freshmen. (DR:2)
4 units, Win (Springer)

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 but with increasing 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 as well as lectures. Prepares students for study at the Florence center. May be taken concurrently with 2 or 3. Prerequisite: 1 or equivalent.
2 units, Win, Spr (Staff) MWF

3. First-Year Italian (Third Quarter)—As above but 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 either two or three quarters of First-Year Italian may be covered. The first part of the course (5A) counts for 8 units and covers Italian 1 and 2 in 5½ weeks. The second part (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 wish to complete more or less than five units per quarter, or who have a spotty background in Italian, or who have a conflict with the normally scheduled language courses. Students work at their own pace in regular consultation with the instructor. Students who wish to take Individualized Italian must submit an application to the coordinator of the Italian Language Program.
1-15 units, Aut, Win, Spr (Staff)

10. Reading Italian—An accelerated course designed specifically 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.
4 units, Win (Springer) MWF
30A,B. Italian Conversation—Intermediate and advanced level conversation courses for students who wish to improve their spoken Italian. 30A, "Intermediate Italian Conversation" is for students who have completed, or are in the process of completing, their first year of Italian. 30B, "Advanced Italian Conversation" is for students returning from the Florence program and/or students who have completed one quarter of second-year Italian. Subject matter of each course varies from term to term; 30A or 30B may be repeated up to two times for credit. 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.

4 units, Aut, Win (Staff) MTThF

52. Second-Year Italian (Second Quarter)—As above but with particular emphasis on translation, stylistics and composition. Prerequisite: 51 or equivalent.

4 units, Win, Spr (Staff) MTThF

53. Second-Year Italian (Third Quarter)—Continuation of 52. Prerequisite: 52 or equivalent.

4 units, Spr (Staff) MTThF

114. 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 are a central component of the course. Prerequisite: 52 or consent of the instructor.

4 units, Aut (Staff)

116. Advanced Stylistics and Composition—Designed to help students 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, 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 (Napolitano)

157. Italian Opera—An historical and aesthetic introduction to Italian opera from its origins to the early 20th century, with emphasis on Verdi, Puccini and Rossini. Includes readings from librettos and study of videotaped and recorded opera performances. Prerequisite: 3 or equivalent.

3 units, Win (Frulla)

198. Language Specials—with special permission of the department only. 1-5 units (Staff)

ADVANCED LANGUAGE AND CIVILIZATION

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. 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)

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 (Harrison)

228. Italian Literature II: From Mannerism through the Modern—Reading of selected works from such authors as Marino, Campanella, Tesauro, Calleo, Vico, Goldoni, Alfieri, Leopardi, Foscolo, Manzoni, Verga and Pirandello. Required of all Italian majors. In Italian. (DR:2)

4 units, Win (Harrison)

229. Special Seminar on Italian Literature—Unlike 227 and 228, the emphasis here is
methodological. An in-depth study of a genre, author, period or theme in Italian literature within the framework of contemporary theories of literature and language. The subject matter and emphasis varies according to the interests of the instructor. Required of all Italian majors who select the Italian literature concentration. Prerequisite: 227 and 228 or permission of the instructor.

Rhetoric, Semiotics and Contemporary Italian Literature—A study of contrasting theories of literary and linguistic signification in works by such authors as Eco, Luzi, Zanzotto, Valesio, Moravia, Sciascia, Barilli.

4 units, Spr (Allen)

(Re)Constructing the Self: Italian Autobiographies—A seminar on the Italian autobiographical tradition from Dante and Petrarch through Vico and Alferi, studied in relation to contemporary theories of autobiography.

4 units, Spr (Schnapp) given 1987-88

233. Dante’s Divine Comedy—(See “General Courses.”)

4 units, Aut (Schnapp) given 1987-88

240. Boccaccio’s Decameron—(See “General Courses.”)

4 units, Spr (Schnapp)

248. Machiavelli—(See “General Courses.”)

4 units, Aut (Frulla)

250. The Italian Renaissance—(See “General Courses.”)

4 units, Win (Harrison)

267. Italy as a Literary Symbol—(See “General Courses.”)

4 units, Win (Allen) not given 1986-87

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—An examination of the origins of vernacular literature in Medieval Italy, including the poetry of the Sicilian School, the stilnovisti, Guido Cavalcanti, the chronicles (Villani), the mystico-religious lyric (Jacopone, S. Caterina), vernacular preachers (Giordano da Rivalto), Brunetto Latini and vernacular learning, ribald verse (tenzoni), and the young Dante. Offered in alternative years from the 335-337 sequence.

4 units, Aut (Schnapp) given 1987-88

333. Dante’s Divine Comedy—(See “General Courses.”)

4 units, Aut (Schnapp) given 1987-88

335-338. Advanced Courses on Dante—Advanced study of Dante’s works in light of recent developments in the field. Emphasis is upon Medieval theories of language and interpretation and questions of textuality 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.

335. Dante’s Divine Comedy: Inferno—Intensive study of the first canticle of Dante’s masterpiece.

4 units, Aut (Jacoff)


4 units, Win (Freccero)

337. Dante’s Divine Comedy: Paradiso—Intensive study of the third and final canticle of Dante’s masterpiece.

4 units, Spr (Freccero)

338. Dante’s Minor Works—The Rime, Vita Nuova, Consolatio, De Vulgari Eloquentia, and Monarchia. Offered in alternating years from the 335-337 sequence.

4 units, Win (Freccero) given in 1987-88

340. Boccaccio’s Decameron—(See “General Courses.”)

4 units, Spr (Schnapp)

THE RENAISSANCE

345. Petrarch and Petrarchism—Includes readings from the Canzoniere, Epistolae, De Vita Solitaria and Secretum, studied in relation to later developments in Petrarchan poetics in Italy (Ariosto, Gaspara Stampa, Tasso), Spain (Garcilaso, Quevedo, Gongora), England (Sidney, Shakespeare) and France (Ronsard). 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 (Harrison)

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) given 1988-89
355. Michelangelo: The Poet and the Artist—Interdisciplinary course which examines Michelangelo’s poetry in relation to his artistic production. The seminar 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 both in Michelangelo’s poems as well as his art work. Readings include Plato’s Symposium, Michelangelo’s Poems, and writings by Panofsky. Open to all students.

4 units, Spr (Harrison)

356. Giordano Bruno and Renaissance Hermeticism—Bruno’s work studied in relation to the development of the occult sciences and the Hermetic tradition.

4 units, Spr (Schnapp) given 1987-88

FROM THE BAROQUE TO THE MODERN

360. Giambattista Vico’s New Science—Vico’s theory of history studied (a) in relation to classical (Herodotus, Livy, Tacitus) and Renaissance (Machiavelli, Guicciaridini) precursors, and (b) in relation to various modern theories of history (Hegel, Nietzsche, Foucault). Offered in alternating years from 362.

4 units, Spr (Harrison) given in 1987-88

362. Seminar on the Italian Baroque—An interdisciplinary study of the poetics of the Baroque in literature, theater, architecture, sculpture, painting and music. Special attention is given 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. Offered in alternating years from 360.

4 units, Spr (Springer)

363. The Italian Theater from Goldoni to Pirandello—The development of Italian theater from the mid-eighteenth century to the second world war. 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. Offered every other year.

4 units, Spr (Springer) given in 1987-88

365. Ruins and Representation in Italian Romanticism—A study of the role of archeology 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 Belli.

Considerable attention is given to the visual arts; museums, fresco cycles, and political festivals. Offered in alternating years from 353.

4 units, Aut (Springer) given 1987-88

367. Italy as a Literary Symbol—(See “General Courses.”)

4 units, Win (Allen) not given 1986-87


4 units, Spr (Springer)

369. The Literature of Unified Italy—Italian literary production from the time of national unification until World War I. Readings from Caracci, 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 macchiati and Futurism. Also studied is 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 (Springer)

370-379. Specialized Seminars on Major 19th and 20th Century Authors and Literary Movements—These seminars 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 such subjects as: 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, Aut (Allen) given 1987-88

372. Italo Calvino: Neo-Realism to Metaphiction—A study of Calvino’s development as a writer which analyzes 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 (Springer) given in 1988-89

373. Filippo Tommaso Marinetti and Italian Futurism—Marinetti’s literary career studied 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 (Schnapp) given in 1987-88
374. Pirandello—Readings consist of 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.) Examines 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, Win (Harrison) given in 1988-89

380. Politics and Culture in 20th Century Italian Literature—The Italian neocento studied in terms of the pre-war and the post-war avant-gardes, with particular emphasis on the development of the modern Italian novel. Major authors: D’Annunzio, Marinetti, Vittorini, Moravia, and Pasolini.

4 units, Spr (Schnapp) given 1988-89

381. Novels into Film—(See “General Courses.”)

4 units, Win (Springer)

382. 20th Century Italian Poetry—The development of modern Italian poetry examined 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 1986-87

385. Fascism and Culture: Seminar on Fascist Modernism—The problem of Fascist modernism approached from within an interdisciplinary/comparatist framework (a) as a problem in the relation of politics and ideology to modern culture; (b) in relation to contemporary theories of the avant-garde; (c) as an issue in 20th century poetics, mythology and narratology; and (d) in relation to the larger problem of interpreting the Fascist movement as a whole. Major topics include 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)

387. The History of the Italian Language—The Italian language studied in its lexical, morphological and syntactical evolution from the 11th century to the present, with an emphasis on the philological analysis of literary texts. Some background in Latin is recommended.

4 units, Spr (Decine) given 1988-89

399. Individual Work—Open to undergraduates who are working on a special project (such as 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 considered in its historical development, in relation to other disciplines and fields, and in terms of problems of literary theory and methodology.

4 units, Aut (Staff) 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 is on overall strategy for research, but provides an opportunity to explore bibliographical sources in the particular fields of interest to each student. (See “Libraries and Information Services.”)

2 units, Aut (Parrine)

498. Ad Hoc Graduate Seminars—Initiated by a group of three or more graduate students, ad hoc seminars can be set up under the sponsorship of an interested faculty member to study a subject or an area not covered by the department’s regular course offerings. Arrangements must be made at least one term in advance.

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

499. Individual Work—For graduate students engaged in work on a special project in the field of Italian Studies. May be repeated for credit. See instructor for section number.

1-15 units, Aut, Win, Spr, Sum (Staff) by arrangement

500. Dissertation Research—Exclusively for graduate students in Italian working on dissertations.

1-12 units, Aut, Win, Spr, Sum (Staff) by arrangement
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 Turneaure
Consulting Professor: J. Alan Pfeffer
Mellon Fellow: Kari Ellen Gade, Winter

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 theme house at 620 Mayfield, is an undergraduate residence which is devoted to developing an awareness of the culture of Central Europe. A number of departmental courses are regularly taught at the house, and there are in-house seminars and conversation courses. Assignment is made through the regular undergraduate housing draw.

The department also houses the Institute for Basic German (J. Alan Pfeffer, Founding Director). The Institute holds a unique corpus of data on the contemporary German language, which is available for research to graduate students and faculty. Currently, the Institute is engaged in a major computer-based research project.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

Majors in German Studies formulate their plans in quarterly consultation with an undergraduate major advisor. All undergraduate major advising is coordinated by Professor Orrin Robinson.

After completion of the basic courses, majors normally select at least two German courses per quarter. The total requirement for the Bachelor of Arts degree in German is a minimum of 50 units of work beyond the basic courses (1 through 22 or equivalent), except in the area of German Culture Studies, as described below.

Students have the opportunity to select any one of four areas of concentration, without, however, limiting their courses exclusively to that area.

German Language and Linguistics—Students choosing this area of concentration must take 203 (History of the German Language), 211 (Syntax of Modern German), and 212 (Linguistics and the Analysis of German). Further coursework may fall into any one of the following fields or a combination of them: (a) contrastive linguistics and language pedagogy
(teaching methods, curricular problems, error analysis); (b) historical German and Germanic linguistics (Introduction to the Germanic Languages, Old High German, Middle High German, Old Saxon, Old Norse, etc.); or (c) theoretical linguistics and the analysis of modern German (phonology, syntax, dialectology, etc.). Appropriate courses in the English and Linguistics Departments may also be taken. Students interested in languages not listed in this department should contact the Special Language Program, Department of Linguistics.

German Literature—Students concentrating in German Literature must take 150 and the complete 160 series, in sequence if possible. Additional courses may be selected from the 150 series, which focuses on various genres, or from the 170 series, which provides possibilities for studying specific developments and topics of German literature and culture in depth. In addition, students are encouraged to take a course or a seminar in literature on the 200 level.

German Thought—Students who are concentrating in German Thought should take 150 and must take the Geistesgeschichte series (241-243) and normally one seminar. Students may want to organize their elective courses around certain themes or sets of problems according to their own interests and choose from among the offerings of German, English, French, Philosophy, History, Religious Studies, and other appropriate disciplines.

German Culture Studies—the aim of this program, which permits maximum flexibility, is to allow students to plan a more broadly based major than is possible in the other areas of concentration. The student can combine the study of German language and literature with such fields as art history, musicology, political science, history, economics, anthropology, comparative literature, etc. The requirements are: (a) at least 30 units of German courses beyond the 22-level, including at least four courses from the series 161, 162, 163 and 131, 132, 133; and (b) at least 25 units of courses outside the department, but in the Central European field, to be planned and presented to the department by the student. Every student will normally participate in at least one Stanford Overseas Program.

HONORS IN GERMAN

Majors with a minimum grade average of “B+” in German courses are eligible for departmental honors. In addition to requirements listed above, each honors candidate will submit an essay representing six to nine units of academic work. This essay will be on a topic chosen in consultation with a faculty member of the department.

EXTENDED MAJOR IN ENGLISH AND GERMAN LITERATURES

Students may enter this program with the consent of the chairmen of both departments. See the “Department of English” section of this bulletin.

DOUBLE 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. Double majors are especially recommended for students spending one or more quarters at the Stanford centers in Berlin and/or Vienna.

COTERMINAL PROGRAMS

Students may elect to combine programs for the A.B. and A.M. degrees in German Studies. For details, see the “Degrees” section of this bulletin.

OVERSEAS STUDIES

Detailed information on the centers in Vienna and Berlin are given in the bulletin Overseas Studies. These programs cover a great variety of courses in language, literature, culture, and other fields of Central European Studies. Most credits earned in Vienna and Berlin can be applied to the undergraduate major in German Studies. For courses offered in Vienna and 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 University of Vienna and the Free University in Berlin.

STANFORD TÜRINGEN 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 the 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 follow-

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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
208A. Introductory Middle High German
311. Syntax of Modern German
203. History of the German Language or 312. Linguistics and the Analysis of German
313. Transformational Grammar of German
304. Gothic or 305. Old Norse or 306. Old High German or 307. Old Saxon

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 341-390 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 (348, 449).

COURSES OVERVIEW

1. General Courses (given in English)
2. Introductory Courses (1-99)
3. Intermediate Courses (100-199)
   Language (100-119)
   Culture (130-139)
   Literature (150-179)
4. 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)

5. Courses for Advanced Graduate Students (400-499)
Seminars and colloquia on special topics; Interdepartmental courses

6. 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 75L.) Survey of the oldest attested stages of the Germanic language family, including Gothic, Old Norse, Old Saxon, Old English, Old High German, Old Dutch, Old Frisian. Presentation both of external history and internal relationships. (DR:4)
3 units, given 1987-88

31A-33A. German Culture and Civilization I-III—(See also 131-133.) A survey of different aspects of modern society and culture in the countries of German-speaking Europe: social processes and institutions, modernism in literature and the fine arts, central concerns of philosophical and social thought. Students may elect to enroll in any part of the series without participating in the full series.

31A. Central Europe: Geography, Institutions, and Society —A survey of geography, people, and institutions of the German-speaking areas of Central Europe focusing on the contemporary situation and historical origins. Topics include governmental structure of the BRD, the DDR, Austria, and Switzerland; population; stability and migration; social structure of East and West Germany; the educational system; communications systems; urbanization and its consequences since World War II. (DR: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 with emphasis on literature, music, painting, and architecture. The connections to broad intellectual and historical developments. Examination of the works of Hofmannsthal, Mahler, Freud, Schönberg, Kandinsky, Gropius, Brecht, and Mann. (DR:2)
3 units, Win (Wilke)

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" and the confrontation with the Holocaust. Democracy as an issue for political philosophy. The Frankfurt School from the critique of enlightenment to the consensus theory of rationality. The New Left, feminism, and ecology. Marxism in the German Democratic Republic and dissident thought. The new sensibility and the new irrationalism. (DR:3)
3 units, Spr (Wilke)

60A. An Introduction to the Medieval Literature of England, France, Germany, and Scandinavia (500-1300) in Translation—Readings in medieval historiography, heroic epic, romance, saga, and lyric. Designed to follow the medieval segment of Western Culture. Lectures and discussions. (DR:2)
3 units, Spr (Wilke)

136A. 20th Century German History—(Same as History 127A.)
5 units, Aut (Puhle) MTWTh 10

138A. Processes of Modernization in Western Europe (1770-1970)—(Same as History 133C.)
5 units, Win (Puhle) MTWTh 9

171A. Austrian Literature of the Fin de siècle—Austrian literature c. 1900 viewed in connection with contemporary philosophy, art, and social developments. Slides supplement readings. Includes works by Schnitzler, Hofmannsthal, Musil, Altenberg, and others as well as political documents and material from the press. An integrated approach to this important period.
3 units, Spr (Rossbacher)

276A. European Novel IV: The Realists—(Same as Comparative Literature 276A.) Special attention to the longterm repercussions of Romanticism and the struggle to establish a Realist approach in fiction. Topics include the transition from Romantic Realism to Positivism and Naturalism, the rise of the historical novel, the inroads of psychological Impressionism, Symbolism, and cultural development. The final list of readings of approximately 6 works will be drawn from such writers as Balzac,
Flaubert, Zola, Dostoevski, Gogol, Turgenev, Tolstoy, Meyer, Stifter, Fontane, Schnitzler, Dickens, Eliot, Trollope, Howells, Caldós.

3-5 units, Aut (Gillespie)

284A. Joyce, Proust, Mann — (Same as 384A.)
Themes, structures and mythopoetic dimensions of the novel in the context of Modernism. Views on Joyce, Proust, and Mann as synthesizers and interpreters of the historical situation ("decline of the West," contending -isms, etc.), forms of consciousness (Bergson, Nietzsche, Freud, Jung, et al.) and artistic expressions (opera, painting, etc.) of their age.

3-5 units, Win (Gillespie)

291A. Literature of Decadence—Symbolist, fin de siècle, and modernist understandings of the evolution of civilization; the themes of intellectual and spiritual crisis, the "decline of the West," and "art for art's sake" in European poetry, drama, and fiction during the decades 1880-1930; the impact of Decadence on modern art and thought ("art nouveau," "Jugendstil," and neo-Rosicrucianism, Wagnerism, "dissociation of sensibility," "superman," etc.)

3-5 units, Win (Gillespie)

384A. Joyce, Proust, Mann—(Same as 384A.)
3-5 units, Aut (Gillespie)

390A. Seminar: The Modern Tradition—
(Same as English 361.)
5 units, Aut (Berman) MW 1:15-3:05

INTRODUCTORY
First- and second-year language courses are under the direction of Walter F. W. Lohnes.

Note—Students registering for the first time in a first- or second-year course must take a placement test if they have studied German before entering Stanford.

FIRST-YEAR

1,2,3. German Language and Culture—
These comprehensive courses provide a balanced introduction to listening and speaking as well as reading and writing.
5 units, Aut, Win, Spr (Staff)

2C. Conversational German—Aim is to enable the student to understand, and to express himself in, simple spoken German. Especially recommended for students going to Vienna or Berlin. Prerequisite: At least one quarter of first-year German.
2-3 units, Aut, Win, Spr (Staff) MWF 10

1P,2P,3P. Individually Programmed Beginning German—Particularly suited to students who wish to complete more or less than five units a quarter, or have a spotty background in German, or have scheduling conflicts, or simply prefer to work independently. Students proceed at their own pace, working on their own with the text and tapes. The instructor is available for consultation on a regular basis. Conversation classes may be attended for listening and speaking practice.
1-15 units, Aut, Win, Spr (Staff)

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 permitted.
4 units, Win (Petig) MTWTh 9
Sum (Petig) MTWThF 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.

SECOND-YEAR

21. Intermediate German I—Course 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. Prerequisites: 3 or 4.
3 units, Aut, Win, Spr (Staff)

21C. Intermediate Conversation — Course builds on the skills developed in 2C. Students are encouraged to develop fluency in expressing their own thoughts in German. Suggested continuation: 100C.
2-3 units, Aut, Win, Spr (Staff) MWF 10

22. Intermediate German II—Course is the continuation of 21, but 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)
A-F. Readings in other Disciplines—For students with a basic 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 also 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) given 1987-88

52B. Readings in History.
3-4 units, Win (Staff) given 1987-88

52C. Readings in Art History.
3-4 units (Staff) given 1987-88

52D. Readings in Political Science and International Relations.
3-4 units, Aut (Staff) MWF 12

52E. Readings in Philosophy and Religious Studies—(Same as Religious Studies 52F.)
3-4 units, Spr (Staff) MWF 12

52F. Readings in Music and Music History.
3-4 units, Win (Staff) MWF 12

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, etc. 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 Vienna and Berlin. (See "Overseas Studies" section in this bulletin.)
Aut, Win, Spr, Sum

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

INTERMEDIATE

100C. Advanced Listening and Speaking Skills—Increases fluency and precision in speaking and builds listening comprehension. Audio- and videotapes, discussions, presentations, vocabulary building exercises, interviews with native speakers. May be taken twice for credit. Prerequisite: 21C or equivalent.
3 units, Aut, Win, Spr (Staff) MWF 10

101. Reading and Writing Modern German I—Short fictional and expository texts are read and discussed. Students write short essays. Exercises covering important points of grammar, idiomatic usage, and vocabulary building.
3 units, Win (Turneaure)

102. Reading and Writing Modern German II—Continuation of 101.
3 units, Spr (Turneaure)

118. Introduction to German Dialects—(Same as 218, Linguistics 176L.) Introduction to the major dialects of German-speaking Europe through texts, tapes, lectures, and presentations by native speakers; also a general introduction to the field of dialect geography. (DR:4)
4 units, Spr (Robinson)

119. Introduction to the Germanic Languages—(Same as 19A, Linguistics 75L.)
3 units (Robinson) given 1987-88

130. German Newspapers—Articles of current interest in German newspapers read and discussed in German. May be taken twice for credit. Prerequisite: 22 or equivalent.
3 units, Aut, Spr (Staff)

131-133. German Culture and Civilization I-III—(See also 31A-33A.) In addition to attending the lectures in 31A-33A, students with an adequate knowledge of German may register for German Studies 131, 132, or 133 and participate in a supplementary section in which further material will be read and discussed in German. Students who have received credit for 31A-33A may not repeat courses in this sequence for credit.

131. Central Europe: Geography, Institutions, and Society—Prerequisites: 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 (Wilke)

133. Democracy, Protest, and Political Culture in German-Speaking Europe—Prerequisites: 22 or consent of the instructor. (DR:3)
4 units, Spr (Wilke)

136A. 20th Century German History—(Same as History 127A.)
5 units, Aut (Puhle) MTWTh 10

150. Introduction to German Literature—Texts (short prose, poetry, and drama) ranging from the classical to the modern period. Introduction to key concepts of major literary periods and of literary criticism. Readings by Lessing, Goethe, Schiller, Hölderlin, Hoffmann, Eichendorff, Büchner, Heine, Nietzsche, Thomas Mann, Kafka, Brecht, and Christa Wolf. (DR:2)
4 units, Win (Turneaure)

151-157. Courses in the 150 series introduce the student to German literature in various genres. Prerequisite: 22 or equivalent.
154. Modern Short Prose—Readings by Kafka, Brecht, Böll, Frisch, Bobrowski, Kunert, Wolf, Bachmann and others. (DR:2)
4 units, Aut (Turnearu)

158. Bertolt Brecht—(Same as 262, Drama 158/258.)
4 units, Win (Esslin) MWF 11

161-163. These courses acquaint the student with the development of German literature from the Enlightenment to the present. Significant works of each period are studied intensively and related to their historical context. Prerequisites: 22 plus 2 additional courses or consent of instructor.

161. The Classical Period—Introduction to major authors, works, and literary movements of the 18th century in historical context. Emphasis on the rise of Weimar classicism against the background of Winckelmann's aesthetics of Greek art ("noble simplicity and quiet grandeur"), Lessing and the Enlightenment, and Storm and Stress. Examples of drama, narrative, lyric poetry, essays from Goethe, Schiller, Hölderlin, and other authors from the richest period of German literature.
4 units, Aut (Mommsen) MWF 11

162. Romanticism and Realism—Introduction to major literary trends of the 19th century in their historical context. Romantic lyric, novella, Kunstmärchen, poetic theory, Junge Deutschland and the critique of romanticism; transition to Realism, Realist theory and prose; cultural pessimism in the later 19th century. Readings from Novalis, Tieck, Hoffmann, Eichendorff, Kleist, Heine, Stifter, Meyer, Fontane.
4 units, Win (Gillespie) MWF 11

163. Naturalism to the Present—Introduction to major literary trends since the end of the 19th century with emphasis on the changing status of the author. Aestheticism and expressionism; literature in the Weimar Republic; the impact of fascism and exile culture; the writer in East and West Germany and current developments. Readings by Heinrich and Thomas Mann, Tucholsky, Brecht, Horvath, Böll, Becker and Enzensberger.
4 units, Spr (Wilke) MWF 11

171-178. Introduces the student to 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.

179. Special Topics—Explores the possibility of interdisciplinary studies and research in areas of special interest: e.g., women authors, social satire, political speeches, Freud and literature. Literature in the German Democratic Republic.

199. Individual Reading—Enrollment only by special permission of the department. Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit. Prerequisite: 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 276L.) Introductory course on the phonological and syntactic development of Modern German from the Germanic parent language. Involves the analysis of selected texts and the consultation of linguistic works on the subject.
3-5 units, Aut (Robinson)

204. Gothic—(Same as 304.) Introduction to grammar and texts of the Gothic language. The grammar of Proto-Germanic is also treated.
3-5 units (Robinson) given 1988-89

205A. Introduction to Old Norse-Icelandic—(Same as 305A, English 200A.) Grammar and readings from Valfells/Cathey, Old Icelandic: An Introductory Course. Emphasis on the acquisition of reading skills.
5 units, Win (Gade)

205B. Advanced Old Norse: Icelandic—(Same as 305B, English 200B.) Readings in Laxdoela saga.
3-5 units, Spr (Beck)

206. Old High German—(Same as 306; English 201.) Introduction to the grammar and documents of the earliest attested stage of High German.
3-5 units (Robinson) given 1987-88

207. Old Saxon—(Same as 307.) Introduction to grammar and documents of the earliest attested stage of Low German.
3-5 units, Win (Robinson)

208A. Introduction to Middle High German—Emphasis on basics of grammar and rapid reading.
3-5 units, Aut (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 175L.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German. 3-5 units, Win (Andersson) given 1987-88

213. Sociolinguistics of German in Austria—(Same as Linguistics 213L.) Sociolinguistic variation from dialects to Standard German on the levels of phonetics, phonology, morphology, syntax, lexicology, text/discourse, both in oral and written styles, including literary styles. 3-5 units, Spr (Robinson)

214. German morphology from a typological point of view—(Same as Linguistics 211L.) The aspects of German inflectional and derivational morphology studied within the context of a theory of natural morphology. 3-5 units, Win (Dressler)

218. Introduction to German Dialects—(Same as 118, Linguistics 176L.) Introduction to the major dialects of German-speaking Europe through texts, tapes, lectures, and presentations by native speakers; also a general introduction to the field of dialect geography. (DR:4) 4 units, Spr (Dressler)

236. Minority Nationalisms in 20th Century Western Europe—(Same as 336, History 236/336.) 5 units, Aut (Puhle) M 1:15-3:05

241-243. Designed to acquaint students with the history of German thought from 1750 to the present and its significance for an understanding of modern culture. Authors studied include Herder, Hegel, Schiller, Marx, Nietzsche, Freud, Husserl, Wittgenstein, Marcuse, and Adorno. Note: This series will be given in German in alternate years (1986-87).

241. Deutsche Geistesgeschichte I—From Lessing to Romanticism. Delineates the conceptual field which from the middle to the end of the eighteenth century the problems of human knowledge, of history, of the nature of man and of art were revolutionized and given a new basis. Centered on readings and detailed interpretations of selected texts by Lessing, Kant, Herder, Schiller, and Fichte. 3-5 units, Aut (Mueller-Vollmer)

242. Deutsche Geistesgeschichte II—From Hegel to Nietzsche. The outlines of Hegel's phenomenology and his model of historical development as the becoming-conscious of freedom. The transformations of this model in the cultural criticism of Heine, the anthropology of Feuerbach and the dialectical materialism of Marx and Engels. Nietzsche's radical critique of the idea of the nature of man and of his historical self-actualization. 3-5 units, Win (Wilke)

243. Deutsche Geistesgeschichte III—From Nietzsche to the present. Texts by Nietzsche, Husserl, Freud, Heidegger, Benjamin, Adorno, and Habermas with special emphasis on aesthetic problems and their relationship to social theory. Introductory course emphasizes the development of the Frankfurt School. Shorter essays on aesthetics discussed to indicate possible applications to literary theory. 3-5 units, Spr (Berman)

244. Freud and Criticism—(Same as 347.) An examination of selected texts by Freud with reference to issues of interpretation, language, sexuality, and civilizational history. Readings in German and English. 5 units, Win (Berman)

248. Topics in Contemporary Criticism—Discussion of current debates in literary theory and methodology. 3-5 units, Spr (Berman, Wellbery)

251G. Seminar in Germanic Philology—Die Germanendiskussion heute. 3-5 units, Spr (Beck)

251-259. German Literature and Culture I-IX—(Same as 351-359.) The major periods of German literature from the early Middle Ages to the present. Open to undergraduates by consent of instructor only.

251. German Literature and Culture VII—(Same as 357.) 19th Century (1830-1900) classical-romantic traditions in the drama, novel, Novelle, and lyric poetry from the Biedermeier to poetic Realism (Grillparzer, Hebbel, Mörike, Stifter, Keller, et al.) The dilemma of the epigons (Immermann.) Oppositional movements, the Young Germans, the Vormärz (Büchner, Grabbe, Börne, Heine, Gutzkow, Herwegh, et al.) Social thought in literary theory and journalism, the influence of Feuerbach. Poetic Realism (Fontane, et al.) Developments of literary theory and the drama of Naturalism (Hauptmann). 3-5 units, Spr (Mommsen)

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, Niet-
zsche, Hofmannsthal, Thomas Mann, Kafka, Brecht, etc.

3-5 units (Staff)

260. Friedrich Hoelderlin: Philosopher and Poet—(Same as German 360, Philosophy 133/233.) His thought in relation to German idealist philosophy (Fichte, Schelling, and notably Hegel) and the development of his poetics and poetic discourse. To be read: Hegel, some early writings, and “Preface” to the Phenomenology; Hoelderlin, major theoretical statements, Hyperion, selected poems from the early period to the late hymns. Open to graduates and undergraduates.

3-5 units, Spr (Mueller-Vollmer, Foerster)

262. Bertolt Brecht—(Same as 158, Drama 158/258.)

4 units, Win (Esslin) MWF 11

265. E.T.A. Hoffman—(Same as German 368.) Intensive study of Hoffman’s work with special reference to: a) Hoffmann’s relation to romantic ideology; b) narratological questions raised by Hoffmann’s texts; c) psychological and psychoanalytic readings of Hoffmann. The basic strategy is to situate Hoffmann’s work in terms of issues in contemporary literary theory.

3-5 units, Aut (Wellbery)

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.

290-299. Special Subjects and Problems—Variable topics.

296. Goethe und die Weltliteratur—(Same as 396.)

3-5 units, Win (Mommsen)

298. Individual Work—Open only to German majors and to students who are working on special projects. Students taking honors in German will use this number for the honors essay. May be repeated for credit.

1-15 units, each quarter (Staff)

GRADUATE

300. Proseminar: German Studies Today—Differences between the United States and Europe. The history of the discipline sociologically and methodologically considered. Relation to other disciplines (Romance, English, Slavic Studies, Comparative Literature). Definition of terms such as literary history, poetics, philology, literary theory and of the major schools of scholarship and criticism. Problems and areas of scholarship and teaching. For all incoming graduate students.

3-5 units (Mueller-Vollmer) given 1987-88

300A. Introduction to German Studies—Bibliographical research is a time-consuming task until one acquires the necessary skills to find, to know, and to handle the essential bibliographies, reference works, etc., in the vast field of German Studies—culture, literature, history, political science, and so on. 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.

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

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) by arrangement

303. Curricular Problems—Given on request only.

3 units, Aut (Lohnes) by arrangement

304. Gothic—(Same as 204.) Introduction to grammar and texts of the Gothic language. The grammar of Proto-Germanic is also treated.

5 units (Robinson) given 1988-89

305A. Introduction to Old Norse-Icelandic—(Same as 205A, English 200A.)

5 units, Win (Gade)

305B. Advanced Old Norse - Icelandic—(Same as 205B, English 200B.)

3-5 units, Spr (Beck)

306. Old High German—(Same as 206.) Introduction to the grammar and documents of the earliest attested stage of High German.

3-5 units (Robinson) given 1987-88

307. Old Saxon—(Same as 207.)

3-5 units, Win (Robinson)

311. Syntax of Modern German—(Same as 211.) Contrastive analysis of English and German syntax.

3-5 units, Spr (Lohnes)

312. Linguistics and the Analysis of German—(Same as 212, Linguistics 175L.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.

3-5 units (Robinson) given 1987-88

336. Minority Nationalisms in 20th Century Western Europe—(Same as History 236/336.1)

5 units, Aut (Puhle) M 1:15-3:05

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 Saus—
sure, Jakobson, and Lévi-Strauss; its redactions in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault).

5 units, Win (Bender, Wellbery)

347. Freud and Criticism—(Same as 247.)

5 units, Win (Berman)

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 Marxist criticism.

3-5 units (Mueller-Vollmer) given 1987-88

349G. The Young Goethe—The works of Goethe prior to the Italian journey with special emphasis on Werther, Götz von Berlichingen, the Urfaust, and lyric poetry. New developments in Goethe research and the relevance of current methodological debates to the study of Goethe's work.

3-5 units, Aut (Wellbery)

349H. Herder and Humboldt on Language and Culture—An introduction to some of their major writings on the study of language as key to an understanding of culture and society, examined in relation to major 18th century theories of language, 19th century linguistics, and to some of the important issues in 20th century theories of culture and of language.

3-5 units, Win (Mueller-Vollmer)

349M. Seminar: Thomas Mann.

3-5 units (Gillespie)

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. Selected topics in literary reinterpretations of ancient myths (e.g., Prometheus, Oedipus, Dionysos, Venüs), remythicizing of the Biblical and Christian past and the Renaissance (e.g., Cain, Satan, Mary, Christ, Faust, Hamlet, Don Juan), dominant archetypes in contemporaneous Romantic fictions.

3-5 units (Gillespie) given 1987-88

ture 391A.) A study of Madame de Staël'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 1987-88

396. Goethe und die Weltliteratur—(Same as 296.)

3-5 units, Win (Mommsen)

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 (Mueller-Vollmer) given 1987-88


3-5 units, Spr (Mommsen)

HISTORY

Emeriti: (Professors) William C. Bark, Claude A. Buss, Gordon A. Craig, Don E. Fehrenbacher, John J. Johnson, George H. Knoles, John C. Miller, Peter Paret, Wayne S. Vucinich, Gordon Wright; (Associate Professor), Rixford K. Snyder

Chairman: James J. Sheehan


Associate Professors: Judith C. Brown (on leave 1986-87), Albert M. Camarillo, Clayborne Carson (on leave Autumn and Winter), Frederick P. Bowser, Estelle B. Freedman, Kennell A. Jackson, Jr., Harold L. Kahn, Carolyn C. Lougee, Sabine MacCormack, Jack N. Rakove

Assistant Professors: Joel Beinin, Stephen C. Ferruolo, Nancy S. Kollmann (on leave Autumn), Richard Roberts

Courtesv Professors: Paul David, Michael Jameson, Susan M. Treggiari

Affiliated Professor: Albert E. Dien

Modern Europe Lecturers: Laurel Carrington, Michael Curtin, James McNaughton, Lee Palmer Wandel, Laurence H. Winnie

Visiting Professors: Hans-Jürgen Puhle, John Stephan

Visiting Associate Professors: Lawrence Bryant, Jonathan Haslam

Visiting Assistant Professor: Lynn Zastoupil


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 ten courses in history with a minimum of three units each, and passed with a letter grade of "C" or higher. The capacity to write with ease and to express oneself with lucidity is an important skill; to gain that skill requires practice; therefore, it is required that each major do a substantial amount of writing (8-10 pages at a minimum) in at least six of the courses taken toward the fulfillment of major requirements. A minimum of five courses must be taken from members of the Stanford History faculty. Directed
reading and undergraduate research may not count toward the ten required courses in history and are given only for Pass/No Credit, unless such courses are part of the Honors project.

To emphasize broad coverage in space and time, it is required that at least two courses must be completed in each of the following three fields: (a) Western Europe (including Britain), and North America (especially the colonial and national history of the present United States), all since 1700; (b) Africa and the Middle East, Asia, Latin America, Russia, and Eastern Europe; and (c) the period before 1700, with at least one course in the field of Western Europe before 1700. No single course may be counted to fulfill more than one of these three fields. Colloquia and seminars meet the field requirement.

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 the end of Winter Quarter of the senior year. To enter this program the student must be accepted by a member of the department who will agree to advise him or her on the essay 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. In considering an applicant for such a project, the advisor and the Director of the Honors Program will take into account the student's general preparation in the field of the project, and will expect at least a "B+" average in the student's previous work in history. Prospective Honors students are urged to take an undergraduate seminar sometime in the junior year. Students satisfactorily completing the program will be eligible for Honors in History, depending upon the quality of their work. To enter the Honors program, apply at the History Department Office.

James Birdsall Weter prizes are awarded each year for the outstanding Honors essay.

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 IN HISTORY

The department admits each year a limited number of undergraduate History majors to work for a coterminal A.B. and A.M. degree in History. Applications for admission to this program should be submitted during the Spring Quarter of the student's junior year and must be submitted no later than November 1 of his or her senior year. Applicants are expected to meet the same general standards as those seeking admission to the A.M. program; they must submit a written statement of purpose, a transcript, and three letters of recommendation, at least two of which should be from members of the History Department faculty. The decision on admission rests with the Graduate 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 Aptitude Test of the Graduate Record Examination. This examination may be taken at most American colleges and by arrangement may be taken in nearly all foreign countries. For details concerning this test see the Information Bulletin. Overseas applicants, who may not receive the Information Bulletin promptly, should write directly to the Educational Testing Service, Box 955, Princeton, New Jersey 08540.

Students who have been admitted to graduate standing do not automatically become candidates for a graduate degree. With the exception of students in the Terminal A.M. program, they are admitted with the expectation that they will be working toward the Doctor of Philosophy degree, and may become candidates to receive the Master of Arts degree after completing three quarters of work.

MASTER OF ARTS

The department requires the completion of nine courses (totalling not less than 36 units) of graduate work; seven courses of this work must be History Department courses. Of these seven, one must be a graduate seminar, and three must be either graduate colloquia or graduate seminars. Directed reading may be counted for a maximum of 10 units. A candidate whose undergraduate training in history is deemed inadequate, must complete nine courses of graduate work in the History Department. The department does not recognize for credit toward the A.M. degree any work that has not received the grade of A, B, P, or +.

TERMINAL A.M. PROGRAM

The department admits applicants who do not wish to continue beyond the A.M. degree at the discretion of the individual fields (U.S., modern Europe, etc.). Students admitted to this program may not apply to enter the Ph.D. program in History during the course of their work for the A.M. degree.

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 section "School of Education" in this bulletin. For certain additional requirements made by the Department of History, contact the Department Office. Candidates must possess a teaching credential, 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, and application must be made separately for admission to candidacy for the A.M. (not later than the end of the first four weeks of the quarter preceding the one at the end of which the degree is to be awarded) and also for the Ph.D. Applicants for the doctoral program must proceed by two steps: First, students must apply for admission to (not candidacy in) the Ph.D. program. Those seeking admission to the program should file application during their second quarter of enrollment in graduate work at Stanford. 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
   - Russia
   - Eastern Europe
   - Middle East
   - East Asia before 1600
   - East Asia since 1600
   - Africa
   - Britain and the British Empire since 1460
2. The department seeks to provide a core colloquium in every major field, in which the students will normally enroll in the first year of graduate study.

3. Students are required to take two research seminars, at least one in the major field. Normally, research seminars should be taken in the second year.

4. Each student, in consultation with his or her advisor, defines a secondary field. This requirement may be met in one of three ways: (a) a field selected from the list below; (b) a European national history of sufficiently long time to span chronologically two or more major fields—for example, students may elect to offer the history of France from about 1000 to the present; (c) a comparative study of a subject across countries or periods. The secondary fields are as follows:

- The Ancient Greek World
- The Roman World
- Europe, 300-1000
- Europe, 1000-1400
- Europe, 1400-1600
- Europe, 1600-1789
- Europe, 1700-1871
- Europe since 1848
- Russia to 1800
- Eastern Europe to 1800
- Russia since 1800
- Eastern Europe since 1800
- Middle East to 1800
- Middle East since 1800
- Africa
- China before 1600
- China since 1600
- Japan before 1600
- Japan since 1600
- England, 450-1460
- Britain and the British Empire, 1460-1714
- Britain and the British Empire since 1714
- Latin America to 1825
- Latin America since 1810
- The United States (including Colonial America) to 1865
- The United States since 1850
- The History of Science

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 FOR GRADUATE STUDY

The above section relates to formal requirements, but the success of a student's graduate program depends in large part upon the quality of the guidance which he receives from the faculty and upon the library resources available. Prospective graduate applicants are advised to study closely the list of History faculty and the course work which this faculty offers. As to library resources, no detailed statement is possible in this bulletin, but areas in which library resources are unusually strong include the following:
The rich, and in some respects unique, collections of the Hoover Institution on the causes, conduct, and results of World War I and World War II are being augmented for the post-1945 period. The materials include government documents, newspaper and serial files, and organization and party publications (especially British and German labor movements and the German Socialist parties). There are also important manuscript collections, including unpublished records of the Paris Peace Conference of 1919 and the Herbert Hoover archives, which contain the records of the Commission for Relief in Belgium; the American Relief Administration; the various technical commissions established at the close of World War I for reconstruction in Central and Eastern Europe; the personal papers of Herbert Hoover as United States Food Administrator; and the personal papers of other important individuals. Other important materials for the period since 1914 relate to revolutions and political ideologies of international importance; colonial and minority problems; propaganda and public opinion; military occupation; peace plans and movements; international relations; international organization and administration including the publications of the United Nations, as well as the principal international conferences.

The Hoover Institution also possesses some of the richest collections available anywhere on the British labor movement, on Eastern Europe, including the Soviet Union, on East Asia (runs of important newspapers and serials and extensive documentary collections, especially for the period of World War II) and on Africa since 1860, including especially French-speaking Africa, the former British colonies, and South Africa.

The University Library maintains strong general collections in almost all fields of history. It has a very large microtext collection, including, for instance, all items listed in Charles Evans' American Bibliography, and in the Short-Title Catalogues of English publications, 1474-1700, and virtually complete microfilmed documents of the Department of State to 1906. It also has a number of valuable special collections in the Bender Room, including the Borel Collection on the History of California, many rare items on early American and early modern European history, the Brasch Collection on Sir Isaac Newton and scientific thought during his time, and other such materials.

See the Time Schedule for changes in course offerings each quarter. For updated information, the History Department has a board listing all courses with the appropriate meeting days and times.

1,2,3. Europe: From the Middle Ages to the Present — This sequence, which fulfills the Western Culture Requirement, explores the inter-relationships between the literary and philosophical masterpieces of Western culture on the one hand and political, social, and economic developments in Europe since the Middle Ages on the other. Special attention is focused on the rediscovery of classical learning in the age of the Renaissance and Reformation, the consolidation of the European state system, intellectual innovations emerging with modern industrial society, and the global consequences of the breakdown of traditional Europe. Students meet three hours a week with lecturers from the regular history faculty and two hours a week for colloquia in small groups led by postdoctoral fellows. Enrollment is limited; students intending to apply the sequence toward their Requirement are given priority.

1. Europe: Late Antiquity, the Middle Ages, and the Renaissance — Traces 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 given to the impact of the rediscovery of classical texts and thought during both the Middle Ages and the Renaissance. The texts include selections from the works of 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 (Ferruolo, Bryant, Staff)
lectures plus a two-hour colloquium

2. Europe from the Wars of Religion to the Nation State — 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 (Lougee, Staff)
lectures plus a two-hour colloquium

3. Europe: 1815 to the Present — In 1815, some Europeans hoped to restore the prerevolutionary world; they failed. European history since Waterloo has been a persistent attempt to come to terms with the promise and perils of the great revolutions of the 18th century. Emphasize the impact of industrialization and democracy on Europe's politics, society, and culture, from the fall of Napoleon 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, Aut (Fox, Roberts, Van Slyke)

22. The World Outside the West in the Age of European Imperialism—(Same as Anthropology 22, Political Science 22). Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western institutions and ideas, from the early nineteenth century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Mexico, China, and Nigeria. Strongly recommended: Anthropology/History 21. (DR:5*; also satisfies Area 3 when taken in sequence with 21.)

5 units, Win (Abernethy, Collier, Duara)

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, Spr (Kollman)

64. Introduction to Chicano Life and Culture—(Same as Chicano Fellows 110, Anthropology 110, Spanish 135.) Interdisciplinary course focuses 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. Students interact with three different Chicano faculty from three disciplines. Historical texts, novels, poems, and ethnographies are the basis for required readings.

5 units, Aut (Camarillo, Cuellar, Ybarra-Frausto)

50. Culture, Politics and Society in Latin America—(Same as Latin American Studies 80, Anthropology 100.) An interdisciplinary course which surveys the interaction of Amerindian, African, and European cultures in the creation of the New World societies from 1500 to the present. A basic introduction to the Latin American courses within several departments. (DR:5*)

5 units, Spr (Wirth, G. Collier)

INTRODUCTORY SEMINARS
Introductory seminars 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 of these courses 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".

12S. Introductory Seminar: Individuals, Communities, and Authority in Medieval Europe 1100-1250, the Problems of Religious Change.

5 units, Aut (Newman)

34S. Introductory Seminar: State Ceremonies and Community Rituals in Early Modern Europe.

5 units, Aut (Bryant)

37S. Introductory Seminar: Popular Culture in Early Modern Europe.

5 units, Spr (Wandel)

41S. Introductory Seminar: Britain and the First World War.

5 units, Aut (Stansky)

42S. Introductory Seminar: Early Modern London, the Creation of a New Urban Culture.

5 units, Spr (Seaver)

43S. Introductory Seminar: 19th Century British Intellectuals.

5 units, Win (Zastoupil)


5 units, Win (Rakove)

57S. Introductory Seminar: The American West.

5 units, Spr (Camarillo)

58S. Introductory Seminar: American Thought in the 1930s.

5 units, Spr (W. Jackson)

79S. Introductory Seminar: Mexico as Intellectual Creation.

5 units, Spr (Bowser)

ADVANCED Courses numbered 100 through 199 are primarily lecture courses designed for advanced undergraduates.

THE ANCIENT WORLD
See Classics, Ancient History section, for description of the following courses, all of which
are accepted for credit toward a major in History.

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 (Treggiari)

103. History of the Roman Empire—(Enroll in Classics 103.) (DR:5)
4-5 units, Spr (Treggiari)

305A,B. Graduate Colloquium: Problems in Late Roman Republican History.
5 units, Aut (Treggiari)
2 units, Win (Treggiari)

MEDIEVAL AND RENAISSANCE EUROPE

106. Modern Jewish Intellectual History from the 16th Century to the Present.
5 units, Win (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, Spr (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, Spr (Dallin)

WESTERN EUROPE

127A. 20th Century German History—(Same as German 136A.)
5 units, Aut (Puhle)

132C. France in Modern Times—Political, social, economic, cultural, and foreign policy developments in France during the 19th and 20th centuries.
5 units, Win (Wright)

133C. Processes of Modernization in Western Europe (1770-1970)—(Same as German 138A.)
5 units, Win (Puhle)

135. The Evolution of the International System, 1789-1949—Focuses on the transformation of the European state system of the late 18th century into the international system of the mid-20th century, with particular emphasis upon the impact of revolution on Realpolitik
and the displacement of Europe as the predominant weight in the system.

5 units, Aut (Haslam)

136B. European Thought in the 20th Century
—Course treats the important European thinkers and intellectual movements of the 20th century. (DR:3)
5 units, Win (Robinson)

HISTORY OF SCIENCE

138A, B, C. Introduction to Cosmology—
(Same as History of Sciences 138A, B, Classics 138A, B, C, Philosophy 138A, B, C.) A three-quarter sequence on the history of the exact sciences, with emphasis on the field of cosmology. Technical aspects of the classical theories (Ptolemaic and Copernican), including mathematics, astronomy, physics and chemical theory, together with more speculative aspects in natural philosophy and theology.

138A. Ancient Period—(DR:3; also satisfies area 6 when taken in sequence with 138B.)
4 units (Knorr) given 1987-88

138B. Middle Ages to Newton—(DR:3; also satisfies area 6 when taken in sequence with 138A.)
4 units (Knorr) given 1987-88

138C. Newton to Einstein—(DR:3)
4 units, Spr (Creath)

139. Scientific Revolution—(Same as History of Sciences 145, Philosophy 145.) Social, intellectual and institutional background of the period that established modern science, the 17th century. Stress on theories of matter and motion, especially 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 17th century texts and modern historical studies. Considers various interpretations of the revolution and what is meant by science and revolution.
4 units, Win (Maienschein)

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 do we mean by “unified” field theories in contemporary physics? Readings: Scientific, historical, and philosophical texts.
4 units, Win (Wise)

159A. The Medieval and Early Modern Culture of Science: Undergraduate and Graduate Colloquium—(Same as History of Science 143.) Aristotelian background. The future of the scientific endeavor in late antiquity and the early middle ages. Growth of universities; scholasticism in science; ties of medieval to early modern science. Emphasize physics, cosmology, and some astronomy with selected problems to be treated in depth.
5 units, Win (Funkenstein)

142. Stuart England, the Making of a Revolution, 1603-1688—An analysis of the conditions that led to the first of the modern revolutions, the collapse of the Stuart regime, the mid-century republican experiments, and the attempted return to royal absolutism in the Restoration era. (DR:5)
4-5 units, Aut (Seaver)

142A. Modern Britain.
5 units, Spr (Zastoupil)

147B. The History of South Africa.
5 units, Win (Worger)

AFRICA

149. Great Thinkers of the Black World—Two centuries (from 1785) of work by black thinkers from the United States, the Caribbean, and Africa. Explores the leading ideas that have shaped the black world as we know it, the ideas about the achievements and genesis of culture; the destiny of the black race; the role of blacks in world history; the political choices open to blacks; the paths to black economic prosperity; and the conception of the future. Lectures are devoted to individual thinkers, movements involving groups of thinkers, and the great debates of the black intelligentsias.
5 units, Spr (Jackson)

THE UNITED STATES

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 such topics as religion, political socialization, race relations, gender, immigration, urbanization, and educational reform.
3 units, Spr (Tyack) MW 10

158B. American Education and Public Policy—(Same as Education 105, Political Science 186K.)
3 units, Aut (Kirst, Tyack)

159B. The Gilded Age: Late 19th Century America—Major developments in American
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history from Reconstruction to 1900. Themes emphasized include the consequences of the Civil War, industrialism and class conflict, the growth of an American state, and the crisis of the 1890s. A central issue is 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)

162A. Race, Ethnicity, and Gender in American Urban Society: History and Public Policy — Provides the background for understanding public policy issues related to various racial and ethnic groups in American cities. Lectures, guest presentations, required readings, mock press conferences, debates, and discussion sections deal with the experiences of blacks, Hispanic Americans, Asian Americans and certain European immigrant groups. Emphasis on the experiences of minority women. Public policies are examined from both historical and contemporary perspectives. Public policy issues analyzed include poverty and social welfare, residential and school segregation, immigration, economic class stratification, urban racial violence, minority youth and the elderly, and affirmative action programs.

5 units, Win (Camarillo)

163A. The Crisis of American Thought, 1890 to the Present — Persistent strains and tensions in American intellectual and cultural history. Readings include autobiographies, documentary works, novels, and theoretical analyses that illuminate such issues as mass culture and society, sex and sexuality, violence, political extremism, and power.

5 units, Spr (Gillam)

165A,B,C. United States History From the Revolution to the Present — An articulated sequence, general in focus, but with attention given to political, social and institutional history. The series as a whole is designed to give students a broad foundation in United States history on which to base further work in history, literature, economics, political science, religious studies, art history, etc. Though the three parts of the series are intended to form an integrated whole, any portion may be taken independently of the others.

165A. 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 (Bernstein)

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)

173A. U.S. Women’s History, 1620-1870— (Same as Feminist Studies 121.) A two-quarter survey which explores women’s relation to the economy, the family and the state; changing ideals of womanhood; and class, race, and ethnic variations in female experience. The first quarter 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)

173B. U.S. Women’s History, 1870-1985— (Same as Feminist Studies 122.) Second-quarter of a two-quarter survey explores the transformation of Victorian womanhood in the late nineteenth-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)

LATIN AMERICA

180. 20th Century Brazil — With its huge size, multi-racial society, mixed economy and pragmatic foreign policy, Brazil’s drive for great-power status and its new capitalist model of development distinguish it from its Spanish-speaking neighbors both in Latin American and world contexts.

5 units, Spr (Wirth)

MIDDLE EAST

187A. The Middle East, 570-1718—From the rise of Islam until the decline of Ottoman absolutism. Emphasis is on the organic relationship between the Middle East and Europe throughout this period. (DR:3*)

5 units, Aut (Beinin)

187B. The Modern Middle East, 1718-Present—From the emergence of regional Arab entities and the commercial penetration of Europe to the present. (DR:5*)

5 units, Win (Beinin)

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 polit-
jcal 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. The narrative line is structured around political history. Attention is paid to social economic, and cultural currents. Recommended: 192A. (DR:5*)
5 units, Win (Kahn)

194A. Medieval and Early Modern Japan, 1336-1500—From the end of the Kamakura era through mid-Tokugawa: descent into localism and feudalism; cultural flowering of the Muromachi era, re-welding of the country in the 16th century; the Tokugawa peace of early modern times; moves away from "medievalism."
5 units, Aut (Mass)

195. Nomad Empires of Inner Asia—(Same as Asian Languages 152.) (DR:5*)
5 units, Spr (Dien)

UNDERGRADUATE SEMINARS AND COLLOQUIA

During 1986-87, a number of colloquia will be offered for undergraduate History majors. Each will ordinarily consist of reading and discussion involving an explicit historical theme. Short papers, reports, and a final examination may be required. A number of undergraduate seminars will also be offered during 1986-87. A seminar differs from a colloquium principally by its concentration on materials and methods of historical research rather than on reading and discussion of a given body of historical literature. The student, in writing a research paper based on a substantial degree upon original sources, will have the opportunity to learn how historians arrive at their conclusions, as well as what the results of their work are. In this sense, the subject matter handled in any given seminar is less important than the process of investigation, analysis, and writing. "How do you know?" becomes more important than "What do you know?"

Courses numbered 200 through 299 (undergraduate seminars and colloquia) are designed primarily for juniors and seniors majoring in history. Admission to seminars and colloquia 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)

206. Undergraduate Colloquium: Politics and Law in Medieval Europe.
5 units, Win (Ferruolo)

211A. Undergraduate Colloquium: The Medieval and Early Modern Culture of Science—(Same as History of Science 143.)
5 units, Spr (Funkenstein)

213. Undergraduate Colloquium: Humanists and Reformers.
5 units, Aut (Spitz)

215S/216S. Undergraduate Seminar in Jewish History.
10 units, Win, Spr (Funkenstein)

5 units, Spr (Weinberg)

232A. Undergraduate Colloquium: The Age of Louis XIV.
5 units, Spr (Bryant)

234C. Undergraduate Colloquium: The Idea of Europe—Literary and Political Writings in East and West Europe Since 1939.
5 units, Spr (Judt)

236. Undergraduate Colloquium: Minority Nationalism in 20th Century Western Europe—(Same as German 336.)
5 units, Aut (Puhle)

237B. Undergraduate Colloquium: The Novel and History.
5 units, Aut (Robinson)

246A. Undergraduate Colloquium: Big Business and Race in South Africa.
5 units, Spr (Worger)

248A. Undergraduate Colloquium: The End of Slavery in Africa and the Americas.
5 units, Win (Roberts)

249A. Undergraduate Colloquium: Africa Since 1945.
5 units, Win (Jackson)

5 units, Aut (Gillam)
261S. Undergraduate Seminar: The American Character.
5 units, Win (Gillam)

263. Undergraduate Colloquium: Women in America.
5 units, Spr (Degler)

265A. Undergraduate Colloquium: Sexuality in American History.
5 units, Aut (Freedman)

271A. Undergraduate Colloquium: Ideas in America from the Revolution to 1900—(Same as American Studies 212.)
5 units, Spr (Fredrickson)

274. Undergraduate Colloquium: The Mind of the South, 1850 to the Present.
5 units, Win (W. Jackson)

279A. Undergraduate Colloquium: Mexico as Intellectual Creation.
5 units, Spr (Bowser)

287. Undergraduate Colloquium: Imperialism, Underdevelopment and Revolution in Modern Middle East.
5 units, Spr (Beinin)

288. Undergraduate Colloquium: Palestine and the Arab-Israeli Conflict.
5 units, Aut (Beinin)

291A. Undergraduate Colloquium: Nation, Region and Culture in Indian History.
5 units, Spr (Duara)

293. Undergraduate Colloquium: Modern Philippines.
5 units, Aut (Rafael)

294A. Undergraduate Colloquium: Modern India.
5 units, Win (Zastoupil)

298A. Undergraduate Colloquium: Visions of Utopia—Travellers to China.
5 units, Win (Kahn)

299. Undergraduate Colloquium: The Institutions of Medieval Japan.
5 units, Win (Mass)

300W. Graduate Directed Reading.
units by arrangement (Staff)

301. Graduate Colloquium: Historiography of American Education—(Same as Education 301.)
5 units (Tyack) given 1987-88

301C. Graduate Colloquium: Administration and Organization of Educational Institutions in Context—(Same as Education 221C.)
5 units, Spr (Tyack)

302A. Graduate Colloquium: Introduction to Problems of Historical Interpretation and Explanation.
5 units, Spr (Emmons)

10 units, Aut, Win (Bowser)

306. Graduate Colloquium: Politics and Law in Medieval Europe.
5 units, Win (Ferruolo)

307. Graduate Core Colloquium in Medieval History.
5 units, Aut (Langumir)

310A. Graduate Colloquium: Augustine as a Political Thinker.
5 units, Aut (MacCormack)

311A. Graduate Colloquium: The Medieval and Early Modern Culture of Science.
5 units, Spr (Funkenstein)

319A. Graduate Colloquium: Problems in Soviet Politics and History.
5 units, Spr (Dallin)

320A. Graduate Colloquium: Major Problems in Early Russian History.
5 units, Win (Kollman)

323A. Graduate Colloquium: Topics in Russian History.
5 units, Aut (Emmons)

331D,E,F. Graduate Core Colloquium on Modern Europe.
15 units, Aut, Win, Spr (Sheehan, Wright, Robinson)

334C. Graduate Colloquium: The Idea of Europe—Literary and Political Writings in East and West Europe Since 1939.
5 units, Spr (Jut)

336. Graduate Colloquium: Minority Nationalisms in 20th Century Western Europe—(Same as German 336.)
5 units, Aut (Puhle)

341B. Graduate Colloquium: Topics in the Culture and Society of Early Modern England.
5 units, Aut (Seaver)

344A. Graduate Colloquium: Problems in Modern British Society.
5 units, Win (Stansky)

346A. Graduate Colloquium: Big Business and Race in South Africa.
5 units, Spr (Worger)

347A. Graduate Core Colloquium on African History.
5 units, Aut (Jackson)

347B. Graduate Core Colloquium on African History.
5 units, Win (Roberts)
348A. Graduate Colloquium: The End of Slavery in Africa and the Americas.
5 units, Win (Roberts)

349A. Graduate Colloquium: Africa Since 1945.
5 units, Win (Jackson)

351A,B,C,D,E,F. Graduate Core Colloquium in American History.
30 units, Aut, Win, Spr (Rakove, Degler, Fredrickson, Carson, Camarillo, Bernstein)

365A. Graduate Colloquium: Sexuality in American History.
5 units, Aut (Freedman)

376. Graduate Colloquium: Modern Latin America, Recent Trends in Historiography.
5 units, Aut (Wirth)

390B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History.
5 units, Win (Van Slyke)

391A. Graduate Colloquium: Nation, Region and Culture in Indian History.
5 units, Spr (Duara)

393. Graduate Colloquium: Modern Philippines.
5 units, Aut (Rafael)

394A. Graduate Colloquium: Modern India.
5 units, Win (Zastoupil)

395A. Graduate Colloquium: Early and Medieval Japan.
5 units, Aut (Mass)

399. Graduate Colloquium: The Institutions of Medieval Japan.
5 units, Win (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)

410. Graduate Seminar: Topics in Early Modern Europe.
5 units, Aut (Spitz)

415A,B. Graduate Seminar in Jewish History.
10 units, Win, Spr (Funkenstein)

421A. Graduate Seminar: Topics in Russian History.
5 units, Win (Emmons)

421B. Graduate Seminar: Topics in Russian History.
5 units, Spr (Kollmann)

433A. Graduate Seminar: 19th Century Europe.
5 units, Win (Sheehan)

433B. Graduate Seminar: 19th Century Europe.
5 units, Spr (Sheehan)

435. Graduate Seminar: Elite and Popular Culture of Early Modern Europe.
5 units, Win (Bryant)

5 units, Win (Puhle)

5 units, Spr (Judt)

5 units, Spr (Fredrickson)

459/459A. Graduate Seminar: Social History of the U.S. in the 19th Century.
10 units, Aut, Win (Degler)

473. Graduate Seminar: Women's, Family and Sexual History.
5 units, Win (Freedman)

476A. Graduate Seminar: 20th Century Brazil, and Latin America.
5 units, Win (Wirth)

490A. Graduate Seminar: Modern China.
5 units, Win (Van Slyke)

PROGRAM IN THE HISTORY OF SCIENCE

Associate Professors: Peter Galison, Wilbur Knorr
Committee in Charge: (Chairman) Wilbur Knorr (Classics and Philosophy), James Adams (Engineering); Barton Bernstein (History), Nancy Cartwright (Philosophy), Francis Everitt (Physics); Alexander Fetter (Physics), Peter Galison (Philosophy and Physics), Craig Heller (Biology), Burton Richter (SLAC)

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 twentieth century. Instruction is designed to accommodate a wide range of students' preparations in the humanities, social sciences and sciences.

The structure of the program will require students to define and pursue their own areas of investigation according to the rubrics of an 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 listing).

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 200-31.

**COURSES**

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. (DR:3).

5 units, Spr (Galison) MWF 11

62. Introduction to the History of Biology—(Same as Philosophy 62.) The changing nature of the biological sciences, addressing such questions as: 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, Win (Maienschein) MWF 11

127. The Vienna Circle—(Same as Philosophy 127.) Surveys the history of 20th century positivism, concentrating on the central epistemic doctrines of Schlick and Carnap. The latter part of the course assesses how well these doctrines survive an extended attack by Quine.

4 units, Win (Creath) MWF 1:15


138A. Ancient Period—(DR:3; also satisfies Area 6 when taken in sequence with 138B.)

4 units (Knorr) given 1987-88

138B. Middle Ages to Newton—(DR:3; also satisfies Area 6.)

4 units (Knorr) given 1987-88

138C. Newton to Einstein—(DR:3)

4 units, Spr (Creath) MWF 1:15

140. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Same as Philosophy 140.) Origins and development of concepts and techniques in their social and philosophical context. Special 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 (Knorr) given 1987-88

141. History of Psychology—(Same as Psychology 141.) The development of psychological theory from an historical perspective. Major systematic positions such as structuralism, Gestalt theory, behaviorism and psychoanalysis are discussed in some detail. The historical roots of major contemporary positions will be explored. Prerequisites: Students should usually have taken 3 courses in Psychology.

4 units (Hastorf) not given 1986-87

143. The Medieval and Early Modern Culture of Science: Undergraduate and Graduate Colloquium—(Same as History 211A, 311A.) Aristotelian background. The future of the scientific endeavor in late antiquity and the early middle ages. Growth of universities; scholasticism in science; ties of medieval to early modern science. Emphasizes physics, cosmology, and some astronomy with selected problems to be treated in depth.

5 units, Spr (Funkenstein) T 1:15-3:05

145. Scientific Revolution—(Same as History 139, Philosophy 145, VTSS 132.) Social, intellectual and institutional background of the period that established modern science, the 17th century. Stress on theories of matter and motion, especially 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 17th century texts and modern historical studies. Considers various interpretations of the revolution and what is meant by science and revolution.

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

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, Hubbauer).

4 units, Aut (Lowood) TTh 2:15-3:30

152. The Darwinian Revolution and the Problem of Heredity—(Same as Philosophy 152.) As a result of the Darwinian revolution, the biological question of what makes offspring the same as their parents became what makes offspring vary? We will examine what Darwin said about heredity and subsequent contributions leading to the establishment of genetics, and the intellectual structure and impact of evolutionary theory generally; specifically asking what is revolutionary about the “Darwinian Revolution.”

4 units, Spr (Maienschein) MWF 2:15

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 do we mean by “unified” field theories in contemporary physics? Readings: scientific, historical, and philosophical texts.

4 units, Win (Wise) TTh 11-12:15

237A, B, C. Graduate Colloquium: Methods in the History of Science—(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. Attention is paid to diverse approaches: “internal,” institutional, Marxist, sociological and anthropological. Guest lecturers from a variety of specialties. After an introduction of core material each student pursues an individual research topic in consultation with the instructor.

3 units each quarter, Spr, Aut, Win (Staff) T 4:15-6:05

PROGRAM IN HUMAN BIOLOGY

Chairman: H. Craig Heller
Facility: Sandra Archibald (Food Research Institute), Brian Arthur (Food Research Institute), Clifford Barnett (Anthropology), Philip Berger (Psychiatry), Merton Bernfield (Pediatrics), Carol Boggs (Biological Sciences), Diane Bray, J. Martin Brown (Radiology), John Bunker (Health Services Research), Luca Cavalli-Sforza (Genetics), Roland Ciarnello (Psychiatry), Raymond Clayton (Medical School), Herbert Dengler, Carl Djerassi (Chemistry), Sanford Dornbusch (Sociology), William H. Durham (Anthropology), Anne Ehrlich, Shirley Feldman, James Fox (Anthropology), Dolores Gallagher, Albert H. Hastorf (Psychiatry), Kevin Hayashi (Psychiatry), Denis Hayes, H. Craig Heller (Biological Sciences), Meredith John (Food Research Institute), Herant Katchadourian (Psychiatry), Donald Kennedy (President), Seymour Levine (Psychology, Psychiatry), Michael Marmor (Medicine), Reynaldo Martorell (Food Research Institute), Thomas McBride (Law), Lorraine Morgan (Human Biology), Thomas Raffin (Medicine), Herbert Dengler, Carl Djerassi (Chemistry), Sanford Dornbusch (Sociology), William H. Durham (Anthropology), Anne Ehrlich, Shirley Feldman, James Fox (Anthropology), Dolores Gallagher, Albert H. Hastorf (Psychiatry), Kevin Hayashi (Psychiatry), Denis Hayes, H. Craig Heller (Biological Sciences), Meredith John (Food Research Institute), Herant Katchadourian (Psychiatry), Donald Kennedy (President), Seymour Levine (Psychology, Psychiatry), Michael Marmor (Medicine), Reynaldo Martorell (Food Research Institute), Thomas McBride (Law), Lorraine Morgan (Human Biology), Thomas Raffin (Medicine), John Rick (Anthropology), Gary Schoolnick (Medicine), Harold Sox (Medicine), David Spiegel (Psychiatry), David Sutton (Human Biology), Richard F. Thompson (Psychology), Tjeerd Van Andel (Geology), Bruce Wilcox (Biological Sciences), Jeffrey Wine (Psychology), Arthur B. Wolf (Anthropology)

Director of Advising, Honors, and Teaching Coordination: Lorraine Morgan

Director of Internship Program: David Sutton

Student Advisors: Todd Dray, Michele Dreyfuss, Eugene Gullingsrud, Kirsten Lund, Darlene Martin, Linda White, Cyndy Yu

STATEMENT OF PURPOSE

The Program in Human Biology is an inter-school, interdepartmental, undergraduate major designed to integrate natural and social
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 gives students an appreciation and understanding of the problems and process in the development, analysis, and implementation of public policy.

The program offers excellent preparation for advanced study in specific natural and social science disciplines and related professions such as medicine, law, and education, but it also is a superb broad, liberal arts education for responsible citizens and those who plan to pursue careers in public policy.

OFFERINGS AND FACILITIES

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 approximately 64 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.

   In addition, familiarity with computer science principles is required. This may be obtained via formal coursework, internship, research, or in some other fashion.

2. **Foundation Level**—Students must take significant foundation coursework (20 unit minimum) designed to prepare them for their areas of concentration. 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 selected from the offerings of the other academic departments of the University. Final approval of the area of concentration rests with the student's faculty advisor. All area of concentration courses are to be taken for a grade.

4. **Upper Division Courses**—Students are required to take three Human Biology upper division courses, one of which may also be included in the area of concentration. One upper division course may be taken Pass/No credit, provided it is not in the student's area of concentration. 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 gui-
dance 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. These units will be in addition to the approximately 30 upper division units ordinarily required for an A.B. in Human Biology (see Human Biology 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 of courses which introduce the biological sciences, the social sciences, and most importantly, the relationships between the two. The courses meet MWF from 9-10:50 throughout the academic year. Students must register concurrently for the A and B series and take the core courses in sequence. Students are advised to initiate the core in the Autumn Quarter of their sophomore year. 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 include population genetics, population dynamics, and community ecology. Emphasis on genetics of the evolutionary process with applications to human populations. 2B is an introduction to the evolutionary study of human diversity. Examines hominid evolution, the origins of social complexity, and contemporary cultural diversity. Emphasis 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 concentrates on 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. Human developmental biology, emphasizing principles is discussed. 3B focuses on 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 are studied. Prerequisite: 2A, B.

**3A. Properties of the Individual—**

- **(DR:7 entire sequence 2A, 3A, 4A, must be completed.)**
- **4 units, Win (Bernfield, Staff) MWF 9**

**3B. Adaptation and the Development of Social Processes—**

- **(DR:4 and DR:5, entire sequence 2B, 3B, 4B must be completed.)**
- **4 units, Win (Feldman, Staff) MWF 10**

**4A, B. The Human Organism, Adaptation and Social Control—**4A is a course in organ system physiology, beginning with coverage of basic principles of neurobiology and endocrinology, and the functions of the organs of the body. Use of the understanding of neurobiology and endocrinology developed earlier to discuss mechanisms of control, regulation, and integration of organ systems. 4B studies 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 exploring such topics as homeostasis, hormones, and behavior, the prevention of heart disease, and aging.

**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. Uses a case study approach both to illustrate general principles of evolution and to emphasize similarities and differences between genetic and cultural change. Topics include Mendelian genetics, basic molecular biology, Darwinian theory, the modern synthesis, the concept of culture, cultural evolutionary theory, differential cultural transmission, and the scientific methods. Recommended for all students considering the Human Biology Core. (DR:5* or DR:7*)

3 or 5 units, Spr (Durham)

10. Human Sexuality—Provides a broad perspective in human sexuality. Part one deals with the biological aspects of sex: anatomy, physiology, endocrinology, pregnancy, contraception, and diseases of the sexual organs. Part two focuses on sexual behavior: its development, patterns, variations and malfunction. The final portion examines the relationship of sex and society in historical and cross-cultural contexts. This is a lecture course without discussion sections. The emphasis is on information not advice. Preregistration is required.

3 units, Win (Katchadourian)

26. Topics in Medicine—(Same as VTSS 146.) Weekly lecture and discussion in which Medical School Faculty deal with their own areas of expertise in the broader context of medicine. Provides students with an overview of major fields of clinical practice and research within the framework of social, economic and ethical aspects of medicine. Useful for students contemplating careers in medicine or health policy. Open to sophomores and above.

2 units, Win (Clayton, Staff)

40. Public Decisionmaking Regarding Human Health—(Same as Health Services Research 220.) The goals are to 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 to be able to assess the validity of analyses carried out by others; and to understand the logical basis for decision making in health policy. Provides an overview of health policy formulation from several perspectives. Consideration is given to 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 complexion of public decision making in the national and international environmental arena, demonstrates how biological information is accommodated in policy-making and how technically-trained people contribute to the policy process. Section exercises and policy research projects are required. Prerequisite: Human Biology Core.

4 units, Win (Sutton, Wilcox) MWF 11

50. Human Biology Colloquium—Weekly seminar designed for present and potential Human Biology majors. Featuring various Human Biology associated faculty presenting seminars and leading discussions on their areas of interest.

1 unit, Spr (Staff)

60. Colloquium on Population Studies—(Same as Food Research 188/288, Biology 183.) 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 presented by the Program in Human Biology are open to non-majors with the proper prerequisites. Human Biology majors will have preference when the number of students must be restricted.

102. Evolutionary Ecology—(Same as Biological Sciences 115.) The fundamental concepts of evolutionary ecology. Topics include 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 covered 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 students)

4 units, Aut (Boggs) MWF 1:15

103. The Natural History of the San Francisco Bay Area—The influence of physical factors on the development of the major plant associations characteristic of the region and the faunas associated with them; the impact of human activity on these natural communities. A one-hour lecture plus one field trip per week to be arranged. Limited to 12 seniors. For acceptance, applica-
tion form is available in the Human Biology Office. Prerequisite: Human Biology Core.

3 units, Aut (Dengler) T 9, Th 8-12
plus hours to be arranged

104. Emotional Disorders of Aging—A comprehensive overview of common emotional disorders of aging in older adults with emphasis on depression and dementia. Guest lecturers present special topics such as the aging family, and cross-cultural issues in mental health and aging. Primary emphasis is on the psycho-social aspects of aging and psychological treatment interventions. One field trip.

3 units, Spr (Gallagher)

110. Nutritional Problems of Developing Nations—(Same as Food Research Institute 250, Anthropology 250.) 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. Detailed consideration is given to efforts 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. Prerequisites: Food Research 119 or equivalent: open to graduate students and to seniors in Human Biology and Anthropology.

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

111. Human Physiology—(Same as Biological Sciences 112.) The functioning of organ systems with emphasis on mechanisms of control and regulation. Topics include structure and function of the endocrine and central nervous systems, cardiovascular physiology, respiration, salt and water balance, immunology, exercise and gastrointestinal physiology. Lectures and discussion/laboratory. Prerequisite: Human Biology or Biology core. Limited to 120. Registration required.

4 units, Win (Heller, Staff) MWF

112. Educational Policy — Provides Human Biology students with an opportunity for close faculty/student interaction through an examination of selected contemporary issues in educational policy. Guidance provided in the development of strategies for the development of a research project which will include the formulation of a statement of the problem, the design of a research study, collection and analysis of data and presentation of findings in both written and oral modes. Systematic evaluation of each student's progress through individual faculty conferences as well as opportunities for peer review. Resources include the utilization of computer literature searches, video taped oral presentations and the use of text editing in the production of a printed document.

3 units, Win (Morgan)

113. Biology and Evolution of Language—(Same as Anthropology 5.) Lecture course on the biology, function, and evolution of the organs of speech and the brain. Topics include: animal communication; non-verbal communication; language structure; the biology and physics of speech; speech disorders; color terminology and color vision; biological influences from language universals and acquisition. (DR:4)

5 units (Fox) alternate years, given 1987-88

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) with special emphasis on theoretical issues and empirical case studies. Teams of students conduct original research projects and report to the class. Prerequisites: Human Biology 1 or consent of the instructor.

4 units, Spr (Durham)

115. Humans and Viruses—Viruses as models of biological processes, the economic impact of viral diseases in animals, psychological aspects of herpes simplex; anthropological aspects of kuru, and policy issues of the swine flu vaccine. An overview of human virology and selected topics to illustrate important concepts in biology and the social sciences. Main foci include vaccination and the eradication of disease, AIDS, herpes viruses, and cancer viruses. Prerequisite: Human Biology Core or consent of the instructor.

3 units, Aut (Siegel)

116. Eye and Implications of Vision — The workings of the eye, and application this knowledge to the larger problems of how humans perceive the world and how that perception influences endeavors. Compares the human eye to the specialized eyes of animals. Explores less-defined areas such as illusions, the optics, and visual physiology of art, and the eye in history. Prerequisites: Human Biology Core, Biology Core, or consent of the instructor.

3 units, Win (Marmor) not given 1986-87

118. Seminar on Evaluation of Health Care Technology—The topic of health care technology from numerous perspectives. The first part: 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. The emphasis then shifts to medical technologies: systematic methods of evaluating a technology's effectiveness and
cost-benefits ratios; what affects the diffusion of a technology into medical practice. The final part is a case study in which the methods that have been discussed are applied to a state-of-the-art medical technology. Limited to 15 students. Prerequisites: Human Biology Core, or consent of the instructor.

3 units, Win (Sox)

119. Conservation Biology—(Same as Biological Sciences 180.) An introduction to conservation biology and its application to conservation practice and policy. Covers biological theory relevant to natural area protection and sustainable development. Yosemite National Park serves as a case study. Prerequisites: Human Biology Core, Biology 40 and consent of the instructor.

2 units, Spr (Wilcox)

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. Prerequisites: Human Biology Core or consent of instructor.

4 units, Aut (Martorell, Bray)

123. Biological and Policy Aspects of Abnormal Fetal Development—Covers selected aspects of human development and some social and legal implications and governmental interventions relevant to these issues. Topics include chromosomal abnormalities; aspects of pre-implantation development, discussing 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, as well as means for its prevention. Lectures and discussion. Limited to junior and/or senior students. Prerequisites: Human Biology Core or Biology Core or consent of instructor. Limited to 24 students.

4 units, Spr (Bernfield)

125. Legal and Political Perspectives in Biology and Technology—(Same as VTSS 150.) A critical examination of how legislatures, courts and regulatory agencies deal with contemporary issues related to biology and technology. Issues include 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. Following an introduction to the workings of law, politics and regulation, emphasis is on student research. Students find data, both library and live, analyze it, understand how government works and why competing interests compete, and use the skills of written and oral presentation to educate and persuade. Limited to 30 students.

4 units, Aut (McBride)

127. Psychobiology of Learning—Focus is on several model systems developed to identify the neural circuitry and cellular mechanisms involved in "simple" forms of learning in infrahuman organisms. Review of the training procedures most commonly adopted in laboratory investigations of learning (habituation and sensitization, Pavlovian conditioning, and instrumental conditioning) and the basic behavioral phenomena generated by these procedures. Detailed consideration of representative vertebrate and invertebrate model systems developed to explain instances of nonassociative and associative learning in terms of neural mechanisms.

3 units, Spr (Thompson)

128. Biosocial Aspects of Sexually Transmitted Diseases—(Same as Feminist Studies 128.) The evolution of research and policy in the field of sexually transmitted diseases (STD's) from the term "venereal disease" as used to describe a limited number of conditions, including gonorrhea and syphilis. "Sexually transmitted diseases" now number in the twenties, and include chlamydia, herpes, and AIDS. The study of the historical, legal and psychological implications of these diseases and syndromes provides students with a broader perspective on the current political and social problem of STD's and provides a basic understanding of the biology, epidemiology, and impact on maternal and child health of STD's necessary for intelligent discussion. Leaders in STD policy and research will present the biology, epidemiology, and impact on maternal-infant health of the STD's. Format is lecture, or debate, with discussion afterwards to present areas of active controversy in strategies for control and research in the STD field. Student research papers develop an in-depth understanding of one interface between social policy and the biology and epidemiology of disease. Students must attend class and participate in discussion, pass a take-home midterm on basic factual material, and develop, in consultation with the teaching assistant, a class presentation and research paper. Prerequisites: Human Biology Core or consent of instructor.

4 units, Win (Cerel-Bower, Schoolnick)

130. Human Population Genetics and Genetic Epidemiology—(Same as Genetics 205.) Examines gene and genotype frequencies in human kind, how they are shaped by the major evolu-
tionary factors: mutation, selection, migration, drift; demography and natural selection; genetic population structure, inbreeding; genetic disease and epidemiology; models for description of complex inheritance; prediction of risks for genetic counseling purposes; human evolution; interactions of cultural, social, and biological evolution; eugenics, euphenics, and human welfare.

3 units, Win (Cavalli-Sforza)

134. Ecological Anthropology—(Same as Anthropology 164.) Seminar on ecological analysis in anthropology with particular attention to patterns of covariation between social systems and ecosystems. Sample societies from diverse habitats (arctic, desert, tropical rainforest, ocean islands, mountain tops, etc.) motivate the exploration of theoretical topics including cultural evolution, adaptation, optimal foraging, resource management, population dynamics, resource competition, warfare, and social stratification.

3 or 5 units, Aut (Durham)


5 units, Win (Arthur) MW 10-11:50


5 units, Aut (John) TTh 1:15-3:05

139. Seminar on Climate Change and Human Affairs—Seminar deals with the impact of climatic change, present as well as in the recent past, on local, regional or global economics, politics, and social stability. Acquaints participants with the resources available to prepare a position on an issue of public policy, and with the techniques for developing a viewpoint and communicating it effectively with decision makers, be that the town major, the U.S. Congress, or the United Nations. Report writing and communication skills are key components. After a general introduction in the workings of climate and its impact on human affairs, students research and judge the state of our knowledge on relevant topics, and report to the seminar on their findings, with recommendations of suitable policies or action. Limited to 24 students.

3 units, Spr (van Andel) not given 1986-87

143. Early Experience—(Same as Psychology 190A.) Experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function. Material covers both animal and human research and deals with behavioral and physiological function. Prerequisite: Human Biology Core or consent of instructor.

3-5 units, Win (Levine) not given 1986-87

144. Planning for Decentralized Energy Systems—(Enroll in Civil Engineering 238.) 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 and cogeneration.

3 units, Spr (Hayes)

148. Environmental Policy — Discussion of important environmental issues of today and the future, how to deal with them technically and politically, and how to resolve conflicts between environmental concerns and other social needs. Focus is on the U.S. but an international perspective will be used when appropriate. Main points include definition and description of environment and environmental impact, history of human impact on environment, causes of increased human impact, history of environmental protection, decision-making and resolution of issues, future environmental issues. Two discussion hours per week. Enrollment limited to 15 Human Biology Seniors. Prerequisites: Human Biology Core and 40 or 41 or with consent of the instructor.

3 units, Spr (Ehrlich, Anne) not given 1986-87

150A. Biosocial Aspects of Birth Control—(Same as Chemistry 137A, Feminist Studies 150A.) 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 many components enter into major policy decisions. Course deals with a critical evaluation of the logistic aspects of human fertility control and on "hardware" as well as "software" aspects of birth control. Groups of five to eight students of diverse backgrounds will develop a series of position papers dealing with new birth control procedures suitable for populations of different cultural and socioeconomic backgrounds. The first half consists of lectures, of selecting the population groups and task forces and of individual discussions with each task force. The remainder consists of library and field work, the completion of written task force reports and oral presentations to the class. The selection of stu-
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 specific logistic aspects of a common topic in the birth control field. Limited to 35 students. Pre-registration prior to December 5, 1986 is essential, using special questionnaires available from the Human Biology office. Prerequisite: At least junior standing.

6 units, Win (Djerassi) TTh 1:15-4:05

150C. Seminar: Feminist Perspectives of Birth Control—In most societies human fertility control is 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. Limited to 15 seniors. Preregistration prior to Winter Quarter is essential using special preregistration forms available from the Human Biology office. Under exceptional circumstances junior standing considered.

5 units, Win (Djerassi) not given 1986-87

153. U.S. Agriculture: Interaction of Biology and Economics—(Same as Food Research 145.) Agriculture in the United States is increasingly shaped by both 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 on assessing long-run biological, environmental and economics 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 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. Detailed consideration of the 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)

160. Primate Biology—The factors that shaped the evolution and behavior of non-human pri-

mates. 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 1986-87

163. Psychobiology: Biological Basis of Psychiatric Disorders—Recent developments in psychopharmacology, as they relate to the study of human mood disorders and schizophrenia. Current theories regarding the etiology of mental illness. The relationship between hormones and human behavior. Emphasis on student participation, using a seminar format. Limited to 24 senior students. Prerequisite: Human Biology core.

3 units, Aut (Berger)

165. Aspects of Recreational Drug Use—The pharmacological and social consequences of licit and illicit drug use in a series of lectures and discussion sections. Topics cover caffeine, tobacco, alcoholic beverages; cannabis, sedatives, stimulants, opiates, and hallucinogens. Prerequisite: Human Biology Core or consent of the instructor.

3 units, Win (Hollister)

166. Biosocial Aspects of Cardiovascular Disease—Examines epidemiological, biological and behavioral perspectives of cardiovascular disease and the assessment and modification of risk factors relating to cardiovascular disease. Detailed consideration of the potential for disease prevention, and an examination of the major preventive trials. Public policy ramifications. Although the course is didactic in nature, students will monitor one of their own health risk behaviors and prepare reports of their experiences. Enrollment limited to 35. Prerequisites: Human Biology Core or consent of instructor.

4 units, Aut (Stanford Heart Disease Prevention Program Staff)

167. Neurochemical Aspects of Behavioral Disorders in Children—A series of lectures on neurotransmitter dynamics as they relate to our understanding of behavioral disorders in chil-
dren. Current hypotheses concerning the neuro-
chemical and neurobiologic basis of behavior dis-
orders in children; Clinical syndromes including
infantile autism, childhood schizophrenia, hyper-
kinetic syndrome and childhood depression in
terms of disturbed neurochemical or neurophys-
ologic functioning. Limited to junior and/or
senior students. Prerequisites: Human Biology or
Biology Core or permission of the instructor. In
addition, Human Biology 111, 163 and organic
chemistry are strongly recommended.

4 units, Win (Ciaranello) not given 1986-87

170. Laboratory in Behavioral Neurophysiology
—(Same as Psychology 149.) Selected as-
pects of behavioral neurophysiology covered in
group lectures, with a focus on the recording of
single neuron activity from the mammalian
brain in the context of behavioral learning.
Students are trained as a group in standard
laboratory technique manufacture of microelec-
trodcs, surgical implantation, recording, be-
havioral training and histological reconstruc-
tions. Smaller groups will conduct a mini experi-
ment. All work to be done during assigned
hours. Prerequisites: Human Biology Core or
Psychology 107. Class limited to 16.

4 units, Win (Thompson)

171. Adolescence—Adolescence viewed from
perspectives including anthropological, socio-
logical, psychological and psychiatric. Topics
include physical and physiological develop-
ment, cognitive growth, identity, peer group,
generation gap, impact of the school, vocational
development, among others. Prerequisite:
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 per-
spectives on adulthood as a phase of life. Topics
include the concept of adulthood, historical and
cross-cultural views, stage theories and longitudi-
nal studies; biological aspects of develop-
ment to adulthood; consolidation of psychoso-
cial and gender identity, interpersonal relation-
ships, patterns of vocational choice; physiolog-
ical and psychological at midlife. Lectures to be
followed by discussion sections. Prerequisite:
Human Biology Core or consent of instructor
for undergraduates. Preregistration required.

4 units, Spr (Katchadourian)

176. Child, Family, and State—An introduc-
tion to family law issues examining how law
distributes power and responsibility among the
child, family, and the state. The moral, philo-
sophical 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: Prerequisites: Human Biology
Core or consent of the instructor.

3 units, Aut (Mnookin) not given 1986-87

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. Study of the
biological basis of various handicaps together
with the psychosocial problems and stigmas
associated with them. Also, discussion of the
legal and political issues concerning the handi-
capped.

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 proc-
esses of aging and the social status of the elderly
in our and other cultures? What are the cul-
tural, social, and economic consequences of
larger elderly populations in developed coun-
tries? What implications do they have for social
policy? These questions are addressed through
readings, lectures, films, field visits and guest
panelists. Students will be assisted in carrying
out research projects.

3-5 units, Win (Barnett)

183. Hunter-Gatherers in Archeological Per-
spective—(Same as Anthropology 187.) Encom-
passes problems of the organization and subsis-
tence of band-level hunter-gatherers, especially
as approached through archeological investiga-
tions. Survey of modern huntergatherers, pro-
viding background for prehistoric groups. The
archeological record of Africa, Europe and the
New World provides examples of how archeo-
logical data is used to reconstruct 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. Prer-
erequisite: Human Biology Core or consent of
instructor. (DR:5*)

5 units, Spr (Rick) not given 1986-87

Practice and Moral Issues—An investigation of
the intensive life support systems used in inten-
sive care units. Topics include 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 sup-
port 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 will spend time in intensive care units. Limited to 30 students. Prerequisite: Human Biology Core.

3 units, Win (Raffin)

188. 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. Prerequisite: Human Biology Core or consent of instructor. (DR:5)

5 units, Spr (Rick)

189. 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. Prerequisites: Human Biology Core, or consent of the instructor.

3 units, Win (Levine)

196. 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 it is hoped that the course will be at the cutting edge of neuroscience and offer students 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. Intended for students with a prior background in neurochemistry. Prerequisites: Permission of the instructor plus either 167 or Biochemistry 200 and Neurobiology 200.

3 units, Spr (Ciaranello) not given 1986-87

197. Internship in Human Biology—Required of all program majors. Offers the student the opportunity to augment the formal course work with a supervised field, community, or laboratory project of his or her own choosing. To be arranged in advance and to be initiated at least three quarters prior to graduation. Limited to majors in Human Biology. Course graded pass/no credit exclusively.

4 units (Sutton) by arrangement

198. Honors Program—An opportunity for in-depth research on an appropriate issue or problem by the student. It is necessary to choose a faculty sponsor who will be the advisor to the project and a faculty consultant who will act as second reader of the thesis; at least one of these two must be a member of the Human Biology faculty. Minimum requirements for program work and thesis: the equivalent of 10 units of work; a maximum of 15 units may be awarded. Limited to majors in the Program in Human Biology who have completed the core courses, including the internship. Interested candidates should consult with advisors in the Program in Human Biology and Lorraine Morgan for explicit requirements.

(Staff) by arrangement

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, Philip H. Rhinelander
Chairman: Paul Robinson
Professors: Kurt Mueller-Vollmer (German Studies and Humanities), Lawrence V. Ryan (English and Humanities)
Program Coordinator: Helen Brooks

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 information under American Studies)
4. Medieval Studies (see information under Medieval Studies)

HONORS PROGRAM

Committee in Charge: Paul Robinson (Chairman), Helen Brooks, Edwin M. Good, Marsh McCall, Kurt Mueller-Vollmer, Jeffrey Schnapp

PURPOSE

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 (consult information under Comparative Literature).
2. If they choose a major in Humanities concentrating in Modern Thought and Literature (consult information under Modern Thought and Literature).
3. If they are permitted, upon petition granted by the Honors Committee, to plan a 40-unit concentration of interdepartmental course work constituting a unified program of study.

Students who wish to major in Humanities must enter the program and plan the concentration before registering for the first quarter of the junior year. Competence in reading a foreign language is required of Humanities majors.

REQUIREMENTS

1. Completion of the Western Culture Requirement: 15 units, freshman year, with an average 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, junior year, 5 units autumn and 5 units winter, senior year). A grade of at least B is required on the essay for graduation with Honors in Humanities.

GRADUATE PROGRAM

Committee in Charge: Kurt Mueller-Vollmer (Chairman), Russell A. Berman, Eckart Förster, Sabine MacCormack, Lawrence V. Ryan, Paul Robinson, Michael Saler, William M. Todd, III

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 Humanities 301-303 (the first three courses in the series "The Western Traditions"), plus at least one of three required seminars or proseminars in an established discipline (for example, Art History, Classics, Philosophy, etc.). During the second year the student will take Humanities 304-306 (the remaining three courses in "The Western Traditions"), Humanities 353 and at least one of the three required seminars or proseminars in the chosen established discipline. The third seminar or proseminar may be taken in either the first or second year. At the end of the second year a written comprehensive examination will be required.

A student will usually complete either 16 or 20 units during the first year, and 20 or 24 units during the second year, for a total of 40 units. Additional elective units may be taken at the option of the student.

When applying for the A.M. Program in Humanities through Graduate Admissions, the candidate should indicate from which established discipline he or she will be choosing the three required seminars or proseminars by noting the field in the "Statement of Purpose" on the application form for Graduate Admissions. Once a student has been admitted to the A.M. program he or she must submit a proposed plan of study to the Chairman, specifying the courses that will be used to fulfill the requirement of three seminars or proseminars in an established field.

Each A.M. program will be approved on its own merits, to ensure that the proposed three seminars and proseminars in an established discipline are suited to the A.M. in Humanities.
Since reading knowledge of a foreign language appropriate to the department in which specialized work will be pursued is required, language proficiency should be noted on the application form submitted to Graduate Admissions.

JOINT Ph.D.

The Graduate Program in Humanities supplements the Ph.D. programs of certain Stanford students, especially in Classics, Drama, Education, English, French and Italian, German Studies, History, Modern Thought and Literature, Philosophy, Religious Studies, Slavic Languages and Literatures, Spanish and Portuguese, with an interdepartmental program devoted to the study of the Western tradition. 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 Humanities 301-305; 18 in Humanities 306.

REQUIREMENTS

1. Continued satisfactory work in the student’s major field, in accordance with departmental requirements.
2. Completion of the six historical seminars (Humanities 301-306) in the Western Traditions series. To qualify for candidacy, students should complete at least three of these seminars in the first two years of graduate residence. Special exemption from or permission to audit one or two of the seminars may occasionally be secured by petition to the Committee in Charge.
3. Completion of Humanities 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, 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, Eu- pides, Plato, Aristotle, Cicero, Epicureus, Virgil. (DR:1; three-quarter sequence) 5 units, Aut (McCatt, Staff) MTW 11; two hours by arrangement

62. Christian and Secular Europe: Medieval and Renaissance—St. Augustine, Boethius, medieval romance, Dante, More, Machiavelli, Luther, Montaigne, Cervantes, Calileio, Shakespeare, Milton. (DR:1; three-quarter sequence) 5 units, Win (Ryan, Staff) MTW 11; two hours by arrangement

63. From the Enlightenment to the Present—Voltaire, Rousseau, Marx, Darwin, Freud, T.S. Eliot. (DR:1; three-quarter sequence) 5 units, Spr (Lindenberger, Staff) MTW 11; two hours by arrangement

90. Introduction to the Humanities—Basic themes and issues of the humanities as treated in important works from various humanistic disciplines, including texts from the Western Culture courses that will be re-examined in
greater depth. Prerequisite: Completion of the Western Culture requirement. Honors majors given preference in enrollment. (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 to 5 units, any quarter (Staff) by arrangement

176. SLE Tutoring.
2-5 units, any quarter (Ryan) by arrangement

190-196. Interdepartmental Seminars on the Nature of the Humanities—Students in the Humanities Honors Program are required to complete two of these seminars; other students may enroll in them only by consent of the director. Prerequisite: 90.

191. History and the Humanities.
5 units, Aut (Wilke) TTh 1:15-3:05

192. The Arts and the Humanities.
5 units, Aut (Lewis) W 2:15-5:05
Spr (Good) T 7-10 p.m.

193. Philosophy and the Humanities.
5 units, Spr (Fruitt) TTh 3:15-5:05

194. Literature and the Humanities—The critical study of major texts; theory and practice of criticism.
5 units, Win (Schapp) TTh 3:15-5:05
Spr (Lindenberger) MW 2:15-4:05

197. Modernism and the Humanities—The presence of biblical scripture (it’s narratives, place names, prophesy, liturgical and lexical elements) in British, American, European and Israeli poetry.
5 units, Win (Felstiner) MW 3:15-5:05

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

INTERNATIONAL POLICY STUDIES

Committee in Charge: Robert E. Ward, Chairman (Center for Research in International Studies), Elie Abel (Communication), Walter P. Falcon (Food Research), Stephen D. Krasner (Political Science), John D. Wirth (History)

The Master of Arts Program in International Policy Studies is administered by the Center for Research in International Studies, 207 Lou Henry Hoover Building, Tel: (415) 725-1495.

GRADUATE PROGRAM

MASTER OF ARTS

The Master of Arts Program in International Policy Studies in an interdisciplinary curriculum intended to provide both a liberal edu-
cation and practical preparation for an internationally oriented career in either the private sector or in government. Although conceived as a one-year postgraduate program, it presupposes the completion during the student's undergraduate career of an unusual number of 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 average of 3.4 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 Center for Research in International Studies, Room 207, Lou Henry Hoover Building. 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,” the “Coterminal Degree Program Yearly Program Sheet” and the “Coterminal Degree Program Information Sheet,” complete the first two of these items, have them approved by both their undergraduate departmental representative and the Center for Research in International Studies, and file the completed petition, the Program Sheet, and a transcript with the Graduate Program Office, Building 590, Room 104.

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 uni-
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 107-120 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 107-120 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 fifty 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 and/or 52). Finally, International Relations majors are required to complete a minimum of ten 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 and 52).

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 an advisor, who will be a member of the Committee on International Relations or a faculty member approved by it. 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 towards the International Relations major 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 co-
suit 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, whose first draft is due early in the Spring Quarter. Seniors are also expected to talk about 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 average in humanities and social science courses; successful experience in writing a research paper, and submission of an acceptable thesis proposal. Normally, students receive fifteen units of credit for their honors project, spread out over three quarters. Five of these units may count toward the required fifty units in the major; an additional five may be used to fulfill the requirement of ten units of related coursework.

Further details of the International Relations honors program are available from the program office.

AWARDS

The International Relations Committee invites undergraduate Stanford students, particularly juniors, to apply for funds to finance research or intensive study on forces that transcend national borders. These grants are intended primarily for use during the summer by students writing honors theses in international relations. Application forms are available in the Winter Quarter in the International Relations office. Preference is given to students whose research proposals are thoughtful and thorough and show promise of leading to truly distinguished honors theses.

Funds may be used to finance travel to places where field work or library research is to be conducted, or may be used to support intensive work during the summer at Stanford. The imaginativeness and intellectual promise of the project and the preparation of the student are major considerations in awarding these funds.

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, or Political Science 22.) Confrontation and accommodation as non-European societies interact with Western Europe from the fifteenth century to the present. Changes in economy, social and political structures, and religious and ethical values in East Asia, West Africa, and Mexico. Strongly recommended background course: Anthropology 21/History 21.

5 units, Win (Abernethy, G. Collier, Van Slyke)


5 units (Abernethy) given 1987-88

35. International Politics— (Enroll in Political Science 35.) Emphasizes a variety of approaches to the study of world politics including realism, idealism, Marxism, and bureaucratic politics. Examines a number of problems such as World War One, superpower intervention since 1945 and international economic relations. The normative and policy implications of different theories. Enrollment limited to 450.

5 units, Aut (Krasner)

75S. Seminar: The Atomic Bomb in History—(Enroll in History 75S.)

5 units (Bernstein) given 1987-88

79S. Introductory Seminar: Mexico as Intellectual Creation—(Enroll in History 79S.)

5 units, Spr (Bowser)

113A. The Politics of Development in Latin America — (Enroll in Political Science 113A.) Survey of the principal political systems of Latin America. (Brazil, Mexico, Argentina) and the major non-capitalist country (Cuba).

5 units (Packenham) given 1987-88
History of International Communism—
(Enroll in History 117 or Political Science 132.)
History of Third International and its antecedents; relations among communist parties since its dissolution. Strategies and tactics, successes and failures, cleavages and their causes. Sources and variations in the appeal of communism, and patterns of adaptation or evolution in different national settings.
5 units, Win (Dallin)

Socialism in Latin America—
(Enroll in Political Science 119.) An examination of socialist experiences in Latin America. The interrelationships between political, economic, and cultural change. Emphasis is given to the historical and international contexts relevant in each case. (Counts for either Cluster A or C.)
5 units, Win (Staff)

Aristocracy and Absolutism: The International Relations of Eastern Europe, 1300-1800
(Enroll in History 119.) Institutions and cultures of early-modern East Central Europe (Bohemia, Hungary, Poland, Ukraine, Belarus); considers these states' interactions in an East European balance of power and its reorganization by absolute empires (Austria, Prussia, and Russia) by the 18th century.
5 units, Win (Kollman)

Russia on the Pacific—
(Enroll in History 121.) The development of Russia in East Asia and the Pacific region from the 16th century to the present: conquest of Siberia; rise and fall of Russian America; treatment of aboriginal peoples; patterns of colonization; exile; relations with China, Japan, U.S., Mongolia, Korea; revolution, civil war, and foreign intervention in Siberia; regional aspects of collectivization, five-year plans, purges; changing economic/strategic roles of Siberia & Soviet Far East.
5 units, Aut (Stephan)

Seminar: Latin American Dependency
(Enroll in Political Science 124.) Assessment of fundamental concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency in Latin America. (Counts for either Cluster A or C.)
5 units, Spr (Packenham)

History of Soviet Foreign Policy—
(Enroll in History 124A.)
5 units, Win (Haslam)

Seminar: Politics in Eastern Europe—
(Enroll in Political Science 126.) Examination of 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 (Triska) given 1987-88

Introduction to International Law—
(Enroll in Political Science 130.) A broad overview of theories, development, present state and propensities of international law as a policy process in various critical arenas of international interaction.
5 units (Triska) given 1987-88

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 will not come out with answers but with a better understanding of the fundamental questions that need answering. Atmosphere is one of intellectual exchange. Outstanding scholars will lecture to provide a common underpinning for individual comprehension and mutual discussions.
3 units, Win (Dornbusch, Drekeimer, Moses, Ross)

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 by both countries 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. Recommended background course: Political Science 35 or 138A.
5 units, Aut (Blacker)

European Diplomacy—
(Enroll in History 135.) The transformation of the European state system of the late 18th century into the international system of the mid-20th century, with emphasis upon the impact of revolution on Realpolitik and the displacement of Europe as the predominant weight in the system.
5 units, Aut (Haslam)

Arms Control and Disarmament—
(Enroll in Political Science 138A.) 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 the post-World War II period. Topics include 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 (Lewis, Blacker)

135B. Seminar in Arms Control—(Enroll in Political Science 138B.) The substantive and procedural aspects of arms control negotiations. Core faculty is assisted by various guest speakers with negotiating experience. Limited enrollment. Prerequisite: 138A.

5 units, Spr (Lewis)

136D. 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 1987-88

138E. Seminar: Accidental or Unintentional Nuclear War—(Enroll in Political Science 138E.) The likelihood of nuclear war occurring through accident, miscalculation, misunderstanding, or inadvertence. An analysis of past accidents in the 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 crises. Mechanisms of risk reduction, anticipatory planning, crisis prevention and management, and the means of translating such measures from theory to practice. Limited enrollment. Prerequisite: 138A.

5 units, Aut (George, Abrams)

139. Seminar: Chinese Foreign Policy—(Enroll in Political Science 139.) The Chinese traditional pattern of foreign relations, the goals and tools of post-1949 Chinese foreign policy, the domestic sources of foreign policy, and the foreign policy-making process. Recommended: Previous courses on contemporary China.

5 units, Win (Halpern)

139A. Japanese Foreign Policy—(Enroll in Political Science 139A.) Analysis of the postwar evolution of Japan’s foreign policy: historical background, external environment, and domestic institutions.

5 units, Aut (Okimoto)

141. Seminar: Public Policy and International Law—(Enroll in Political Science 141.) Analysis of the nature, determinants, and consequences of public policy decisions which impinge upon orderly, sequential development of world community. Emphasis on the Law of the Sea Treaty and exploitation of the oceans; pollution; terrorism; weather control; arms control of weapons which aggravate suffering; nuclear proliferation, and human rights. Recommended: Political Science 130 or equivalent.

5 units (Triska) given 1987-88

144J. America in Vietnam—(Enroll in American Studies 222, Political Science 144J.) The social, political and cultural aspects of America’s involvement in the Vietnam War.

5 units, Spr (Goldstein)

145J. American Foreign Policy—(Enroll in Political Science 145J.) Introduction to American foreign policy, its formulation and implementation and specific problems which have been influential in its development in the post-World War II era. Begins with the modes of foreign policy analysis and the particular internal and external constraints facing American central decision-makers. Topics include 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, Aut (Bernstein)

146. Seminar: Soviet Foreign Policy in the Third World—(Enroll in Political Science 146.) A broad critical examination of 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; 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 (Triska) given 1987-88

148C. Africa in the 20th Century—(Enroll in History 148C.) Transformation of African societies during colonial rule. Resistance to colonial conquest; decline of the old elite and rise of the new one; peasants and labor; nationalism; decolonization.

4-5 units, Spr (Roberts) given 1987-88

152. Social Structure of World Society—(Enroll in Sociology 152 or Education 231.) A sociological analysis of human society on a worldwide basis. Competing models of the emerging world order and its dynamics. Worldwide population dynamics, the nature of the world economy, communications 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, Spr (Inkeles)
153. Nomad Empires of Inner Asia—(Enroll in Asian Languages 152, History 195.) The nomads of Inner Asia (Scythians, Turks, Mongols, etc.), their way of life, their relationship with the sedentary populations about them, and their history and impact on the world at large. Inner Asia as a channel of trade and cultural inter-change between the “higher” civilizations. Inner Asia as an area of conflict between Russia-Soviet Union and China, with England, Japan and other powers occasionally being involved.

5 units, Spr (Dien)

172A. America Since 1945—(Enroll in History 172A.) An analysis of America that emphasizes foreign policy and politics, and deals with the intellectual history, and social themes. (Fulfills the American foreign policy requirement.)

4-5 units, Win (Bernstein)

176. Seminar: 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 (Abel) given 1987-88

180. 20th Century Brazil—(Enroll in History 180.) With its huge size, multi-racial society, mixed economy and pragmatic foreign policy, Brazil's drive for great-power status and its new capitalist model of development distinguish it from its Spanish-speaking neighbors both in Latin America and world contexts.

5 units, Spr (Wirth)

187A. The Middle East, 570-1718—(Enroll in History 187A.) From the rise of Islam until the decline of Ottoman absolutism. Emphasis is on the organic relationship between the Middle East and Europe throughout this period.

5 units, Aut (Beinin)

187B. The Modern Middle East, 1718 to the Present—(Enroll in History 187B.) From the emergence of regional Arab entities and the commercial penetration of Europe to the present.

5 units, Win (Beinin)

195. Nomad Empires of Inner Asia—(Enroll in History 195 or Asian Languages 152.)

5 units, Spr (Dien)

228A,B. Seminar: The U.S. and the U.S.S.R. as Regional Powers—(Enroll in Political Science 228A,B.) A research seminar on the progressive alienation between restive, frustrated social forces and obsolete political structures in Eastern Europe and in Central America and the Caribbean. Focus is on the dilemma of the two regional powers and how to deal with social change without harming their regional interests.

228A. 5 units (Triska, Packenham) given 1987-88

228B. 5 units (Triska, Packenham) given 1987-88

242L. Seminar: Theories of International Conflict—(Enroll in Political Science 242L.)

5 units, Win (Levy)

244. Seminar: International Relations Theory —(Enroll in Political Science 244.) Examines and compares both traditional and some of the more contemporary approaches to international relations theory from an interdisciplinary viewpoint. Realists, idealists, behaviorists, environmentalists, socio-cultural evolutionists, futurists, and others.

5 units, Aut (Goldstein)


5 units (Roberts) given 1987-88

249A. Africa Since 1945—(Enroll in History 249A.)

5 units, Aut (Jackson)

269S. Seminar: U.S. Foreign Policy in the World War II Era—(Enroll in History 269S.)

5 units (Kennedy) given 1987-88

279. Colloquium: Mexico as Intellectual Creation —(Enroll in History 279.) Mexican self-perception as a response to internal and external influences and its impact on historical events.

5 units, Spr (Bowser)
18. Zen Buddhism—(Enroll in Religious Studies 18.) A survey of the history and development of ideas represented in the two forms of Buddhism in China and Japan respectively. In studying and comparing Ch'an and Zen, emphasis given to the cultural transmission of Buddhism from India to China and then from China to Japan. Also the role of religion as an agent for change.
3-4 units, Spr (Bielefeldt)

24A. Christianity—(Enroll in Religious Studies 24A.) Christians through the ages have struggled with what it means to be Christians. Various forms of Christian communities with varying implications for the social and political order have resulted. Course explores some of the varieties of Christian communities with their accompanying sets of beliefs and perceptions of Christ.
4 units, Win (Gelber)

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.
3 units, Win (Berman)

64. Introduction to Chicano Life and Culture — (Enroll in History 64.) Interdisciplinary course 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. An opportunity to interact with three different Chicano faculty from three disciplines. Historical texts, novels, poems, and ethnomusicology are the basis for required readings.
5 units, Aut (Camarillo, Cuellar, Ybarra-Frausto)

77. Ethics in International Relations—(Enroll in Philosophy 77.)
4 units, Spr (Bogart)

80- Culture, Politics, and Society in Latin America—(Enroll in History 80, Latin American Studies 80 or 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. This is a basic introduction of Latin American courses within several departments.
5 units, Spr (Collier, Wirth)

106. Modern Jewish Intellectual History from the 16th Century to the Present—(Enroll in History 106.)
5 units, Win (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, Spr (Langmuir)

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 1987-88

114. Core Seminar: Western Culture and the Black Diaspora—The Semiotics of Self and Other—(Enroll in African and Afro-American Studies 113.) Use narrative analyses 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)

4 units (W. Corn) given 1987-88

5 units, Win (Robinson)

165. Afro-Hispanic Culture and Literature—(Enroll in African and Afro-American Studies 165.) An outgrowth of African and Afro-American Studies 104. Africa and the Black Diaspora, this course concentrates on Spanish-speaking countries with a sizeable Black population, particularly Colombia and Cuba. Students are also introduced 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 studied.

5 units (Wynter)

166. The Reciprocal Vision—(Enroll in English 165C.) 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, Win (Evans)

195. An Introduction to Africa Through Film: Tarzan, Terrs, and Liberation—(Enroll in Education 195.) The contemporary African situation with the use of film as an instructional medium.

4 units (Staff) given 1987-88

211. The Spanish Golden Age—(Enroll in Spanish 211.) An overview of 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)

215S. Seminar in Jewish History—(Enroll in History 215S.)

5 units, Win (Funkenstein)


5 units, Spr (Berman)

241. Afro-Hispanic Cultural Worlds: An Introduction—(Enroll in Spanish 241.) An overview to the literature and thought of Black Latin American writers in the Spanish-speaking Americas as well as in Brazil. Provides an introduction to the popular syncretic cultures of interesting but little known worlds. Reading Spanish/Portuguese, and in English translations.

3-5 units, Spr (Wynter)

250. The Caribbean Americas: An Introduction to Their Literature, Thought and Cultural Worlds—(Enroll in African and Afro-American Studies 248, Spanish 248.) A general introduction to the literature, thought and popular cultures of the Caribbean Basin area within the context of an overview of its multiple cultural and linguistic worlds.

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, Aut (Pratt)

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 such as Graham Greene, V. Naipaul, S. Naipaul, Paul Theroux, Isak Dinesen and others.

3-5 units, Win (Pratt)

298A. Colloquium: Visions of Utopia—Travelers to China—(Enroll in History 298A.) Prerequisite: At least one course in Chinese history. (May count for either Cluster A or B.)

5 units, Win (Kahn)

CLUSTER C: POLITICAL-ECONOMIC ISSUES AND POLICY ANALYSIS

91. Problems in United States-Mexico Relations—(Enroll in Latin American Studies 91.) An overview of the principal problem areas in the complex relationship between the United States and Mexico. A brief historical survey of U.S.-Mexico economic and social relations followed by a selective look at trade problems, the foreign debt crisis, foreign investment, agriculture, energy policy and the migration issue, including immigration policies and labor markets. Enrollment limited to 15.

5 units, Aut (Smith) W 7-9 p.m.

106. The World Food Economy—(Enroll in Food Research 103 or Economics 106.) The interrelationship 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 associated with economic development. Focus is on Asia, tropical Africa, and Mexico. The U. S. and Japan receive attention in highlighting 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)

114K. The Political Economy of Development—(Enroll in Political Science 114K.) An introduction to major theories of political development, stressing the relationship between economic and political factors.

5 units, Win (Karl)
The Economics of Development—(Enroll in Economics 118.) The state of underdevelopment and the dynamics of development are at the heart of international (and within-country) conflicts between the rich and the poor. The process of economic development as an international perspective. The focal point is the experience of developing countries since World War II. Discussed 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. The impact of aspects of development on societal values and institutions receives special attention. Prerequisite: Economics 51 and 52.
5 units, Win (Anderson)

5 units (Samoff) given 1987-88

Development and Population Interactions in the Third World—(Enroll in Economics 119 or Food Research 121.) Historical and contemporary examination of the record of economic development and of population growth suggests a broad diversity of experience. Case studies of specific countries are a point of departure to illustrate the systematic components of the experience of economic development and those of population growth. Implications are drawn in terms of alternative structures of development, the timing of the demographic transition, income distribution, employment and migration. The interactions and possible causal effects between economic development and population growth are discussed.
5 units, Win (Yotopoulos)

Socialism in Latin America—(Enroll in Political Science 119.) Socialist experiences in Latin America, the interrelationships between political, economic, and cultural change and especially the historical and international contexts relevant in each case. (Counts for either Cluster A or C.)
5 units, Win (Staff)

The Marxian and Radical Tradition—(Enroll in Economics 120.) The economic theories of Marx, Lenin, Stalin, and Mao, and the application of the theories to current economic problems. Prerequisite: Economics 1.
5 units, Aut (Gurley)

The Theory of Capitalist Development—(Enroll in Economics 122.) The theoretical and historical analysis of the process of capitalist development: economies; the analysis of the mechanisms, determinants, and consequences of capital accumulation and technical change, the formation of a labor supply, the role of international trade and investment, and the uneven character of the development process. Various theoretical approaches to the analysis are examined, including Classical, Schumpeterian, and Keynesian, with main focus on Marxian theory and recent elaborations and extensions of that theory. Reference to relevant historical case studies. Prerequisites: Economics 51 and 52.
5 units, given 1987-88

Seminar: Economic Development in Latin America—(Enroll in Economics 123 or Food Research Institute 218.) (Open to advanced undergraduates only with consent of instructor.) Examination of 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 such as the U.S., Mexico, Brazil and the Caribbean. Prerequisites: Economics 51 and 52.
5 units (Reynolds) given 1987-88

Seminar: Latin American Dependency—(Enroll in Political Science 124.) Assessment of fundamental concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency in Latin America. (Counts for either Cluster A or C.)
5 units, Spr (Packenham)

Seminar: Development and the International System—(Enroll in Political Science 125F.) The external constraints on development in the Third World and the interaction between national and international factors. Prerequisite: 35.
5 units, Spr (Karl)

Food, Technology, and Third World Development—(Enroll in VTSS 136.) The role of food and food production technologies in international development policy. Topics: technology in national and international food aid programs; the technocratic approach to development; national and international strategies for development; and the importance of international relations, political, social, economic,
and other non-technical concerns in food technology- development contexts.

4 units, Win (Schmidt)

140A,B,C. Ethics of Development in a Global Environment (EDGE)—(Enroll in Anthropology 133A, B, C; Education 274A, B, C; Engineering 297A, B, C; or 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 role of institutions affecting the transfer of technology—e.g., political systems, World Bank, transnationals; Spring Quarter: the role and responsibilities of the individual who wants to affect development. Speakers present widely differing case studies from their own 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 (Pagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor)

142. European Agricultural Policy—(Enroll in Food Research 146 or Economics 142.) An analytical approach to the development of agricultural policy in Europe, with particular reference to the Common Agricultural Policy of the European Community, and its relationship to agricultural and food problems of member states. Topics include the agricultural trade relationships between the EC and other advanced countries, trade agreements between EC and developing countries, and the question of enlargement of the community to include Spain and Portugal. Agricultural policies are discussed in the context of general economic, political and institutional development. Prerequisite: Economics 51.

3 units (Josling) given 1987-88

152. Social Structure of World Society—(Enroll in Sociology 152 or Education 231.) A sociological analysis of human society on a worldwide basis. Competing models of the emerging world order and its dynamics. Topics include worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socio-economic stratification of the world population, and education, science and technology as global systems. (Counts for either Cluster A or C.)

5 units (Inkeles) given 1986-87

164. International Economics I—(Enroll in Economics 165.) Comparative advantage in production and trade among nations, the international monetary mechanism; income distribution and the gains from trade; tariffs and quotas; exchange rate policies and their relationship to foreign trade. Economics 1, 51 and 52 required.

5 units, Aut (Anderson)

Win (Staiger)

167. International Trade Policy—(Enroll in Economics 166 or 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)

207. Seminar on International Cooperation in Educational Development: The Role of International Organizations—(Enroll in Political Science 248 or Education 207X.) The role of international and bilateral organizations involved in development assistance, especially in the field of education. Seen as part of an interlocking system of political/economic power and cultural/intellectual objectives. Case studies deal with the World Bank, UNESCO, OECD, regional development organizations such as the African Development Bank or the European Development Bank, and bilateral programs.

5 units, Spr (Wetler)


215A. 5 units, Aut (Okimoto)

215B. 5 units, Win (Okimoto)

225. Seminar: The Political Economy of Reform in Socialist Countries—(Enroll in Political Science 225.) The emergence and nature of the Stalinist and post-Stalin politico-economic systems in the U.S.S.R., Eastern Europe, and China. The selected reform efforts in these countries, analyzing the interaction of political, economic, and social factors in producing the reform efforts and conditioning their success or failure.

5 units, Spr (Halpern)

240A,B. Seminar: International Political Economy — (Enroll in Political Science 241A,B.) Major theoretical approaches emphasizing structural/mercantilism, liberalism, and Marxism. Approaches are applied to a variety of historical and contemporary issues. Includes lectures and class presentations on reading. 241B provides the opportunity to complete a research paper. Class sessions are based on
work being conducted by students and the lec-
turer.  

241A. 5 units, Win (Krasner)  

241B. U.S./Japan Trade Simulation.  
3 units, Spr (Krasner)  

251. Communication and Development—(En-
roll in Communication 251.) A critical review of 
the literature on the causes of underdevelop-
ment, 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 (Snyder)  

267. International Agricultural Policy—(En-
roll in Food Research Institute 267.) The major 
continuing and contemporary problems in 
world agricultural trade with emphasis on the 
economic analysis of such problems and of the 
variety of proposed and possible solutions. The 
implications of the domestic policies of the 
major trading countries on agricultural markets 
in particular as regards staple food products. 
Emphasis given to issues of food security, trade 
liberalization, and international market regula-
tion and to the role of international institutions. 
Prerequisite: Economics 51, 52 or equivalent. 
3 units, Win (Josling)  

INDEPENDENT STUDY  

197. Directed Study in International Rela-
tions*.  
3-5 units, any quarter (Staff)  

198A,B,C. Honors Thesis—Open only to de-
clared International Relations majors with ap-
proved honors thesis proposals.*  
3-5 units, any quarter (Staff)  

STUDIES OVERSEAS  

More detailed descriptions of courses listed 
may be found in the Stanford University Bulle-
tin for Overseas Studies, 1986/87.  

BERLIN  

The Two Germanics—(Enroll in History 131.) 
Cluster A.  
4-5 units, Spr (Rupieper)  

The German Federal Republic in the Interna-
tional System—(Enroll in Political Science 
140X) Cluster A.  
4-5 units, Aut (Gortemaker)  

Europeanism and the Idea of Eternal Peace 
—(Enroll in Political Science 141X.) Culster A. 
3 units, Win (Wolfe)  

FLORENCE  

U.S. and Western Europe After WW-II—(En-
roll in History 135A or Political Science 122X.) 
Cluster A.  
4-5 units, Spr (Mammarella)  

INTERNATIONAL RELATIONS  

OXFORD  

British Economic Policy and European Inte-
gration—(Enroll in Economics 115S.) Cluster 
C  
4-5 units, Spr (Crafts)  

The Rise and Fall of Europe's Overseas Em-
pires, 1415-1980: A Comparative Study—(En-
roll in Political Science 25.) Cluster A. 
5 units, Spr (Abernethy)  

Seminar: Decolonization and After—The Brit-
ish and French Experience 1945-1980—(Enroll 
in Political Science 127X.)  
5 units, Spr (Abernethy)  

The British Empire and Commonwealth— 
(Enroll in Political Science 132X.) Cluster A. 
4-5 units, Aut (Rizvi)  

British Foreign Policy and International Rela-
tions, 1935-1985—(Enroll in Political Science 
138X.) Cluster A. 
4-5 units, Win (Holmes)  

TOURS  

La Politique exterieure de la France—(Enroll 
in Political Science 120X.) Cluster A. 
5 units, Aut, Spr (Billard)  

France and the Third World—(Enroll in Polit-
ical Science 140.) Cluster A. 
5 units, Win (Billard)  

VIENNA  

Austria and Southeast Europe—(Enroll in His-
tory 123.) Cluster A. 
4 units, Spr (Peyfuss)  

Politics in Eastern Europe—(Enroll in Political 
Science 126.) Cluster A. 
5 units, Spr (Triska)  

Introduction to International Law—(Enroll in 
Political Science 130.) Cluster A. 
5 units, Spr (Triska)  

Eastern Europe Since 1945—(Enroll in Polit-
ical Science 130X.) Cluster A. 
4 units, Aut (Bachmaier)  

*(Obtain section number from International Relations 
Office.)
The Language Laboratory program is an academic support service designed to provide faculty and students with a variety of resources outside the classroom which enhance the acquisition of foreign languages. Resources range from foreign language dictionaries to the most sophisticated video immersion and computer programs.

Situated on the first floor of the Meyer Library building, the laboratories comprise three rooms equipped with drill and practice cassette recorders which students may use for intensive classroom preparation, and one multi-media room. Instructional audiotapes and accompanying lab manuals are available in roughly eighty 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 except during intersessions.

*Afrikaans, Amharic, Arabic, Bambara, Bengali, Blackfoot, Bulgarian, Cambodian, Cameroon Pidgin, Cantonese, Catalan, Chinese, Cherokee, Chadic, Cree, Czech, Danish, Dutch, English, Estonian, Finnish, French, Gaelic, German, Greek, Greek, Latin, Lithuanian, Mam, Mandarin, Navajo, Nepali, New Guinea Pidgin, Norwegian, Persian, Polish, Portuguese, Quechua, Quiché, Romanian, Russian, Sanskrit, Serbo-Croatian, Shona, Slovak, Spanish, Swahili, Swedish, Tagalog, Taiwanese, Tamil, Telugu, Thai, Tibetan, Tolowa, Tswana, Turkish, Twi, Tzotzil, Urdu, Vietnamese, Welsh, Xhosa, Yakima, Yiddish, Yoruba, Yucatec, Yurok

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, Stefano Varese
Classics: Gregson Davis
Communication: Steven Chaffee
Economics: Donald Harris, Ronald McKinnon
Education: Martin Carnoy
English: Sandra Drake, John Felstiner, Shirley Heath
Food Research Institute: Bruce Johnston, Reynaldo Martorell, Clark Reynolds
History: Frederick Bowser, Albert Camarillo, Sabine MacCormack, John D. Wirth
School of Law: John Barton, William Gould, Thomas Heller, John Merryman
School of Medicine: Paul Basch, Elois Anna Berlin
Political Science: Richard Fagen, Stephen Krasner, Robert Packenham, Philippe Schmitter
Sociology: William Goode, Alex Inkeles
Spanish and Portuguese: Fernando Alegría, Nestor C. Canclini (Autumn), Heloisa Buarque de Hollanda (Winter), Mary Pratt, Jorge Ruffinelli, Maria Sandoval, Sylvia Wynter, Tomás Ybarra-Frausto

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. Since 1981-82, the Stanford Berkeley Joint Center for Latin American Studies has also provided 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 Latin American Studies 80; Anthropology 104; History 176 and 177; Political Science 113A; Economics 123. (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 toward 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 fifteen 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 grades averaging 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 Latin American Studies 80; Anthropology 104; History 176 and 177; Political Science 113A; Economics 123. (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 grades averaging 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, 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.B. or a B.S. degree, training in at least one of the social sciences, and a working knowledge of Spanish or Portuguese. Applicants must also take the Aptitude Test of the Graduate Record Examination and have the results sent to the Office of Graduate Admissions. Applicants whose native language is not English and who have not studied in an English-speaking institution for at least one and a half years must take the Test of English as a Foreign Language (TOEFL). Deadline for submission of applications for admission and financial aid is January 1. Admission is normally granted beginning in the Autumn Quarter only.

The student's program is worked out in consultation with the Director of the Center and with the faculty of the participating departments, within the framework of the following academic requirements:

1. Ten courses with a minimum of 40 units. At least eight of the ten courses must be basic
ally 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; 5 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 as a full-time student.

JOINT-DUAL DEGREE PROGRAMS

LAS/Law—The Center for Latin American Studies and the Stanford Law School offer a joint program leading to the J. D. degree in Law and the A.M. degree in Latin American Studies. Students must apply to and be independently accepted by both Law and Latin American Studies.

LAS/Education—The degree of Master of Arts in Teaching with an interdisciplinary concentration in Latin American Studies is offered jointly by the Center and the School of Education. For the general requirements, see the section “School of Education” in this bulletin. Candidates must have a teaching credential.

LAS/Medicine—An A.M. degree in Latin American Studies is also offered in conjunction with the M.D. degree program at Stanford. Students accepted by the School of Medicine can then apply to the Center for Latin American Studies for admission into the special joint-degree program.

For additional information regarding Latin American Studies joint degree requirements, inquiry should be made to the center.

Since the University does not offer a Ph.D. in Latin American Studies, students who wish to remain in an academic program at Stanford after completing their A.M. must be accepted by one of the 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 sixty 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 course which surveys 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, Spr (Collier, Wirth) MTWTh 9

107. Latin American Migration to the U.S.—(Same as Anthropology 107.) Lectures and discussions dealing with migration from Mexico, Central America, and the Spanish-speaking Caribbean. Addresses current debates about U.S. policies and procedures by 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 experi-

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ences? 4) What is their relationship to the U.S. society and culture?

3 or 5 units, Spr (Rouse) TTh 10-11:50

112. National State and Ethno-political Indigenous Movements in Latin America—(Same as Anthropology 112.) Examines the indigenous and peasant movements of colonial and contemporary Latin America in relation to political-economic developments, including the rise of capitalism and the formation of nation-states, and with special reference to ethnic consciousness.

5 units, Aut (Varese) MWF 9

137. State and Society in Latin America—The historical evolution of the Latin American social structure in selected cases, and the nature of the state (role incumbents, political regime, institutional characteristics, and policy outputs) in relation to society in Latin America.

5 units, Win (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

169. 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

198. Senior Thesis—Restricted to undergraduate majors.

1-10 units, Aut, Win, Spr (Staff) by arrangement

204. Andean Oral History—(Same as Anthropology 204.) Examines present-day Andeans and their perceptions of their past. Focuses on contemporary "official" history and interpretations by local inhabitants of Bolivia and Peru.

5 units, Win (Millones)

250, 251, 252. Core Seminar in Latin American Studies—Introduction to methodologies and the status of research in the social sciences through examination of an interdisciplinary Latin American research topic. Restricted to A.M. degree students except with permission of instructor.

5 units, Aut (Bowser) M 3:15-5:05

Win, Spr (G. Collier) M 1:15-3:05

256. The Politics and Ethno-Politics of Community Development—(Same as Anthropology 256.) Seminar examining the impact of national development programs on rural communities and of grass-roots movements on development processes, particularly as concerns Latin America.

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

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

LINGUISTICS

Emeritus: (Professor) Joseph H. Greenberg
Chairman: Dorothy A. Huntington
Professors: Joan Bresnan, Clara N. Bush, Eve V. Clark (on leave Spring), Charles A. Ferguson, Shirley Brice Heath, Dorothy A. Huntington, Paul Kiparsky, Will Leben, P. Stanley Peters, Elizabeth C. Traugott, Tom Wasow
Associate Professors: Ivan A. Sag, Terry Winograd
Assistant Professors: William J. Poser, John Rickford
Affiliated Faculty: Jon Barwise, Herbert H. Clark, James A. Fox, Kung-Yi Kao, Mary L. Pratt, Orrin W. Robinson, III, Richard D. Schupbach
Senior Lecturers: Beverley McChesney, Frieda N. Politzer
Acting Assistant Professors: K. P. Mohanan, Peter Sells (Autumn)
Visiting Emeritus Professor: Dwight Bolinger
Visiting Professor: Arnold Zwicky (Winter)
Consulting Professors: Lauri Karttunen, Martin Kay
Consulting Associate Professors: Philip Cohen, Ronald M. Kaplan
Consulting Assistant Professor: Annie Zaenen
English for Foreign Students
Director: Beverley McChesney
Senior Lecturers: Beverley McChesney, Frieda N. Politzer
Lecturers: Michele Fisher, Philip Hubbard
Special Language Program Coordinator: Marya Teutsch-Dwyer
Lecturer in Arabic: Khalil Barhoum
Lecturer in African Languages: Lioba Moshi
Lecturer in Hebrew: Aliza Kreisel

OFFERINGS AND FACILITIES

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...
unique in languages, what universal; how people learn language; how they use it; and how it changes. Linguistics is therefore one of the cognitive sciences; it provides a link between the humanities and social sciences, and also with education and hearing and speech sciences.

The department offers courses at the undergraduate and graduate levels in the areas central to linguistic theory and analysis: phonetics, phonology, morphology, syntax, semantics, pragmatics, and language change. It also offers particularly strong areas of specialization in language acquisition, theoretical (including computational) linguistics, sociolinguistics, and philosophy of language.

A variety of open forums are provided for the discussion of linguistic issues, including the linguistics colloquium, and weekly 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.

1. Courses-A total of 45 units is required, including 120L, 130L, and 110L (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 110L, 115L, and 116L. Designated courses in Psychology
and Hearing and Speech Sciences 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 an average of B+ or better in the courses required for the major.

Honors students will take a total of 55 units. These will include 120L, 130L, and 110L, 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 Linguistics 98L, 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 (refer to 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 120L, 130L and 110L (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 grade point average 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., 40 units exclusive of dissertation units. This includes:

a) In the first year, a sequence in phonetics, phonology and morphology (205L, 206L, 207L), a sequence in syntax, semantics and pragmatics (220L, 221L, 230L), and a sequence in language acquisition, sociolinguistics, and language change (240L, 250L, 260L).

b) A three-course sequence in theoretical issues (200L ABC), and two other three-course sequences, one of which will normally be a sequence in either phonology (208L, 209L, 210L) or syntax (222L, 223L, 224L). As many of these courses as possible should be taken in the second year, with the remainder taken in the third.

c) One course in methods (one of 285L, 286L, 287L, 288L).

Candidates must achieve a grade of B or better in each of these courses.

3. Research—Completion of two substantial research papers during the second year, one
to be turned in by the end of Winter Quarter, the other by the end of May. Their subject matter must be clearly distinct though they may be related. Fulfilled by Linguistics 395A,B, Research Workshop (2 units in Winter, 2 units in Spring), and evaluation by a committee of three faculty members, one selected by the student, the others by the faculty.

4. **Teaching**—At least two quarters serving as Teaching Assistant in a Linguistics course.

5. **Colloquia**—Two oral presentations exclusive of the oral presentation of the dissertation proposal (see 6b below). This requirement is satisfied by class presentations, conference papers, or talks in the Linguistics Colloquium. Both should normally be given during the first three years of study.

6. **Dissertation**—
   a) A written dissertation proposal.
   b) Oral presentation of the dissertation proposal in the Linguistics Colloquium.
   c) Approval of dissertation topic and appointment of a dissertation committee by the Chairman.
   d) Successful passing of a University oral examination on the dissertation project and related areas.
   e) Dissertation (up to 15 units of 399).

**Ph.D. MINOR IN LINGUISTICS**

1. **Courses**—Candidates must complete 30 units of course work in Linguistics at the 100L level or above, including 120L, 130L, and 110L (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.

**GRADUATE PROGRAMS**

**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, 15 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

**II. Introduction to Linguistics**—A general introduction to the nature of human language and the methods of modern linguistics. Topics include: principles of the structure of human
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AND SCIENCES

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 (Clark, Sag)

4. Language and Culture—(Same as Anthropology 4.) Lecture course on the ethnography of communication and theories of language and culture. Intensive analysis of linguistic repertoire, rules of use, ethnosemantics, and linguistic history of a single speech community. Comparison with other speech communities throughout the world.

5 units, Win (Fox)

5. Biology and Evolution of Language—(Same as Anthropology 5, Human Biology 113.) Lecture on the biology, function, and evolution of the organs of speech and the brain. Topics include: 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.

alternate years, given 1987-88

25L. Mathematics for the Study of Language — Introduction to mathematical methods and results relevant to the analysis of natural language syntax and semantics. Topics include elementary logic, set theory, and the Chomsky hierarchy of grammars. (DR:6)

4 units, Win (Wasow)

35L. 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 (Winograd) MWF 10

45L. Introduction to Language and Speech Disorders—Introductory survey of disorders of human communication. Major congenital and acquired pathologies (e.g. deafness, aphasia, articulatory deficits, vocal malfunctions), their physiological bases and remediation.

3 units, Aut (Huntington)


4 units, Spr (Ferguson)

70L. 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 some of 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)

5 units, Spr (Heath)

73L. Black English—Survey of the features of the English vernacular spoken by Black Americans, especially in big city settings, and its relation to the creole English dialects spoken on the south Carolina Sea Islands ("Gullah"), in the Caribbean, and West Africa. The expressive uses of Black English (e.g., in soundin', and rappin'), and its educational implications are explored. (DR:4)

4 units, Spr (Rickford)

75L. Introduction to the Germanic Languages—(Same as German Studies 19A/119.) Survey of the oldest attested stages of the Germanic language family, including Gothic, Old Norse, Old Saxon, Old English, Old High German, Old Dutch, Old Frisian. Presentation both of external history and internal relationships. (DR:4)

alternate years, given 1987-88

SSL. Introduction to Methods of Teaching English as a Foreign Language—A practical approach to problems of teaching English to speakers of other languages, including a survey of those features of English phonology, morphology, and syntax which present particular difficulties, presentation of problems, construction of exercises and lesson planning. For the duration of the course, each student is required to serve as a tutor to an individual who is learning to speak English.

3 units, Win (McChesney)

86L. Practicum in TEFL—Workshop for volunteer teachers currently active in area TEFL programs or planning to teach English abroad.
Includes demonstration teaching, discussion of teaching problems, and evaluation of classes observed. Prerequisite: 85 or equivalent.

2-3 units, Spr (McChesney)

98A,B. Honors Research.
2 units, Aut (Staff)
4 units, Win (Staff)

99L. Independent Study.
1 or more units, any quarter (Staff) by arrangement

110L. 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. Designed for students desiring a broad background in the field.
4 units, Aut (Mohanan)

115L. Speech Perception—(Same as Hearing and Speech Sciences 231.) Perceptual and physiological correlates of the acoustic constituents of speech. Prerequisite: Course in phonetics, 110L or consent of instructor.
3 units, Win (Huntington)

116L. Physiology of Speech Production—(Same as Hearing and Speech Sciences 230.) Study of the structure of the speech mechanism and its function. Includes laryngeal control in the production of segmented and prosodic features of speech as well as articulatory coordinations and control. Prerequisite: Course in phonetics or consent of instructor.
4 units, Spr (Huntington)

120L. Introduction to Syntax—Introduction to syntactic theory. Analyses of various grammatical constructions, primarily in English, and their consequences for a general theory of language. Practical experience in forming and testing linguistic hypotheses, reading and constructing rules.
4 units, Spr (Wasow)

130L. 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)

135L. Basic Concepts of Mathematical Logic—(Enroll in Philosophy 159.) Introduction to the basic concepts and techniques used in mathematical logic: sets, functions, structures, formalization, proof, mathematical induction, enumerability and effectiveness.
4 units, Win (Echemendy)

136L. First-order Logic—(Enroll in Philosophy 160A.) The syntax and semantics of sentential and first-order logic, with an introduction to the basic concepts of model theory. Gödel's Completeness Theorem and its consequences (such as the Löwenheim-Skolem Theorem and the Compactness Theorem) are discussed and applied. Prerequisite: Philosophy 57 and basic knowledge of set theory for students with no mathematics or computer science background.
4 units, Win (Echemendy)

138L. Meaning and Experience—(Enroll in Philosophy 183/283.) Study of the interrelationships between meaning and experience, with particular emphasis on 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, Sum (Follesdal)

145L. Language and Thought—(Same as Psychology 146.) Survey of 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. Consideration of language functions in natural contexts and their relation to the processes by which language is produced, understood, and acquired.
4 units, Aut (H. Clark) MWF 1:15

150L. 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)

160L. Languages in Contact—Study of the different kinds of situations in which two or more languages remain in or come into contact, and the sociolinguistic effects of such contact. Topics include borrowing and linguistics interference, language convergence and divergence, multilingualism, pidginization, decreolization, interlanguage and other continua, social and psychological dimensions of language contact.
4 units, Win (Rickford)

175L. Linguistics and the Analysis of German—(Same as German Studies 212/312.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.
alternate years, given 1987-88
176L. Introduction to German Dialects—
(Same as German Studies 118/218.) Introduction to the major dialects of German-speaking Europe through texts, tapes, lectures and presentations by native speakers; also a general introduction to the field of dialect geography.

4 units, Spr (Robinson)

203L. Topics in the Philosophy of Linguistics
—(Same as Philosophy 264.) Seminar on the goals and methods of theoretical linguistics, addressing the relationship between theory and data in linguistics, the "psychological reality" of linguistic analyses, and Katz's "platonism". Readings are drawn from both the linguistic and philosophical literatures. Prerequisite: Graduate standing in Linguistics or Philosophy, or consent of instructor.

3 units, Aut (Wasow) T 10-12

205L. Phonetics—Introduction to phonetics with emphasis on aspects of more general scientific interest and its relationship to phonology. Anatomy and physiology of the articulatory apparatus, survey of human speech sounds including practice in transcription and discussion of feature systems, acoustic properties of speech sounds, speech perception, relationship between phonology and phonetics.

4 units, Aut (Poser)

206L. Phonology—Survey of the types of phenomena that occur in phonological systems; the phonology of English, supplemented with examples from other languages. Examination of the types of theoretical devices used for describing regularities involving the distribution of phonemes, the distribution of phones, and phonological alternations.

4 units, Win (Leben)


4 units, Spr (Kiparsky)

208L. Issues in Phonological Theory I—Issues in phonological theory and their resolution in a 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, Aut (Leben)


4 units, Win (Kiparsky, Mohanan)

210L. Phonological Representation—Systematic construction of a coherent theory of phonological representation, covering segmentation, distinctive feature theory, autosegmental representation, and syllable and foot structure. Emphasis on the dual role of phonological representation as support for phonological rules and input to phonetic interpretation. Attention to formalization, semantics of representations, and partition between theory of rules and theory of representations.

4 units, Win (Poser)

211L. German Morphology from a Typological Point of View—(Same as German Studies 214.) The aspects of German inflectional and derivational morphology studies within the context of a theory of natural morphology.

3-5 units, Win (Dressier)

212L. Metrics—Accent, quantity, intonation, phonological phrasing. The theory of metrical verse: current issues and approaches. Analysis of metrical systems in English and some other languages.

4 units, Aut (Kiparsky)

213L. Sociolinguistics of German in Austria—
(Same as Linguistics 213L.) Sociolinguistic variation from dialects to Standard German on the levels of phonetics, phonology, morphology, syntax, lexicon, text/discourse, both in oral and written styles, including literary styles.

3-5 units, Win (Dressier)

215L. 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.

2-4 units, Win (Huntington, Poser)

216L. Experimental Phonetics—In-depth coverage of the motor, acoustic, and perceptual correlates of speech. Material will vary, hence may be repeated any quarter for credit. Prerequisite: Graduate standing and consent of instructor.

alternate years, given 1987-88

220L. Syntactic Theory I—Intensive introduction to syntactic argumentation through detail-
ed analysis of data from English and other languages. Development of an explicit theory of grammar and treatment of major issues in syntactic theory, including constituent structure, grammatical functions, lexical structure, complementation, and long distance dependencies. Theory to be discussed 1985-86: Lexical Functional Grammar.

4 units, Aut (Bresnan)

221L. Syntactic Theory II—Integration of unification-based approach to the syntactic and semantic analysis of human language. Topics include syntactic subcategorization, semantic role assignment, lexical rules and unbounded dependencies. Development of an explicit fragment of English syntax and semantics with emphasis on cross-linguistic variation. Theory for 1986-87: Head-Driven Phrase Structure Grammar. Prerequisite: 220L or permission of instructors.

4 units, Win (Sag, Pollard)

222L. Issues in Syntactic Theory—Exploration of central issues in syntactic theory, including anaphora and island constraints. Reading of primary sources from several different perspectives, including transformational grammar, government and binding theory, and relational grammar.

4 units, Aut (Sells)

223L. Universal Grammar — In depth investigation of topics in universal grammar, drawing on data from a variety of languages. Choice of particular issues and languages may vary from year to year. Prerequisite: 222L.

4 units, Win (Bresnan)

224L. Advanced Syntactic Theory—Detailed study of selected constructions across several languages and their implications for syntactic theory. Choice of constructions and languages may vary from year to year. Prerequisite: 222L.

4 units, Spr (Sag)

225L. Morphosyntax—Role of morphology in grammar: how word structure serves syntax in the expression of meaning. Universal properties and typology of morphological categories; proposals towards their principled explanation in a restrictive theory of language. alternate years, given 1987-88

227L. Computational Models of Syntax of Natural Language—Introduction to formal systems and computer implementations for syntax. Survey of relevant material from linguistics and formal language theory. Review and discussion of past and current parsing systems. Overview of relevant aspects of the syntax of English.

4 units, Win (Winograd)

230L. Semantics and Pragmatics—(Continuation of 221L.) Fundamental issues in the semantic and pragmatic analysis of human language with attention to their incorporation into the fragment of English grammar developed in 221L. Topics include speech acts, conversational implicature, binding phenomena (quantifiers, unbounded dependency constructions, pronouns and reflexives), discourse representation theory and pragmatic inference. Prerequisite: 221L.

4 units, Spr (Peters)

231L A,B. Semantics and the Logic of Natural Languages—(Same as Philosophy 265A,B.) Two quarter sequence treating 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, Spr, Win (Barwise, Peters)

235L. Computational Models for Semantics of Natural Language—(Same as Computer Science 276.) Conceptual overview of problems of meaning. Formalisms from logic, computation theory, psychology and linguistics, relevant to computer systems for natural language. Survey and critical discussion of current research on computational approaches to natural language.

4 units, Win (Winograd) MWF 10


3-4 units, Spr (Staff)

237L. Phenomenological Foundations of Cognition, Language, and Computation—(Same as Computer Science 378, VTSS 178.) Critical analysis of theoretical foundations of the 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, Aut (Winograd) MWF 10

240L. Language Acquisition I—(Same as Psychology 240.) Review of present knowledge of processes of language acquisition from a linguistic point of view. Survey of recent and past literature.

4 units, Aut (Clark) MW 2:15-3:30
245L. Language and Speech Disorders—Directed reading on selected congenital and acquired pathologies (e.g. deafness, aphasia) which underlie language deficits. Given any quarter. May be repeated for credit. Prerequisite: 45 or consent of instructor.

alternate years, given 1987-88

246L. Psycholinguistics—(Same as Psychology 214.) Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) TTh 1:15-2:20

248L. Topics in Language Acquisitions: Acquisition of Morphology and Syntax—(Same as Psychology 251.) Forms and uses of noun modification, compounding, adjectival phrases, prepositional phrases, and relative clauses. Prerequisite: Consent of instructor.

4 units, Win (Clark) by arrangement

250L. 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, Spr (Rickford)

251L. Sociolinguistics andPidgin/Creole Studies—Seminar intended for graduate students and advanced undergraduates, explores the semi-symbiotic relationships between sociolinguistics (both theoretical and applied) and pidgin-creole studies which have emerged in past and recent work, and the prospects for enhancing that relationship in the future.

4 units, Spr (Rickford)

255L. 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 1987-88

257L. Sociolinguistics of German in Austria—(Same as German Studies 213.) Sociolinguistics variation from dialects to Standard German on the levels of phonetics, phonology, morphology, syntax, lexicon, text/discourse, both in oral and written styles, including literary styles.

3-5 units, Win (Dressler)

258L. Topics in Sociolinguistics—Politeness as a framework for sociolinguistics analysis; using the Brown and Levinson model as a starting point, the phenomena of directives, forms of address, and formulaic exchanges explored cross-linguistically. May be repeated for credit.

4 units, Spr (Ferguson)

260. Language Change—The nature of linguistic change in phonology, morphology, syntax, and semantics; problems of internal and comparative reconstruction, the role of language acquisition, sociolinguistics, and other factors in the explanation of diachronic processes.

4 units, Spr (Kiparsky)

274L. Structure of Malayalam—Exploration of aspects of the phonology, morphology, and syntax of Malayalam. Previous knowledge of Malayalam not required.

4 units, Win (Mohanan)

278L. The Structure of Modern Chinese—(Same as Asian Languages 291.) Prerequisite: Asian Languages 23 or equivalent. Recommended: a general introductory course in linguistics.

alternate years, given 1987-88

287L. 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 (Mohanan)

288L. Research Methods in Phonetics—Treatment of experimental design, statistics, exploratory data analysis; presentation of results, and pitfalls in obtaining and analyzing instrumental data. Includes critical reading of published research for methodological soundness and exercises in analysis of data and presentation of results. Prerequisite: 205.

4 units, Spr (Poser)

289L. 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) MW

395L. A.B. Research Workshop—Student presentations of research toward qualifying
papers. Designed for second year students in the doctoral program.

2 units, Win (Bresnan)
2 units, Spr (Wasow)

396. Directed Teaching.
1-5 units, any quarter (Staff)
by arrangement

397. Directed Reading.
1-5 units, any quarter (Staff)
by arrangement

398. Directed Research—Research at predis-
sertation level.
1-6 units, any quarter (Staff)
by arrangement

399. Dissertation Research.
1-15 units, any quarter (Staff)
by arrangement

REGULARLY OFFERED
BUT NOT DURING 1986-87

51. Language Minorities in Modern Nations.
55. Language and Culture.
60. Language, Past and Present.
72. Linguistic Approaches to Point of View in Fiction.
80. Indigenous Languages of North and South America.
100. Typology and Universals of Language.
151. Pidgins and Creoles.
155. Multilingualism.
218. Topics in Phonetics.
219. Topics in Phonology, Morphology.
228. Topics in Syntactic Theory.
238. Topics in Semantics, Pragmatics.
239. Topics in Computational Linguistics.
241. Language Acquisition II.
247. Psycholinguistic Theories of Parsing.
249. Topics in Psycholinguistics.
253. Language Planning and Public Policy.
254. Literacy: Social and Historical Perspec-
tives.
259. Topics in Multilingualism.
261. Phonological and Morphological Change.
262. Syntactic Change.
263. Semantic Change.
265. 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.

SPECIAL LANGUAGE PROGRAM
(620-679)

The Special Language Program offers a num-er of foreign languages not otherwise taught at Stanford. Courses planned for 1986-87, given sufficient enrollment, are:

620A,B,C. Beginning Arabic — Successful completion of 620C may fulfill the foreign lan-
guage 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 (Kreisel)


4 units, Aut, Win, Spr (Kreisel)

630A,B,C. Advanced Hebrew.

4 units, Aut, Win, Spr (Kreisel)

640A,B,C. Beginning Danish.

3 units, Aut, Win, Spr (Staff)

642A,B,C. Beginning Norwegian.

3 units, Aut, Win, Spr (Staff)

644A,B,C. Beginning Swedish.

3 units, Aut, Win, Spr (Staff)

652A,B,C. Beginning Hindi.

3 units, Aut, Win, Spr (Staff)

656A,B,C. Beginning Indonesian.

3 units, Win, Spr (Staff)

662A,B,C. Beginning Thai.

3 units, Aut, Win, Spr (Staff)

664A,B,C. Beginning Czech.

3 units, Aut, Win, Spr (Henzl)


3 units, Aut, Win, Spr (Henzl)

666A,B,C. Beginning Polish.

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)

674A,B,C. Beginning Irish.

3 units, Aut, Win, Spr (Staff)

678A,B,C. Beginning Sign (ASL).

3 units, Aut, Win, Spr (Haas)


3 units, Aut, Win, Spr (Haas)

All beginning level 3 unit courses are offered on a Pass/No Credit basis only. “Beginning and Intermediate” each refer to an academic year’s sequence of language study; the suffixes A, B, and C refer to 1st, 2nd, and 3rd quarter of language instruction that year.

These and other languages will be offered only on request. Requests must be made by the end of Autumn Quarter registration period at the Special Language Program office 380-381A. The course offerings for the entire year are decided immediately following Autumn 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; grading in all beginning level 3 unit courses is on a Pass/No Credit basis only. 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:

632A,B,C. Beginning Armenian (Computer-Assisted).

638A,B,C. Beginning Nepali.

646A,B,C. Beginning Quechua.

648A,B,C. Beginning Cantonese.

650A,B,C. Beginning Navaho.

654A,B,C. Beginning Tagalog.

658A,B,C. Beginning Korean.

660A,B,C. Beginning Taiwanese.

672A,B,C. Beginning Hungarian.

ENGLISH AS A FOREIGN LANGUAGE (685-699)

The courses below represent the basic offerings in English as a Foreign Language. Each quarter, additional sections of these courses are scheduled as needed. Those students who are required to take 697 should normally expect to 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.

A 9-week program in Intensive English and Academic Orientation for Foreign Graduate Students is also offered in the summer. This program is open to qualified graduate students who have been admitted to degree programs at other United States institutions as well as those who have been admitted to Stanford for the following Autumn Quarter. 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, Spr (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 and present papers in English. Focus on developing clarity, intelligibility, and effectiveness in oral presentations. With collaboration of Center for Teaching and Learning, various methods of feedback will be utilized (e.g., audio, video, peer and staff evaluations). Techniques of self-criticism encouraged.
1 unit, Aut, Win, Spr (McChesney, Fisher) 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 academic orientation, general vocabulary, reading comprehension, or pronunciation, to be determined each quarter according to enrollment.
3 units, Aut, Win, Spr (Staff) by arrangement

697. Written English I — Intermediate work in expository writing with special attention to correct grammatical usage. Prerequisite: Consent of instructor.
3 units, Aut, Win (Staff) by arrangement

698A. Written English II — For students with some facility in written English. Emphasis on fluency, idiomatic usage, and style. Special attention given to mechanics and form appropriate to academic papers. May be repeated for credit. Prerequisite: Consent of instructor.
3 units, Aut, Win, Spr (Staff) by arrangement

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 or major research reports, 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
131. Chinese Poetry and Drama in Translation.
133. Modern Chinese Literature in Translation.
137. Classics of Japanese Literature in Translation II.

CLASSICS
11. Age of Heroes.
172. Classical Influences in Modern Literature.

FRENCH AND ITALIAN
114B. Modern French Novel.
250/350. The Italian Renaissance.
281/381. Novels into Film.
335. Dante's Divine Comedy: Inferno.
336. Dante’s Divine Comedy: Purgatorio.
337. Dante’s Divine Comedy: Paradiso.
345. Petrarch and Petrarchism.

GERMAN STUDIES
31A, 32A, 33A. German Culture and Civilization I-II.
35A. Images of Women in German Film.
60A. An Introduction to the Medieval Literature of England, France, Germany, and Scandinavia (500-1300).
171A. Austrian Literature of the Fin de Siecle.
276A. European Novel IV: The Realists.
284A/384A. Joyce, Proust, Mann.
291A. Literature of Decadence.
390A. The Modern Tradition.

HUMANITIES SPECIAL PROGRAMS
301. The Greek Period.
302. The Roman Periods.
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 Translation I.
146. Survey of Russian Literature in Translation II.
147. Survey of Russian Literature in Translation III.
151. Fyodor Dostoevsky.

SPANISH AND PORTUGUESE
123A. Spanish American Literature in Translation.
145. The Spanish Republic, the Civil War and the Aftermath.

MATHEMATICAL AND COMPUTATIONAL SCIENCE

Committee in Charge: Bradley Efron, Chairman (Statistics); Ernst W. Mayr, Associate Chairman (Computer Science); Paul W. Berg (Mathematics), Richard W. Cottle (Operations Research), William J. Clancey (Computer Science), Gene H. Golub (Computer Science), John G. Herriot (Computer Science), Joseph B. Keller (Mathematics), Robert Osserman (Mathematics), Mary V. Sunseri (Mathematics)

Ex-officio Members: Takeshi Amemiya (Economics), Thomas M. Cover (Electrical Engineering and Statistics), John T. Gill III (Electrical Engineering), J. Michael Harrison (Graduate School of Business), David R. Rogosa (Education)

STATEMENT OF PURPOSE
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 77 to 81 units, distributed as follows:

1. Mathematics (33 units): Calculus and Analytic Geometry through Mathematics 44, or equivalent; Matrix Theory and Applications (103) and (104) or Linear Algebra and Matrix Theory (113) and (114); Modern Algebra and
Applications (109) or Modern Algebra (120); Fundamental Concepts of Analysis (115); Differential Equations (130).

2. Computer Science (11-18 units): (1) Introduction to Software Engineering (106A,B) and Introduction to Computer Organization, Machine, and Assembly Languages (111); or Introduction to Software Engineering—Accelerated (106X) and (111); or Fundamentals of Computer Science 108A,B,C.
   (2) One of the following: Fundamentals of Artificial Intelligence (223A); Numerical Analysis 237A; Automata, Languages, and Computability (254); Logical Basis for Computer Programming (257A); Concrete Mathematics (260); Introduction to Data Structures and Algorithms (261); Introduction to Combinatorial Theory (264).

3. Operations Research (7-9 units): Introduction to Operations Research (151,153); or Linear Programming (240) and Models in Operations Research (250,251).

4. Statistics (9 units): Theory of Probability (116); and Introduction to Statistical Inference (200); or Data Analysis I (201A).

5. Electives (12 units): Four courses in mathematical and computational science, 200-level (100-level for mathematics) or above and at least 3 units each. Two must be chosen from the following: Mathematics 101; Computer Science 237A; Computer Science 260; (or Computer Science 264 or Operations Research 245); Statistics 217. The choice of electives will be determined by the student's interest. In particular, students planning doctoral study in Operations Research or in Numerical Analysis (Computer Science) are advised to take Mathematics 116.

   All courses used to fulfill the major requirement must be taken for a letter grade, with the exception of courses offered Pass/No Credit only. The student must have an average grade of "C" or better in all course work used to fulfill the major requirement. Majors must file a plan with their advisors for completing their degree requirements at least three quarters before their graduation.

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. An average letter grade equivalent in mathematical sciences courses of at least 3.4.
2. Completion of at least 15 units in mathematical sciences in addition to the requirements for the 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.

MATHMATICS

Emeriti: (Professors) Harold M. Bacon, Georg Kreisel, Jim McGregor, Ralph Phillips, Hans Samelson, Menahem Schiffer, Mary Sunseri
Chairman: Solomon Feferman

Associate Professors: Ralph Cohen, Steven Kerckhoff, Peter Sarnak, Brian White
Assistant Professors: Alejandro Adem, Daniel Bump, Walter Craig, Russell Lyons, Rafe Mazzeo, Brad Osgood, Jacob Rubenstein, Philip Scowcroft, Peter Sternberg

OFFERINGS AND FACILITIES

The Department of Mathematics offers programs leading to the degrees Bachelor of Science, Master of Science, and Doctor of Philosophy in Mathematics, and participates in the program leading to the degree B.S. in Mathematical 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
this purpose. The department does not give its own Advanced Placement examination. For referral to an advisor on advanced placement, communicate with the Academic Secretary of the department.

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, 101, 106, 115, 130, 131, 132, 134A,B, 171, 173 and 175; geometry—any of the courses numbered in the 140’s; foundations—160A,B, 161, 162. Notice that the 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 at least a C average in all courses used to fulfill the major requirement. Letter grades are required in all courses used to fulfill the major requirement, except for those offered Pass/No Credit only and for cognate courses (see 4, below).

Students planning graduate study in mathematics are advised to include one or more 200 level courses in their programs and, to facilitate this, to complete 113, 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 45H, or equivalently, Math 44, 101, 113, and 130. Beyond this level, fourteen three-unit Math courses are required, as well as the successful completion of a senior thesis. Of these fourteen courses, the following are required: 171, 173, 134A, 134B, 106, 114, and 120. 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 to begin in the Autumn Quarter of the senior year, 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:

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<thead>
<tr>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Freshman year:</td>
<td>Freshman year:</td>
<td>Freshman year:</td>
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<tr>
<td>43H</td>
<td>44H</td>
<td>45H</td>
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<td>Sophomore year:</td>
<td>Sophomore year:</td>
<td>Sophomore year:</td>
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<td>120</td>
<td>114</td>
<td>155 or 157</td>
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<tr>
<td>171</td>
<td>134A</td>
<td>or 173 and 134B</td>
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<td>Junior year:</td>
<td>Junior year:</td>
<td>Junior year:</td>
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<tr>
<td>106</td>
<td>140's</td>
<td>123, 173, 205, or 140'S, 123, or 160</td>
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<tr>
<td>140's</td>
<td>140'S, 123, 173, 205, or 140'S, 123, or 160</td>
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<tr>
<td>Senior year:</td>
<td>Senior year:</td>
<td>Senior year:</td>
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<tr>
<td>2-4 elective courses and the senior thesis</td>
<td>2-4 elective courses and the senior thesis</td>
<td>2-4 elective courses and the 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 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 a B average over all course work taken in Mathematics, and a B average in the 200 level courses considered separately.

For the degree of Master of Science in Computer Science, see Computer Science Department material in this bulletin.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the School of Education section of this bulletin or address inquiry to the Credential Secretary, School of Education.

MASTER OF ARTS IN TEACHING (MATHEMATICS)

In cooperation with the School of Education, the department offers a program leading to a degree, Master of Arts in Teaching (Mathematics). This degree is intended for candidates who have a teaching credential or relevant teaching experience and wish further to strengthen their academic preparation. Detailed requirements are outlined in this bulletin under “School of Education, Master of Arts in Teaching.”

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 grade 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 material in this bulletin.

For further information concerning degree programs, requirements for a Ph.D. minor in Mathematics, fellowships, and assistantships, inquire of the Academic Secretary of the department.
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 are the same as for 41. (DR:6)

3 units, Aut (Staff) MWF 8, 9, 10, 11 and 1:15
Win (Staff) MWF 8, 9, 10, and 11


3 units, Win (Staff) MWF 8, 9, 10, 11 and 1:15
Spr (Staff) MWF 8, 9, and 10


3 units, Aut (Staff) MWF 8 and 2:15
Spr (Staff) MWF 8, 9, 10, 11 and 1:15

41, 42, 43—(Autumn, Winter, Spring respectively) consists of three large lecture classes per week together with two classes in small sections. The sections allow options for emphasis in particular directions, including physics/engineering, computer science, and economics.

41. Calculus and Analytic Geometry—An introduction to differential and integral calculus. Principal topics are limits, derivatives of polynomials, algebraic functions, and trigonometric functions, curve sketching, mean value theorem, maxima and minima, indefinite and definite integrals, geometric and physical interpretations and applications. Prerequisite: Algebra and trigonometry. (DR:6)

5 units, Aut (Osgood) MTWThF 11, 1:15

42. Calculus and Analytic Geometry—Continuation of 41. Logarithms, exponential functions, hyperbolic functions, techniques of integration, analytic geometry: conic sections, polar coordinates, introduction to vectors. Prerequisite: 41 or equivalent. (DR:6)

5 units, Aut (Staff) MTWThF 10 and 1:15
Win (Staff) MTWThF 11 and 1:15

43. Calculus and Analytic Geometry—Continuation of 42. Vector functions, functions of several variables, partial derivatives, gradient, Lagrange multipliers, double and triple integrals. Prerequisite: 42 or consent of department. (DR:6)

5 units, Aut (Staff) MTWThF 8, 10 and 1:15
Win (Staff) MTWThF 10 and 1:15
Spr (Staff) MTWThF 11 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, as well as possible additional topics from advanced calculus and ordinary or partial differential equations. Mathematics 43H, 44H, and 45H are designed 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 that of 43 and greater attention is paid to justification and more thorough understanding of techniques. Topics covered in 43H include those listed under 43 above, as well as 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 (Kerckhoff) MTWThF 2:15-3:15

44. Calculus—Continuation of 43. Principal topics included are: Taylor’s theorem, infinite series, complex numbers and functions, and ordinary differential equations. Prerequisite: 43 or equivalent.

3 units, Aut (Staff) MWF 10, and 1:15
TTh 11-12:15
Win (Staff) MWF 10 and 1:15
TTh 11-12:15
Spr (Staff) MWF 11
TTh 11-12:15
44H. Honors Calculus—Continuation of 43H. Elements of linear algebra and ordinary differential equations. Topics are the same as those covered in 113 and 130. Prerequisite: 43H or consent of instructor. (DR:6)
5 units, Win (Kerckhoff) MTWTh 2:15-3:15

45H. Honors Advanced Calculus—Continuation of 44H. Topics from differentiation and integration of integrals depending on a parameter, change of coordinates in multiple integrals and the implicit function theorem, vector analysis and the theorems of G Stokes, stability of solutions of differential equations and phase plane analysis, introduction to partial differential equations. (DR:6)
5 units, Spr (White) MTWTh 2:15-3:15

51, 52, 53. The Nature of Technology, Mathematics and Sciences—(Enroll in VTSS 51, 52, 53.) Integrated three-quarter sequence that enhances 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 include sources of problems, nature of invention and discovery, experiment vs. theory, societal concerns. No partial credit allowed, whole sequence must be taken. (DR:6, 7, and 8 when entire sequence taken.)
3 units, each quarter, Aut, Win, Spr (Adams, Fetter, Osserman)

101. Advanced Calculus—Topics include: 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. 113 or 113S or equivalent strongly recommended.
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 with emphasis on computational and algorithmic aspects together with a consideration of the scientific problems in which linear algebra is applied. Solution of linear equations. Linear spaces and matrices. Orthogonal projection and least squares. Introduction to eigenvalues and eigenvectors.
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)

3 units, Win (Rubenstein) 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, Win (Hawley) MWF 10
Spr (Sternberg) MWF 9

109. Modern Algebra and its Applications—(Formerly 120S.) The same content 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 (Berg) MWF 10

113. Linear Algebra and Matrix Theory—The study of the algebraic properties of matrices and their interpretation in geometric terms. The relationship between the algebraic and geometric points of view and matters that are fundamental to the study and solution of linear equations. Topics include linear equations, vector spaces, linear dependence, bases and coordinate systems; linear transformations and matrices; similarity; eigenvectors and eigenvalues; diagonal and Jordan forms. (DR:6)
3 units, Aut (Milgram) MWF 10
Win (Simon) MWF 11

114. Linear Algebra and Matrix Theory—(Continuation of 113.) A deeper study of certain topics indicated above 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 (Adem) MWF 9
Spr (Scowcroft) MWF 11
115. **Fundamental Concepts of Analysis**—Development of real analysis in Euclidean space: sequences and series, limits, continuous functions, derivatives. Basic point set topology. Honors math majors and students who intend to do graduate work in Mathematics should take 117. Prerequisite: 44.

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 (R. Cohen) MWF 1:15

123. **Theory of Probability**—Introduction to the theory of probability and some of its applications. Basic concepts of probability, random variables and their distribution functions are treated in the modern manner. Detailed classical limit theorems for sequences of independent random variables. Prerequisite: 44.  
alternate years, 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. A wide range of applications are discussed relevant to the natural, biological, social and managerial sciences.  
alternate years, given 1987-88

126. **Mathematical Models in Population Biology**—(Same as 226.) For advanced undergraduates and beginning graduate students in biology and mathematics. Topics include the elements of population genetics and ecology, models of the evolution of behavioral traits (e.g., 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) MWF 1:15

130. **Ordinary Differential Equations**—Special equations, exact equations, linear equations; series solutions, numerical solution; Laplace transform; systems of equations. Prerequisite: 44, concurrent registration in 44, or consent of instructor.

3 units, Aut (Staff) MWF 9 and 10  
Win (Staff) MWF 10 and 1:15  
Spr (Staff) MWF 1:15, TTH 11-12:15  
Sum (Staff)

131. **Partial Differential Equations I**—First order equations, classification of second order equations. Initial-boundary value problems for heat equation, wave equation, and related equations. Separation of variables, eigenvalue problems, Fourier series, existence and uniqueness questions. Prerequisite: 130 or equivalent.

3 units, Win (Staff) MWF 10 and 2:15  
Spr (Staff) MWF 1:15


3 units, Spr (Craig) MWF 10

134A,B. **Honors Analysis**—A coherent, mathematically sophisticated presentation of some basic areas in classical real analysis. Primarily for students planning graduate work in Mathematics or Physics who would normally enroll in an honors sequence. Required of honors math majors, but of use and interest to other majors at ease with rigorous proofs and qualitative discussion. Emphasis on ordinary and partial differential equations. Prerequisite: 45H, or 113 and 130, and 171 or consent of instructor.

3 units, Win (P. Cohen)

135. **Perturbation Methods in Mathematics and Physics**—An introductory account of the analysis intent on securing quantitative results for problems which, though lacking exact solutions, are correlated with others that admit complete resolution. Applications to eigenfunction/eigenvalue problems in irregularly shaped domains, diffusion/wave problems in nonhomogeneous settings and non-linear differential equations. Prerequisite: 131 or equivalent.

3 units, Win (Levine)

141. **Higher Geometries**—A study of various geometries, including projective, affine, and non-euclidean geometry. Prerequisite: 113.  
alternate years, given 1987-88

143. **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 (Mazzeo) MWF 11

144. **Topics in Geometry.**  
alternate years, given 1987-88

145. **Algebraic Geometry**—Affine and projective spaces, plane curves, Bezout's theorem, singularities and genus of a plane curve, applications of commutative algebra to geometry. Prerequisite: 157.  
alternate years, given 1987-88

147. **Differential Topology**—(Replaces 159.) Smooth manifolds, transversality, Sard's theorem, embeddings, degree of a map, Borsuk-Ulam theorem, Hopf degree theorem, Jordan Curve Theorem. Prerequisite: 115 or 171.

3 units, Spr (Staff)
148. **Algebraic Topology** — Fundamental group, covering spaces, Euler characteristic, classification of surfaces, knots. Prerequisite: 171.

*3 units, Win (Adem)*

149. **Topics in Topology.**

*alternate years, given 1987-88*

150. **Introduction to Combinatorial Theory** — (Enroll in Computer Science 264.)

*J. P. S. Kung*

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, Spr (Bump) MWF 10*

153. **Group Theory** — Discrete groups, groups, homomorphisms, permutuations, 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 (Bump)*

154. **Geometrical Groups** — The rotation and unitary groups with particular attention to two, three and four dimensions. Quaternions. The Lorentz group and SL(2,C).

*3 units, Spr (Royden)*


*alternate years, given 1987-88*

156. **Fundamental Concepts of Analysis** — Similar to 115 but altered contents and more theoretical orientation. Properties of Riemann integrals, continuous functions and convergence in metric spaces; compact metric spaces, basic point set topology. Recommended for Math majors and required of honors Math majors. Prerequisite: 44.

*3 units, Aut, Win, Spr (Suppes)*

157. **Analysis on Manifolds** — Differentiable manifolds, tangent space, submanifolds, implicit function theorem, differential forms, vector and tensor fields, Frobenius' theorem, DeRham theory. Prerequisite: 113.

*3 units, Spr (Katznelson)*

158. **Introduction to Combinatorial Theory** — (Enroll in Computer Science 264.)

*J. P. S. Kung*

159. **Set Theory** — Non-axiomatic (informal) approach. Operations on sets and Boolean algebra. Relations, orderings, equivalence relations and functions. Set-theoretical characterization of the basic number systems. Equinumerosity of sets, the axiom of choice and cardinal numbers. Well-ordering relations and ordinal numbers. Transfinite arithmetic. Prerequisite: 44.

*3 units, Aut (Scowcroft) MWF 2:15*

160A. **First-order Logic** — (Enroll in Philosophy 160A.) The syntax and semantics of sentential and first-order logic with an introduction to the basic concepts of model theory. Gödel's Completeness Theorem and its consequences such as the Löwenheim-Skolem Theorem and the Compactness Theorem are discussed and applied. Prerequisite: 159 or consent of instructor.

*4 units, Win (Etchemendy) MWF 9*

160B. **Computability and Logic** — (Enroll in Philosophy 160B.) A precise definition of "effective procedure" through Turing machines, register machines and recursive functions. Church's Thesis is explained. These are used to develop Gödel's work on the undecidability of arithmetic, culminating in his famous Incompleteness Theorem. Also other undecidable problems. Prerequisite: 160A.

*4 units, Spr (Scowcroft) MWF 9*

161. **Axiomatic Set Theory** — (Enroll in Philosophy 158.) Zermelo-Fraenkel axioms. Operations on sets, relations and functions. Equivalence and ordering relations. Equipollence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. This is a computer-based course; 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 algebra. Relations, orderings, equivalence relations and functions. Set-theoretical characterization of the basic number systems. Equinumerosity of sets, the axiom of choice and cardinal numbers. Well-ordering relations and ordinal numbers. Transfinite arithmetic. Prerequisite: 44.

*3 units, Aut (Scowcroft) MWF 2:15*

171. **Fundamental Concepts of Analysis** — Similar to 115 but altered contents and more theoretical orientation. Properties of Riemann integrals, continuous functions and convergence in metric spaces; compact metric spaces, basic point set topology. Recommended for Math majors and required of honors Math majors. Prerequisite: 44.

*3 units, Aut (Kerckhoff) 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, DeRham theory. Prerequisite: 113.

*3 units, Spr (Katznelson)*

175. **Elementary Functional Analysis** — (Formerly 117.) Linear operators on Hilbert space. Spectral theory of compact operators; applications to integral equations. Elements of Banach space theory. Prerequisite: 115 or 171.

*3 units, Spr (Berg) MWF 11*

182A,B. **Topics in the History of Mathematics.**

182A. Topics from the 17th to the 19th century. Principally the rapid development of the powerful new concepts and methods in analysis and their direct connection with the physical sciences, in particular mechanics. Illustrations from the work of famous mathematicians from Descartes to Abel.

*3 units, Win (Hawley)*

182B. Topics from the 19th to the early 20th century. The further extension and expansion of analysis and its applications. Rigorization and generality; the rise of algebra and abstract mathematics. Illustrations from the work of famous mathematicians from Fourier to Lebesgue.

*3 units, Spr (Hawley)*
195. Teaching Practicum—An opportunity for students to assist in an undergraduate course, lead problems sessions, and tutor. Some reading in topics in mathematics education is required.

3 units, Aut, Win, Spr

196. Undergraduate Colloquium—Readings and discussions of topics in mathematics, the history of mathematics, and the philosophy of mathematics. Emphasis on the influence of mathematical models on science and western civilization. Topics determined on the basis of interests and backgrounds of class members. Term paper required.

3 units, Win (Hawley) by arrangement

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 Department of Mathematics. Topics are limited to those which are not the content of regular course offerings of the department. Credit may be used toward the fulfillment of the elective requirement for the degree in mathematics. Students wishing to use credit for the course toward the fulfillment of the department’s area requirements must receive the approval of the Undergraduate Affairs Committee of the department. Students having a topic they wish to investigate but who need help in finding a faculty member to direct their reading should consult the Academic Secretary of the department.

(Staff) by arrangement

PRIMARILY FOR GRADUATE STUDENTS


205A. 3 units, Aut (Katznelson) MWF 10
205B. 3 units, Win (Katznelson) MWF 10
205C. 3 units, Spr (Katznelson) 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 (P. Cohen) MWF 11
206B. 3 units, Win (P. Cohen) MWF 11
206C. 3 units, Spr (Sarnak) MWF 11

210A,B,C. Modern Algebra—Groups, rings and fields; Galois theory, ideal theory, introduction to algebraic geometry; representations of groups and algebras; multilinear algebra. Prerequisite: 120 or equivalent.

210A. 3 units, Aut (Milgram) TTh 11-12:15
210B. 3 units, Win (Brumfiel) TTh 11-12:15
210C. 3 units, Spr (Brumfiel) TTh 11-12:15


217A. 3 units, Win (Morgan) MWF 1:15
217B. 3 units, Spr (Simon) MWF 11

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 (Craig) TTh 9:35-10:50
220B. 3 units, Win (Craig) TTh 9:35-10:50
220C. 3 units, Spr (Keller) 9:35-10:50

221A,B. Calculus of Variations—Euler-Lagrange equations, sufficient conditions; applications to eigenvalue and scattering problems; direct methods, Dirichlet’s principle. alternate years, given 1987-88

224. Integral Equations—Singular types and methods for their solution; alternative integral equation reformulation of boundary value problems, dual equations and affiliated variational principles. alternate years, given 1987-88

226. Mathematical Models in Population Biology—(Same as 126.)

3 units, Spr (Karlin) MWF 1:15


230A. 3 units, Aut (Stein) MWF 9
230B. 3 units, Win (Stein) MWF 9
230C. 3 units, Spr (Stein) MWF 9

231. Topics in Stochastic Processes—Topics in combinatorial stochastic models are empha-
sized including random walks on groups, graphs, trees, etc., processes of order statistics, fluctuation theory for partial sums of independent identically distributed random variables. Multidimensional Poisson processes, stochastic population processes, applications to biological structure, population dynamics in space and time, reliability regimes, and to various communication and engineering systems.

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


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

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. Prerequisites: Some knowledge of differential equations and the elements of probability theory.

alternate years, given 1987-88

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) TTh 1:15-2:30
235B. 3 units, Win (Ornstein) TTh 1:15-2:30
235C. 3 units, Spr (Ornstein) TTh 1:15-2:30

236A,B,C. Advanced Numerical Analysis—(Enroll in Computer Science 337A,B,C.)

238A,B,C. Advanced Topics in Numerical Analysis—(Enroll in Computer Science 338A, B,C.)


3 units, Aut (Chung) MWF 10

242. Difference Equations—A theoretical account of linear functional equations which have a difference or recursive character; applications to special (i.e. Gamma) functions and to physically motivated problems. Comparison with analogous aspects of differential equations.

3 units, Spr (Levine)

244A,B. Riemann Surfaces—Primarily treats compact Riemann surfaces: topological classification, Hurwitz' formula, Riemann-Roch formula, uniformization theorem, Abelian varieties. Also, some elements of harmonic analysis are developed with applications. Methods generally applicable to algebraic curves are highlighted.

alternate years, given 1987-88


248A. 3 units, Aut (Sarnak)
248B. 3 units, Win (Sarnak)

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, exist
ence of periodic solutions and orbital stability.

alternate years, given 1987-88

256A,B,C. Partial Differential Equations—
Elliptic equations: linear boundary value problems — potential theoretic methods (Schauder theory) and weak solutions (L^1 theory, Sobolev space techniques). Second order nonlinear equations — a priori estimates and fixed point methods. Hyperbolic equations: The case of constant coefficients by methods of Fourier analysis. Mixed boundary value problems for hyperbolic systems in two independent variables by the method of characteristics. Initial value problems for strictly hyperbolic systems using energy inequalities and geometrical optics.

256A. 3 units, Aut (Simon) TTh 2:15-3:30
256B. 3 units, Win (Simon) TTh 2:15-3:30
256C. 3 units, Spr (Simon) TTh 2:15-3:30


alternate years, given 1987-88


263A. 3 units, Aut (Staff) TTh 11-12:15
263B. 3 units, Win (Staff) TTh 11-12:15

267A,B. Mathematical Theory of Relativity—Ricci calculus; variational principles and covariance properties; differential geometry of space-time; Cauchy’s problem for the differential equations of gravitation and electromagnetism; relativistic hydrodynamics; unified field theories.

given when teaching staff available

270. Perturbation and Asymptotic Methods with Applications—An exposition of perturbation and asymptotic methods. Topics include regular perturbation theory, singular perturbation theory, initial and boundary layers, the method of multiple scales, ray theory, two-time methods, etc. Applications include problems from fluid and solid mechanics, wave propagation, etc. Prerequisites: Some familiarity with ordinary and partial differential equations.

alternate years, given 1987-88

274. Wave Propagation — (Same as Mechanical Engineering 236B.) 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, etc. Applications are made to electromagnetic, acoustic, elastic, and other types of waves.

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

275. Introduction to Nonlinear Continuum Mechanics—(Same as Mechanical Engineering 242A.)

given 1987-88

277A,B. Mathematical Theory of Relativity — Ricci calculus; variational principles and covariance properties; differential geometry of space-time; Cauchy’s problem for the differential equations of gravitation and electromagnetism; relativistic hydrodynamics; unified field theories.

given when teaching staff available


281A. 3 units, Aut (R. Cohen) MWF 2:15
281B. 3 units, Win (R. Cohen) MWF 2:15

283A,B. Topics in Topology—Topics from loop spaces and classifying spaces, cohomology operations, homotopy theory, differential topology.

283A. 3 units, Win (Staff)
283B. 3 units, Spr (Staff)

284. Differentiable Manifolds—Embeddings of manifolds in Euclidean space, tubular neighborhood theorem, Morse theory, transversality, differential forms, integration on manifolds, de Rham cohomology.

3 units, Spr (Milgram)

286A,B. Topics in Differential Geometry—Presents some parts of differential geometry which will lead students to do research in the field. Possible topics include: the relation between the curvature of a manifold and its topology; the use of the methods of partial differential equations in the construction of metrics, and the isometric embedding problem; the problem of isometric deformation of submanifold; the application of geometry to general relativity. Topics depend to some extent on the interest of the students. Prerequisite: 217B.

286A. 3 units, Aut (White)
286B. 3 units, Win (White)
287A,B. Topics in Algebra and Number Theory—The classical theory of algebraic numbers including local p-adic theory, class numbers, Dirichlet unit theorem and decomposition of prime ideals. If time permits, an introduction to class field theory and a discussion of quadratic forms, especially the Minkowski-Siegel theorem.

287A. 3 units, Win (Staff)
287B. 3 units, Spr (Staff)


alternate years, given 1987-88


given when teaching staff available

292A,B. Set Theory—(Same as Philosophy 392A,B.) The cumulative hierarchy. Axiomatic theories of sets (and classes). Inner models, particularly the constructible sets. Models obtained by forcing and generic sets; Boolean valued models. Consistency and independence results for mathematical statements. Prerequisites: 160A,B and 161 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. Prerequisites: 160A,B or equivalent.

alternate years, given 1987-88

294. Topics in Logic—Vary from year to 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, Win, Spr (Simpson) TTh 1:15-2:30

350. Directed Reading.

any quarter (Staff) by arrangement

351. Seminar Participation—Participation in a student-organized graduate seminar under the general supervision of a faculty member.

any quarter (Staff) by arrangement

360. Advanced Reading and Research.

any quarter (Staff) by arrangement

361. Seminar Participation—Participation in a faculty-led seminar which has no specific course number.

any quarter (Staff) by arrangement


by arrangement

381. Seminar in Analysis.

by arrangement

382. 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: Suzanne Lewis (Chairman), Theodore M. Anderson, Stephen Ferruolo, Gavin I. Langmuir, William P. Mahrt

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 Frecceco (French and Italian), Hester Gelber (Religious Studies), Donald R. Howard (English), Gavin I. 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 pro-
Program in Medieval Studies; rather the option exists for interested students to propose individually designed majors in Medieval Studies. Individually designed majors must be proposed to and approved by the Dean of Undergraduate Studies' Advisory Committee on Individually Designed Majors. Guidelines may be found under the section "Program for Individually Designed Majors." Students interested in planning a course of studies should consult the Chairman of Medieval Studies. Additional information about this option, as well as referral to faculty advisors, is available through the Humanities Special Programs office. For information about proposing individually designed majors, students should go to the 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 ten 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 ten courses, a language proficiency equal to two years of college-level study is suggested in Latin or one of the following: French, German, Spanish, or Italian.

** COURSES **

65. 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 broad context of medieval life. The approach to medieval history, literature and art is interdisciplinary and integrated with a consistent structured emphasis on the mutual interdependence of all aspects of culture and society from the 12th through the 14th century. Topics include 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, Ferruolo) not given 1986-87

300. Graduate Colloquium—A consideration of 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, Spr (Lewis)

** 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 and Medieval Art.
103. Byzantine Art and Architecture.
108. 15th-Century Netherlandish Painting.

** CLASSICS **

103. History of the Roman Empire.
177. Introduction to Paleography and Codicology.

** ENGLISH **

10/110. Masterpieces of English Literature I: Chaucer, Shakespeare, Milton and Their Contemporaries.
64B/164B. Arthurian Literature.
102. The History of the English Language.

171A. Chaucer’s Canterbury Tales.
171B. Chaucer’s Troilus and the Dream Poems.

200A. Old Norse Icelandic.
200B. Advanced Old Norse.

201. Old Saxon.

205. Old English.

209. Introduction to Paleography and Codicology.

211. Readings in Middle English.

270A. Beowulf.


314. Piers Plowman.

371. Seminar: Chaucer’s Early Works in Relation to His Times.

FRENCH

130. French Literature I: Middle Ages and Renaissance.

210. Old French.

GERMAN STUDIES


205A/305A. Introduction to Old Norse Icelandic.
205B/305B. Advanced Old Norse.


208A. Introduction to Middle High German.
208B. Advanced Middle High German.

ITALIAN

227. Italian Literature I: The Middle Ages and the Renaissance.

240. Boccaccio’s Decameron.

335. Dante’s Divine Comedy: Inferno.
336. Dante’s Divine Comedy: Purgatorio.
337. Dante’s Divine Comedy: Paradiso.

HISTORY


108. The Christianization of Western Europe, 500-1350.

206. Undergraduate Colloquium: Politics and Law in Medieval Europe.

210. Undergraduate Colloquium: Augustine as a Political Thinker.

MODERN THOUGHT AND LITERATURE

306. Graduate Colloquium: Politics and Law in Medieval Europe.

307. Graduate Core Colloquium in Medieval History.

MUSIC

100. Music History: Medieval and Renaissance.

RELIGIOUS STUDIES

23. Judaism.

24A. Christianity.


234B. Virgin Mary and the Images of Power.

273. Aquinas’ Ethics.
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 (i.e., since the eighteenth-century), intellectual history, and critical theory. Students planning to concentrate in Modern Thought and Literature must apply for admission to Humanities Honors Program and for graduation with Honors in Humanities.

Modern Thought and Literature as a major is one of the options within the Humanities Honors Program major. Students in the program do not need to complete an additional major in another department, but in order to satisfy the fourth requirement listed below, they will normally have the equivalent of a major in a single national literature. It is in the student's interest to complete the requirements of a departmental major in order to be able to graduate, should the honors essay not be completed in acceptable form. The requirements for the program include:

1. Completion of the Western Culture requirement (15 units, freshman year) with an average 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, junior year; 5 units, Autumn; 5 units, Winter, senior year). A grade of at least B is required on the essay for graduation with Honors in Humanities.

**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, 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 a M.A. in Modern Thought and Literature.

**DOCTOR OF PHILOSOPHY**

A candidate for the Ph.D. degree in Modern Thought and Literature must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the A.B. He or she will be expected to offer at least 90 units of graduate work in addition to the dissertation. At least three consecutive quarters of graduate work must be taken at Stanford. Students may spend one year of graduate study abroad.

Each student will plan his or her program with specific advisors. The exact distribution of time, between the literature of specialization and the interdisciplinary work in modern thought and literature, will depend on the nature of the undergraduate preparation. Candidates with an inadequate preparation in earlier literature may be asked to take appropriate additional courses.
The committee believes that creative writing or other artistic activity contributes to the development of the teacher of modern literature. A reasonable amount of creative work (the amount to be approved by each student's advisor) may be counted among the 40 units of interdisciplinary work required.

The requirements for the Ph.D. in Modern Thought and Literature are as follows:

1. An introductory seminar, Modern Thought and Literature 361 (5 units).
2. 45 units of advanced work in the modern literature of one language, normally English. Another national literature taught at Stanford may be substituted. Of the 45 units, at least 30 must be regularly scheduled, substantive courses in post-1750 English and American literature. Courses in the teaching of composition (English 396, 397), ad hoc graduate seminars (395), research courses (398), and thesis registration (399) may not be counted among these 30 units. 396, 397, and 399 may not be counted among the 90 units of graduate work required for the degree.
3. Approximately 40 units of advanced work in a coherent and individually arranged interdisciplinary program, including at least one further seminar. The program may include courses and readings in various areas of modern thought and culture, and individual creative work.
4. Qualifying Procedures:
   a) By the end of the Spring Quarter of the first year each student will either organize a colloquium developed from work done in the Winter Quarter, Modern Tradition seminar, or submit a 25-30 page essay based on the student's term paper for that seminar. The colloquium must be scheduled, or the seminar paper completed and given to the secretary, at least three weeks before the end of the Spring Quarter.
   b) Students may choose between two ways of demonstrating their knowledge of literature since 1750: a special one hour examination at the beginning of the second year, or a collection of brief critical commentaries on authors not covered in courses, to be submitted not later than the eighth week of the sixth quarter in residence. These tests or commentaries will be based on reading lists drawn up by the student in consultation with her or his advisor and approved by the Committee in Charge. The list should be based primarily on one of the advisory reading lists in literature, but may include additional works in modern thought or drawn from the student's special field of interest.
5. Teaching is an essential part of the program. All candidates are required to do four quarters of supervised teaching at half-time. During the first year a candidate is expected to act as a reader for two courses or a section leader for one course, in the second year to teach two quarters of Freshman English, and in the third or fourth years to assist a faculty member as a section leader in a larger course.

As preparation for teaching, students are required to take English 396, a 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.

COURSES

See departmental listings for course descriptions and for (DR) notations. Courses are open to qualified students from any department.

207. Sense of Identity in Modern Women Writers—(Same as Feminist Studies 165.) An examination of French and American female writers whose sense of identity is related to their creativity, sexuality, maternity, work and social class.
5 units, Spr (Yalom) MW 2-4

208. Autobiography and Literature: Gender and Genre.
given 1987-88

216. The Romantic Age: Revolution and Revival.
216A. The Generation of Wordsworth and Austen—(Enroll in English 216A.)
5 units, Spr (Dekker)
216B. Byron, Shelley, Keats, and Their Contemporaries—(Enroll in English 216B.)
5 units, Aut (Grigely)

221. History of Film—(Enroll in Communication 141/241.)
4 units, Win (Breitrose)

234D. Critics of America—(Enroll in English 234D.)
5 units, Spr (Chace)

239. American Short Fiction—(Enroll in English 239.)
5 units, Win (Fields)

242. Deutsche Geistesgeschichte II—(Enroll in German 242.) Taught in German.
3-5 units, Win (Wilke)

243. Deutsche Geistesgeschichte III—(Enroll in German 243.) Taught in German.
3-5 units, Spr (Berman)

245. Deutsche Geistesgeschichte I—(Enroll in German Studies 241.) Taught in German.
3-5 units, Aut (Mueller-Vollmer)

245A. Survey of Russian Literature in English Translation I: The Age of Experiment—(Enroll in Slavic Languages 145/245.)
4 units, Aut (Fleishman)

245B. Survey of Russian Literature in English Translation II: The Novel and Beyond—(Enroll in Slavic Languages 146/246.)
4 units, Win (Frenkel)

245C. Survey of Russian Literature in English Translation III: A Fractured Culture—(Enroll in Slavic Languages 147/247.)
4 units, Spr (Brown)

246. The Symbolist Poets—(Enroll in French 262.) Baudelaire, Mallarmé, Verlaine, Rimbaud, Yeats, George, etc.
4 units, Spr (Cohn)

255. American Drama (1960’s to Present)—(Enroll in Drama 255.)
4 units, Aut (Richards)

256. American Women Playwrights—(Enroll in Drama 256.)
4 units, Win (Richards)

257. Contemporary Black Playwrights—(Enroll in Drama 257.)
4 units, Spr (Richards)

258. History of Theater: 19th and 20th Century—(Enroll in Drama 261.)
4 units, Aut (Eddelman)

260. Contemporary Jewish Thinkers—(Enroll in Religious Studies 260.)
5 units, Spr (Eisen)

261. Victorian England—(Enroll in English 261.) The social pleasures of Victorian autobiography. Admission by consent of instructor.
5 units, Aut (Gagnier)

262. Seminar: Thought and Action—(Enroll in Political Science 262.)
5 units, Aut (Drekmeier)

263A. Seminar in Feminist Studies—(Enroll in English 263A, Feminist Studies 103/203.)
5 units, Aut (Rich)

264. Social Theory and Modern Political Thought—(Enroll in Political Science 264.)
5 units, Win (Drekmeier)

265. Figures of Imagination and Desire in Film and Literature—(Enroll in English 265.)
5 units, Aut (Carney)

266. Cultural Transmission—(Enroll in Anthropology 266, Education 315.)
3-5 units, Win (G. and L. Spindler)

268. E.T.A. Hoffman—(Enroll in German Studies 268/368.)
3-5 units, Aut (Wellbery)

269. Memory and Modernity—(Enroll in French 269.)
4 units, Spr (Terdiman)

271. Céline—(Enroll in French 271.)
4 units, Aut (Godard)

275. Le Surréalisme—(Enroll in French 275.)
4 units, Win (Newman-Gordon)

277. Joseph Conrad—(Enroll in English 277.)
5 units, Spr (Watt)
281. Encounters Between Modern Philosophy and Judaism: Kant—(Enroll in Religious Studies 281.)
  5 units, Win (Eisen)

284A. Joyce—Proust Mann—(Enroll in German Studies 284A.)
  3-5 units, Aut (Gillespie)

285C. Gertrude Stein and Ezra Pound—(Enroll in English 285C.)
  5 units, Win (Perloff)

286. Satire: Literature and Politics—(Enroll in French 286.)
  4 units, Win (Giraud)

287. Seminar: Convergence and Divergence in Industrial Societies — (Enroll in Sociology 287.)
  5 units, Win (Inkeles)

288A. Joyce—(Enroll in English 288A.)
  5 units, Win (Chace)

288C. Yeats and T.S. Eliot—(Enroll in English 288C.)
  5 units, Aut (Lindenberger)

290A. History of Anthropological Theory—(Enroll in Anthropology 290A.)
  5 units, Aut, Win (Wolf)

290B. Anthropological Theory in Historical Context—(Enroll in Anthropology 290B.)
  5 units, Win (Wolf)

295. L’Art Plastique récit au 19e siècle—(Enroll in French 391D.)
  2 units, Aut (Serres)

296. Le Temps et le récit au 17e siècle—(Enroll in French 391E.)
  2 units, Spr (Serres)

297. Feminist Attitudes in France—(Enroll in French 296.)
  4 units, Spr (Newman-Gordon)

300. Graduate Seminar: Literature as Institutions.—(Enroll in Slavic Languages 300A.)
  4 units, Spr (Todd)

303A. Colloquium: Literature and Ideas from Swift to Wollstonecraft—(Enroll in English 303A.)
  5 units, Aut (Bender, Carnochan)

303B. Colloquium: The Age of Sensibility or the Age of Johnson—(Enroll in English 303B.)
  5 units, Win (Donoghue)

304. Colloquium: Romanticism and History—(Enroll in English 304.)
  5 units, Aut (Lindenberger)

304B. Colloquium: Historiography of 19th Century Spanish America—(Enroll in History 304B.)
  5 units, Win (Bowser)

305. Colloquium: Literature of World War I—(Enroll in English 305.)
  5 units, Win (Stone)

  5 units, Win (Drape)

307A. Colloquium: Major Modern Critics—(Enroll in English 307A.)
  5 units, Aut (Halliburton)

307B. Colloquium: The Poetry of Postmodernism—(Enroll in English 307B.)
  5 units, Spr (Perloff)

313. Seminar: Modern Literary Research, 1750 to the Present—(Enroll in English 313.)
  5 units, Spr (McPherson)

329. Rhetoric Semiotics and Contemporary Italian Literature—(Enroll in Italian 229/329.)
  4 units, Spr (Allen)

331D. Graduate Core Colloquium: Modern Europe—(Enroll in History 331D.)
  5 units, Aut (Sheehan)

331E. Graduate Core Colloquium in Modern Europe—(Enroll in History 331E.)
  5 units, Win (Wright)

331F. Graduate Core Colloquium on Modern Europe—(Enroll in History 331F.)
  5 units, Spr (Robinson)

347. Freud and Criticism—(Enroll in German Studies 247/347.)
  5 units, Win (Berman)

349A. Graduate Colloquium: The End of Slavery in Africa and the Americas—(Enroll in History 349A.)
  5 units, Win (Roberts)

349H. Herder and Humboldt on Language and Culture—(Enroll in German Studies 349H.)
  5 units, Aut (Jackson)

351B. Seminar: Pinter, Bond, Stoppard, Churchill—(Enroll in Drama 351B.)
  5 units, Spr (Esslin)

353. Seminar: Contemporary German Drama—(Enroll in Drama 353.)
  5 units, Win (Esslin)

354A. Seminar: 20th Century Visual Aesthetics—(Enroll in Drama 354A.)
  5 units, Aut (Eddelman)

360. Friedrich Hoelderlin: Philosopher and Poet—(Enroll in German Studies 260/360.)
  3-5 units, Spr (Forster, Mueller-Vollmer)
361. Seminar: The Modern Tradition—(Enroll in English 361, German 390A.) An inquiry into conceptualizations of modernity, modernism and modernization in terms of cultural criticism and social theory. Topics include diachronic designations with reference to tradition and post-modernism; the institutional status of culture; modern identity and the confrontation with alterity. Readings by figures such as Marx, Weber, DuBois, Hoggart, Thompson, Adorno, Habermas, Baudrillard, Kristeva, Lyotard.
  5 units, Aut (Berman) MW 1:15-3:05

365. Seminar: American Literature and Culture in the 1840s—(Enroll in English 365.)
  5 units, Spr (Fliegelman)

365A. Colloquium: Sexuality in American History—(Enroll in History 365A.)
  5 units, Aut (Freedman)

369. Seminar: The Structuralist Paradigm and its Transformations—(Enroll in Comparative Literature 369.)
  5 units, Win (Bender, Wellbery)

375. Dostoevsky and French Literature—(Enroll in Comparative Literature 375.)
  5 units, Win (Frank)

381. Novel into Film—(Enroll in Italian 381.)
  4 units, Win (Springer)

384. Seminar: Jane Austen—(Enroll in English 384.)
  5 units, Win (Watt)

385D. Seminar: Henry James and the Romance Tradition—(Enroll in English 385D.)
  5 units, Aut (Dekker)

387. Colloquium: Imperialism, Underdevelopment and Revolution in the Modern Middle East—(Enroll in History 387.)
  5 units, Spr (Beinin)

388F. Seminar: Joyce's Finnegans Wake—(Enroll in English 388F.)
  5 units, Spr (Polhemus)

388G. Seminar: Flan O'Brien and Samuel Beckett—(Enroll in English 388G.)
  5 units, Win (Sorrentino)

389. Graduate Seminar: 19th Century Europe—(Enroll in History 433A.)
  5 units, Win (Sheehan)

390. Graduate Seminar: 19th Century Europe—(Enroll in History 433B.)
  5 units, Spr (Sheehan)

391. Graduate Seminar: Elite and Popular Culture of Early Modern Europe—(Enroll in History 435.)
  5 units, Win (Bryant)

391A. Graduate Seminar: Culture and Ideology in 19th Century America—(Enroll in History 454.)
  5 units, Spr (Fredrickson)

  5 units, Aut (Degler)

393. Graduate Seminar: Women's Family and Sexual History—(Enroll in History 473.)
  5 units, Win (Freedman)

394. Graduate Seminar: 20th Century Brazil, and Latin America—(Enroll in History 476A.)
  5 units, Win (Wirth)

395. Ad Hoc Graduate Seminars—Graduate students (at least three but preferably more) who wish, the following quarter, to study a subject or an area not covered by regular courses and seminars may plan an informal seminar and approach a suitable member of the faculty to supervise it, Letter grade or Pass/No Credit basis.
  any quarter, by arrangement

396. Introduction to Graduate Study—(Enroll in English 396.)
  2 units, Aut (Moser, Packer)

397A. Rhetoric and Teaching Composition—(Enroll in English 397A.)
  5 units, Aut (Packer)

397B. Teachers Workshop I—(Enroll in English 397B.)
  5 units, Win (Fifer)

397C. Teachers Workshop II—(Enroll in English 397C.)
  5 units, Spr (Fifer)

398. Research Courses—The student pursues a special subject of investigation under supervision of some member of the Committee or another faculty member. Thesis work not to be registered under this course.
  any quarter, by arrangement

RELATED OFFERINGS

Students of Modern Thought and Literature are referred to the offerings of the following departments: Anthropology, Art, Asian Languages, Communication, Comparative Literature, Drama, English, French and Italian, German Studies, History, Humanities Special Programs, Linguistics, Philosophy, Political Science, Psychology, Religious Studies, Sociology, Slavic Languages and Literatures, and Spanish and Portuguese. Consent of the instructor is required for most courses offered in this department.
Chairman: Albert Cohen
Professors: Albert Cohen (on leave Spring), John Chowning, George Houle, William H. Ramsey, Leland C. Smith (on leave Autumn)
Associate Professors: Karol Berger, William P. Mahrt
Assistant Professor: Thomas Bauman
Professors (Performance): Arthur P. Barnes (Director of Bands), Andor Toth* (Director of Orchestras and Opera, on leave Spring)
Senior Lecturers: Judith Bettina (Voice), Margaret Fabrizio (Early Keyboard), Genady Kleyman (Violin, Viola), Naomi Sparrow (Piano), Gregory A. Wait (Voice)
Lecturers: Ross Bauer (Theory), Kay Bedenbaugh (Piano), Frances Blaisdell (Flute), David Burkhart (Trumpet), Marjorie Chauvel (Harp), Anthony J. Cirone (Percussion), Floyd O. Cooley (Tuba), Gregory Duford (Clarinet), Charles A. Ferguson (Guitar), Josephine A. Gandolfi (Piano), Ted Gioia (Jazz), Stephen Harrison* (Violoncello), Alexandra W. Hawley (Flute), William Klingelhoffer (French Horn), Roy Malan* (Violin), Anthony P. Martin (Baroque Violin), James Matheson (Oboe), Martha McGaughey (Viola da Gamba), Herbert Myers (Early Winds), James O. Nadel (Jazz), Karen Nagy (Music Librarian), Rufus Olivier (Bassoon) Julius O. Smith (Computer Music), Harold Stein (Saxophone), Stephen Tramontozzi (Contra- bass), Michael B. West (Glee Club), J. Elwood Williams (Trombone), Bernard Zaslav* (Viola)
Visiting Lecturer: Arthur Haas (Harpischord)
Artist-in-Residence: Stan Getz (Autumn)
*Member of Stanford String Quartet (Ensemble in Residence)

OFFERINGS AND FACILITIES

The department’s aims are to promote understanding and enjoyment of music in the University at large and to provide specialized training for those who plan careers in music as composers, performers, teachers, or research scholars.

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) Music 21, 22 (Elements of Music), Music 23 (Functional Harmony), Music 24 (Elementary Tonal Counterpoint).
   c) Music 100, 101, 102, 103, 104 (Music History).
   d) Music 121, 133 (Advanced Harmonic Materials).
   e) One elective from among the following topics: theory and composition, history and literature, conducting, performance practice. Note: Music 199 and honors projects will not satisfy this requirement.

2. Additionally, all music majors must fulfill the following two performance requirements:
   a) Individual studies in performance: six quarters.
b) Ensemble: six quarters of work in one or more of the department's organizations or chamber groups. Note: Music 161C (Sports Activity Band) and Music 167 (Glee Club) will not satisfy this requirement.

3. All majors are required to demonstrate a minimum proficiency in piano by sight-reading works at the level of Clementi sonatinas and by playing two prepared pieces comparable in difficulty to Bartok's Mikrokosmos, Book IV. This requirement should be fulfilled as early as possible and not later than the beginning of the junior year.

4. Students must also demonstrate an ability to hear music accurately and to perform it at sight. These skills will be tested by two examinations, the first to be taken upon completing Music 22, the second to be taken in the first quarter of the senior year.

The following sample schedule shows how a student may include substantial work on a major in music while also fulfilling the University Distribution Requirements during the freshman and sophomore years. The schedule also includes foreign language study, which is strongly recommended for all music majors and especially for those expecting to continue into graduate work in any area of music.

**RECOMMENDED SCHEDULE FOR COMPLETING THE MUSIC MAJOR PROGRAM**

**FIRST YEAR**

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
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<tbody>
<tr>
<td>Freshman English*</td>
<td>3</td>
<td>3</td>
<td>—</td>
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<tr>
<td>Music 21-23, * 22S-23S</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Individual Instruction and/or Ensemble</td>
<td>1-4</td>
<td>1-4</td>
<td>1-4</td>
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<tr>
<td>Western Culture</td>
<td>3-5</td>
<td>3-5</td>
<td>3-5</td>
</tr>
<tr>
<td>Choice of Foreign Language, Distribution requirement or Freshman Seminar</td>
<td>3-5</td>
<td>3-5</td>
<td>3-5</td>
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</tbody>
</table>

**SECOND YEAR**

<table>
<thead>
<tr>
<th>Courses</th>
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<th>Sp</th>
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<tbody>
<tr>
<td>Music 24,24S</td>
<td>4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Music 100-102 and 121</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Individual Instruction and/or Ensemble</td>
<td>1-4</td>
<td>1-4</td>
<td>1-4</td>
</tr>
<tr>
<td>Distribution Requirement</td>
<td>3-5</td>
<td>3-5</td>
<td>3-5</td>
</tr>
<tr>
<td>Elective (or Music 23 if not taken previously)</td>
<td>3-5</td>
<td>(3)+</td>
<td>3+</td>
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</table>

**THIRD YEAR**

<table>
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<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
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<tbody>
<tr>
<td>Music 103-4 and 122</td>
<td>8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>(4)</td>
<td>(4)</td>
<td></td>
</tr>
</tbody>
</table>

* The Music 21-23 sequence may begin in the Winter rather than Autumn Quarter. If so, Music 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.

**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 indicated by grade average and recommendations from members of the faculty. The program, in addition to the regular requirements for the major, consists of a special honors project undertaken for the duration of one or two quarters of the senior year. Application for the program must be made well before the end of the Spring 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 grade of A, B, or plus will be recognized as fulfilling the advanced degree requirements in music.

Doctoral candidates working in absentia on Ph.D. dissertations or D.M.A. final projects which require consultation with faculty members must continue enrollment in the University under the heading of Terminal Graduate Registration.

**Teaching**—All fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at halftime 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 and pedagogy 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 demonstrate performance supported by a written commentary on the performance practices that are involved.

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 study; (2) a written comprehensive examination in the candidate's special area of concentration, no later than the third quarter after passing the qualifying examination.

DOCTOR OF PHILOSOPHY

A limited number of students with superior qualifications are accepted by the department for work toward the Ph.D. degree in music.

General University regulations regarding this degree are discussed in the "Degrees" section in this bulletin.

Admission—In addition to completing entrance tests, an applicant is asked to submit some evidence of his or her work in the field of music history such as a term paper or a master's thesis.

Basic Requirements—Each candidate must complete a minimum of three years of full-time work. The student may proceed directly to the Ph.D. without taking the A.M. en route. The program will normally include: (1) seminars in musical notation, analysis, 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.

**COURSES**

**FOR THE GENERAL STUDENT**

1. **Introduction to Music**—Musical expression, style, structure explained, illustrated for the listener. (DR:2)
   - 3 units, Win (Houle)

2A. **The Symphony**—(DR:2)
   - 3 units (Barnes)

2B. **The Concerto**.
   - 3 units, Aut (Barnes)

2C. **Opera**.
   - 3 units (Mahrt)

3C. **Medieval Music**.
   - 3 units (Mahrt)

4A. **The Music of J. S. Bach**—(DR:2)
   - 3 units (Staff)

4B. **The Music of Mozart**.
   - 3 units, Spr (Bauman)

4C. **The Music of Beethoven**.
   - 3 units (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, Aut (Cohen)

5C. **Music and Culture at the Court of Louis XIV**.
   - 3 units, Win (Marshall)

6D. **Technology and Musical Expression**—(Enroll in VTSS 165.)
   - 4 units (Good) alternate years, given 1987-88

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 (Bauer)

20B. **Advanced Jazz Theory**.
   - 3 units, Aut (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, Bauer)
   - Win (Barnes)

22. **Elements of Music**—A continuation of 21, with emphasis on contrapuntal writing: modal and species counterpoint. Use of keyboard ear training and sight singing underlie all written work. Lecture and laboratory sections. Prerequisite: 21.
   - 3 units, Win (Bauman)
   - Spr (Bauer)

22S. **Ear Training and Sight Singing**.
   - 1 unit, Win, Spr (Staff)

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.
   - 3 units, Aut (Barnes)
   - Spr (Staff)

23S. **Ear Training and Sight Singing**.
   - 1 unit, Aut, Spr (Staff)

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.
   - 3 units, Win (Bauer)

24S. **Ear Training and Sight Singing**.
   - 1 unit, Win (Staff)
100. Music History: Medieval and Renaissance—Prerequisites: 21, 22.
   4 units, Aut (Houle)

101. Music History: Baroque—Prerequisites: 21, 22, 100.
   4 units, Win (Cohen)

102. Music History: Classic — 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

123. Composition—Individual projects in creative work. May be repeated for credit.
   Prerequisite: Consent of instructor.
   3 units, Aut (Staff)
   Win, Spr (Smith)

125. Modal Counterpoint.
   3 units (Berger)

126. Tonal Counterpoint—Prerequisite: 103.
   3 units (Staff)

127. Orchestration—Prerequisite: 23.
   3 units (Barnes)


220A. Fundamentals of Computer-Generated Sound—Introduction to computer-
   sound generation, basic mathematics of signal processing, and computer programming.
   Prerequisite: Experience in musical composition or consent of instructor.
   4 units, Aut (Chowning)

220B. Compositional Algorithms, Psychoacoustics, and Spatial Processing—Use of
   high-level programming language as a compositional aid in creating complex musical
   structures. Studies in the physical correlates to auditory perception, theories of hearing,
   and review of psychoacoustic literature. Simulation of a reverberant space and the control
   of the position of sound within the space. Prerequisite: 220A.
   4 units, Win (Chowning, Smith)

220C. Research—Research projects in composition, psychoacoustics, or signal processing.
   Prerequisite: 220B.
   4 units, Aut, (Chowning)
   Win, Spr (Chowning, Smith)

220D. Music Typography on the Computer.
   4 units, Spr (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

140. Studies in Medieval and Renaissance Music—Prerequisite: 100.

140E. The Music of Guillaume Dufay.
   4 units (Mahrt)

   4 units (Staff)

141C. The Music of Handel.
   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 studied through detailed
   examination of selected operas. Prerequisite: 23.
   4 units, Win (Bauman)

143B. The Music of Brahms.
   4 units (Mahrt)

144. Studies in Modern Music—Prerequisite: 104.

   144A. Twelve-Tone and Serial Music.
   4 units (Smith)

   144B. Innovations in Contemporary Music.
   4 units (Smith)

   144C. The Music of Stravinsky.
   4 units (Barnes)

   144D. Music Since 1945.
   4 units (Berger)

150A. History of Musical Instruments.
   4 units (Myers)

150C. History of Musical Esthetics.
   4 units (Houle)

153. Organ Literature.
   153A. Organ Music (Cabezon to Bach).
   4 units, Aut (Marshall)
153B. Organ Music (Bach to Ligeti).
4 units (Marshall)

198. Senior Honors Project.
4 units (Staff)

199. Independent Study—For advanced undergraduates who wish to do work outside the regular curriculum. Before registering a student must present a specific project and enlist a faculty sponsor. Credit up to 4 units per quarter.

251. Choral Repertory (1500-1750).
4 units (Ramsey)

252. Choral Repertory (1750 to Present).
4 units (Ramsey) alternate years, given 1987-88

PERFORMANCE

GROUP INSTRUCTION

12. Introductory Piano—Preference to music majors. A special fee of $50 per quarter is charged for enrollment for non-music majors.
1 unit, Aut, Win, Spr (Bedenbaugh)

65C. Voice Class—For credential candidates, music majors, and non-majors who are members of departmental performing organizations.
1 unit, Aut, Win, Spr (Wait)

65D. Percussion Class—For credential candidates.
1 unit, Spr (Cirone)

72, 73, 74, 75, 76, 77. Small Group Instruction—A special fee of $60 per quarter is charged for enrollment in any of these groups.
1 unit, Aut, Win, Spr (Staff)

72. Piano Class—For intermediate students.
(Bedenbaugh, Gandolfi)

73. Voice Class.
(Wait)

74A. Stringed Instruments Classes.
(Harrison, Kleyman)

74C. Classical Guitar Class.
(Ferguson)

74D. Harp Class.
(Cirone)

75A. Wind Instruments Classes.
(Hawley, Staff)

75B. Renaissance Wind Instruments Class.
(Myers)

76. Brass Instruments Classes.
(Staff)

77. Percussion Class.
(Cirone)

INDIVIDUAL INSTRUCTION

172, 173, 174, 175, 176, 177, 272, 273, 274, 275, 276, 277. Individual Vocal and Instrumental Instructions—A special fee of $120 per quarter for majors and $240 for non-majors is charged for enrollment in these courses. Students wishing to enroll must demonstrate, by audition with the appropriate teacher, a minimum proficiency on his or her instrument. Minimum repertory lists for each instrument are available at the Music Department office.
3 units, Aut, Win, Spr

172A/272A. Piano.
(Baller, 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, Malan, 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.
(Cirone)

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.
(Klingelhofer)

176B/276B. Trumpet.
(Burkhart)

176C/276C. Trombone.
(Williams)

176D/276D. Tuba.
(Cooley)
PRACTICES

130. Orchestral Conducting—Prerequisite: 127.
130A. 3 units, Win (Toth)
130B. 3 units, Spr (Toth)
alternate years, given 1987-88

131. Choral Conducting.
131A. 3 units, Win (Ramsey)
131B. 3 units, Spr (Ramsey)

4 units, Aut (Houle)

ISO. Diction for Singers.
180A. Italian.
1 unit, Spr (Staff)

180D. English.
1 unit, Win (Staff)

181. Performance of Vocal Literature.
1 unit, 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 (Ramsey)

268. Thorough-Bass Realization.
1 unit, Aut, Win, Spr (Fabrizio)

269. Studies in Performance Practices—Performance studied in the light of musical resources, aesthetic attitudes, and theoretical principles of the various historical periods. Lectures, individual research, and practice sessions leading to concert performances. May be repeated for credit. Prerequisite: 169.
269A. Medieval.
4 units, Spr (Mahrt)

269B. Renaissance.
4 units, Win (Marhurt)

269C. Baroque.
4 units, Spr (Houle).

269D. Classic.
4 units (Ratner)

269E. Romantic
4 units (Mahrt)

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.
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 (Bowen)
by arrangement

161C. Sports Activity Bands.
1 unit, Aut (Barnes) MWF 4:15-5:30
1 unit, Win, Spr (Barnes) by arrangement

162. University Chorus.
1 unit, Aut, Win, Spr (Ramsey)
M 7:30-9:45 p.m. and W 4-5:30

163. University Choir—Official choir of Memorial Church, which furnishes music for Sunday services and special occasions in the Church calendar.
2 units, any quarter (Ramsey) 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 units, Aut, Win, Spr (Ramsey) MWF 12

166. Chamber Orchestra—Open to advanced players who have had orchestral experience.
1 unit, Aut, Win, Spr (Toth) TThF 12-1:50

1 unit, Aut, Win, Spr (West)
T 7:15-8:45 p.m. and Th 4:15-5:45

168A. University Symphonic Band.
1 unit, Aut, Win, Spr (Barnes) MWF 12

170. Piano Accompanying.
170A. Piano Accompanying.
1 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)

201. Graduate Review in Musical Analysis.
4 units, Aut (Bauer)

221. History of Music Theory.
221A. Ancient Through Renaissance.
4 units (Cohen)
221B. Baroque Through Modern.
4 units (Cohen) alternate years, given 1987-88

240. Seminar in Music History.
4 units, Win (Berger)

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)

301. Seminar in Music History and Analysis.
4 units, Aut, Win, Spr (Smith, Ratner, Berger)

302. Research in Musicology.
Aut, Win, Spr (Staff) by arrangement

310. Seminar in Research.
4 units, Aut, Win, Spr (Bauman, Houle)

320A. The Discrete Fourier Transform (DFT)—Fundamentals of Spectral analysis for discrete-time signals. Topics include sampled signals, complex variables, geometric projection, orthogonality, the DFT, and Fourier theorems relating to time-shift, convolution, correlation, aliasing, signal power, symmetries, and bandlimited interpolation. Prerequisites: High-school algebra and trigonometry.
3 units, Aut (J. Smith)
320B. Applications of the Fast Fourier Transform (FFT)—Spectrum analysis and digital filtering using the FFT. Topics include convolution, z transforms, transfer function analysis, frequency response, FFT windowing, and use of the FFT to implement non-recursive 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 include 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. Final Project.
any quarter (Staff) by arrangement

420A. Acoustical Signal Processing—Classical acoustics translated into a digital signal processing framework. Topics include 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. Prerequisite: 320C, or equivalent, and calculus.
2 units, Aut (J. Smith) plus lab by arrangement, alternate years, given 1987-88
420B. Nonlinear Modeling—Computational models for woodwinds and strings. Physically meaningful synthesis algorithms are built by coupling a "negative-resistance de-
vice” (such as provided by a 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, alternate years, given 1987-88

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. One well-known special case is linear predictive modeling of speech.

2 units, Spr (J. Smith) plus lab by arrangement, alternate years, given 1987-88

STANFORD OVERSEAS STUDIES

Stanford Overseas Studies programs offer a variety of study opportunities to Stanford undergraduate and graduate students. General studies programs in Austria, Britain, France, Germany, and Italy provide courses for undergraduates in the history, politics, literature, art, and economics of each country. Programs in Germany, France, Israel, Egypt, Spain, and Africa afford advanced undergraduates a chance to study in foreign universities. Graduate students can use these centers as a base for advanced research.

Students in Berlin, Tours, and Vienna live mostly in student dorms or with families and generally take courses specifically organized for Stanford students, although students with a strong language background may take courses at local universities. In Florence and Oxford students live in a residential center and take courses designed for Stanford students; independent work is also available. In Haifa, Paris, and Salamanca, students take courses at local universities and live in dorms and apartments; a similar program for advanced language students in German exists at the Free University (FU) of Berlin.

Stanford Overseas Studies also administers or participates in consortium programs in Lima, Peru; São Paulo, Brazil; Rome, Italy; and Cairo, Egypt. Specific information about these programs should be obtained directly from the Overseas Studies Office.

All regularly enrolled Stanford students are eligible to attend an Overseas Studies Center. Language and preparatory course requirements vary for each center. In general, students can study overseas for one, two, or three quarters. Tuition overseas is the same each quarter as on the home campus and the overseas fee closely approximates the quarterly room and board fees on the home campus.

All courses taken overseas receive regular University credit. Courses taken at an overseas studies center will satisfy Distribution Requirements according to the “DR.” designation and as noted in the Appendix. Overseas courses do not automatically receive major credit in departments on the home campus. Those which do have the department(s) for which they receive credit listed in parenthesis after the course title.

For more information about offerings, requirements, fees, and application deadlines, see the appropriate program folder in the Overseas Studies Office.

The information listed below is accurate at the time of printing, but is subject to change. Up-to-date curricular information is available from the Overseas Studies Office, on the first floor of Sweet Hall.

STANFORD PROGRAM IN BERLIN

Director: Karen Kramer
Assistant Director: Hannelore Noack
Faculty: Eike Gebhardt, Manfred Görtemaker, Anton Kaes, Franz Neckenig, Michael Ramsaur, Hermann Rupieper, Charles Steele, Frieder Wolf

SOCIAL SCIENCES, NATURAL SCIENCES AND TECHNOLOGY

10N. Applied Mechanics: Statics—(Also listed as Engineering 10N.) Equilibrium of particles; moments, couples; equilibrium of rigid bodies; analysis of trusses, frames, machines, dry friction; hydrostatic forces. Vectors and vector algebra are introduced and used in the course. Prerequisites: Physics 51. (DR:8)

3 units, Aut (Steele)

12. Intermediate Dynamics—(Also listed as Engineering 12.) 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 (Steele)

125. Culture and Society in German, 900-1870—General introduction to German cultural history, with emphasis on recurring types of social and cultural conflict.

4 units, Win (Neckenig)
127. Social and Cultural Life in Germany—
(Also listed as History 127.) A general historical introduction to both East and West German society and culture 1945-present. Contemporary problems presented and discussed: the political consolidation of East and West Germany; the economic miracle; detente; the German student rebellion; SPD/FDP coalition; German terrorism; the coming to power of the CDU; and the emergence of the Green and Alternative movements.
5 units, Aut (Neckenig)

131. The Two Germanies — (Also listed as History 131.) An introduction to the politics and social structure of the two Germanies and their relations with each other. Course takes advantage of the unique opportunities of Berlin for field trips and films.
4-5 units, Spr (Rupieper)

133. The National Question in Germany—
Political and cultural nationalism in Germany from the 19th century to the present.
4 units, Win (Rupieper)

139. Images of German: History through Film—Selected German films from 1920 to the present as social-historical documents. Includes works by Lang, Sternberg, Brecht, Riefenstahl, Wolf, Herzog, Fassbinder, Sander, Kluge, and Wenders.
4 units, Win (Rupieper)

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, Win (Cortemaker)

141X. Beyond the Nation State: Europeanism and the Idea of Eternal Peace—(Also listed as Political Science 141X.) An examination of "transnational" politics, including European unification and other approaches to overcome the tendency toward war inherent in the modern nation state. Four parts: State of Nature, Civil Society, and State of War in Classical Political Theory; the project of a European League in modern European Political Thought; beyond the Nation-State: Alternatives in Debate.
5 units, Win (Wolfe)

230B. Berlin: History and Culture, 1870 to the Present—(Also listed as History 230B.) Berlin's role in Germany's recent history, thorough an interdisciplinary approach, including on-site examination of Berlin art, historical sites, and contemporary culture. (DR:5)
4 units, Spr (Neckenig)

LITERATURE AND ARTS

51. Wagner: Drama, Ideas, and Aesthetics—
(Also listed as Drama 51.) An examination of Richard Wagner's aesthetic ideas in light of contemporary and subsequent productions of his works. Examines productions by Adolph Appia, Wieland Wagner, Patrice Cheareau, and Peter Hall, among others.
4 units, Spr (Ramsaur)

52. The Practice of Theatrical Production—
(Also listed as Drama 52.) An introduction to the arts and crafts associated with theater production, including script and analysis, acting, directing, lighting, costumes, and theater management. The differences between the subsidized theater structure of West Germany and the commercial theater system of the U.S. are stressed.
4 units, Spr (Ramsaur)

101A. German Theater as Seen in Berlin —
(Also listed as Drama 101A.) Plays and productions of German theater discussed in their historical, literary and socio-political context. Attendance at theatrical productions from the classical and modern repertory in both East and West Berlin is an integral part of the course.
5 units, Aut (Kramer)

120X. New Ways of Seeing — (Also listed as Art 120X.) Interprets art objects in the Berlin cityscape, museums and galleries as historical symbols. Students seek access to 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, Aut (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 in the period 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 break with the international scene in the Nazi period. (DR:2)
4 units, Win (Neckenig)

124. German Art Since 1945—German art in the European and American contexts, combining historical and critical analysis. Emphasis is on the city of Berlin, its museums, monuments, and galleries. (DR:2)
4 units, Spr (Neckenig)
165. Engagement to Subjectivity: German Literature 1968-1980—(Also listed as German 165.) A survey of German Literature of the 60’s and 70’s in the social context of protest movements and Tendenzwende. Documentary literature, the death-of-literature discussions, and New Subjectivity. Feminist writings are discussed in the context of changing political discourse.

5 units, Win (Kramer)

GERMAN LANGUAGE PROGRAM

60. Special Intensive German—Grammar, composition, reading, and conversation. A special, intensive course designed for interns to increase their language proficiency as quickly as possible and to 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 to 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 will be expanded in the fields of politics, economics, sports, and the arts.

2 units, Win, Spr (Staff)

STANFORD PROGRAM IN FLORENCE

Director: Giuseppe Mammarella
Assistant Director: Carla Lekai
Language Program Coordinator: Joan M. McConnell
Faculty: Lucia Benini, Franca Celli, Robert Chase, Roberto D’Alimonte, Guello Frulla, Paola Gori, Joan McConnell, Nathan Oliveira, Lucio Ruotolo, Giovanni Scichilone, Maria Todorow

SOCIAL SCIENCES, NATURAL SCIENCE AND TECHNOLOGY

102. Anatomy and Renaissance Art in Italy—(Also listed as Surgery 102.) An exploration of the mutually advantageous relationship between the development of anatomy as a scientific discipline and the new art of the Renaissance.

3 units, Spr (Chase)

103. Technology and Ethics in Medicine—(Also listed as Surgery 103.) The ethical conflicts that develop as new technology enters the field of health care. Includes consideration of both societal and individual human implications of new technologies.

4 units, Spr (Chase)

110X. Contemporary Italian 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.

4-5 units, Aut (D’Alimonte)

112X. Italy after Fascism—A comprehensive understanding of the Italian political system as it has emerged since the end of World War II. Prospects for future change including the effects of economic crises and the role of the Communists in shaping the direction of future development. (DR:5)

5 units, Win (Mammarella)

115. Firenze nel Rinascimento — (Also listed as History 115.) Florentine civilization from Dante to Machiavelli, including intellectual and political history. Students visit important Florentine sites of the Renaissance. (DR:3)

5 units, Win, Spr (Frulla)

118. Resorgimento to Fascism: 1860-1922—(Also listed as History 118.) Designed to give the students a background of facts, information, and evaluation on the Italian history of that period. The connection between Italian and European history and the ideological influences and political currents active in the period is particularly emphasized.

5 units, Aut (Mammarella)

125X. Comparative European Institutions — 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 type of analysis is used selectively for a better grasp of particular aspects related to single political systems. Also examined: 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 last section analyzes the European Economic Community and its future.

4 units, Spr (D'Alimonte)

127X. II Sistema Politico Italiano—A comprehensive understanding of the Italian political system as it has emerged and developed from the end of WW II to the present. Part I deals with general trends of political and economic development and contrasts a rapidly expanding economy and a political system retaining many of the traditional features of rural society. Part II focuses on institutional mechanisms of the state and on parties and interest groups. Prospects for regime change are examined emphasizing the impact of economic crisis and the communist party in shaping future development.

4 units, Win (D'Alimonte)

135A. US and Western Europe After WW II—(Also listed as History 135A, Political Science 121X.) The economic, political, military, and cultural relations between the United States and Western Europe. Analyzes the different American policies toward Europe from 1945 to 1982 within the framework of East-West relations. Emphasizes the European answer at political and economic levels. Provides an understanding of European points of view toward American policy.

(DR:5)

5 units, Spr (Mammarella)

LITERATURE AND ARTS

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 such masters as 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 stylistic trends, iconography, and social history of Italian art, concentrating on Michelangelo and Raphael but including Bronzino, Vasari, Titian, Tintoretto, and Caravaggio. Emphasis on classical influence on the artists studied.

(DR:2)

4 units, Win (Todorow)

125A. Masterpieces of Italian Literature: Origins to Dante—(Also listed as Italian 125A.) The emergence of vernacular literature in Italian, followed by close reading of The Divine Comedy. Sections conducted in Italian.

(DR:2)

4-5 units, Aut (McConnell)

125C. Italian Literature: 19th and 20th Centuries—(Also listed as Italian 125C.) Includes works by Manzoni, Tomasi di Lampedusa, Moravia, Pirandello, Silone, and Verga.

(DR:2)

5 units, Spr (McConnell)

126. Art and Culture in Etruria and Rome—(Also listed as Anthropology 126.) An introduction to the most important native cultures of ancient Italy. Etruscan culture in relation to its Italic neighbors is interpreted mainly on the basis of archeological evidence. The culture of the Roman Republic and Empire are viewed mainly through literary evidence.

4 units, Win (Scichilone)

148X. Florentine Sites—(Also listed as Art 148X.) Art workshop, intended to involve students in a work in progress; a series of monotypes that visualize and interpret Florence. Students also do work of their own in watercolor or drawing.

3-4 units, Aut (Oliviera)

149X. Florentine Art: Through the Eyes of a Modern—(Also listed as Art 149X.) Interpretation, from the point of view of a practicing artist, of the masterworks of art in Florence and its museums.

2-3 units, Aut (Oliviera)

180. The Modern Italian Novel—(Also listed as English 180.) Surveys recent Italian literature in translation. Authors include Manzoni, Verga, Svevo, Pirandello, Vittorini, Buzzati, Silone, Moravia, Pavese, Tomasi di Lampedusa, Malaparte, Levi, Cassola, and Sciascia. Emphasizes the relationship of art and politics, the idea of the modern, and the image of women in Italian fiction.

5 units, Win (Ruotolo)

181. Dante's Inferno—(Also listed as English 181.) Seminar on Dante's classic work, with equal emphasis on historical interpretation and literary ambience.

5 units, Win (Ruotolo)

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, Benini, Celli, Gori)
90. Advanced Italian.
5 units, Aut, Win, Spr (J. Mammarella, Benini, Celli, Gori)

Italian Language Continuation Courses—Grammar, conversation, and composition are presented in the context of a literary or social issues theme. Students enroll in Language Continuation at the appropriate level during their second and third quarters in Florence.
5 units, Aut, Win, Spr (J. Mammarella, Benini, Gori)

STANFORD PROGRAM IN OXFORD

Director: Geoffrey Tyack
Associate Director: Pamela Murray
Faculty: David Abernethy, Nicholas Crafts, John Durant, John L’Heureux, Ruth Mateer, Brendon McLaughlin, David Miles, Syed Rizvi

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.

SOCIAL SCIENCES, NATURAL SCIENCES AND TECHNOLOGY

25. The Rise and Fall of Europe's Overseas Empires, 1415-1980: A Comparative Survey—(Also listed as Political Science 25.) A comparative historical analysis of European exploration, conquest, and colonial rule in Latin America, the Caribbean, Africa, and Asia, emphasizing the British experience. Factors affecting the timing, character, and effectiveness of nationalist movements in the Third World. Impact of colonialism on post-colonial political and economic systems. (DR:5*)
5 units, Spr (Abernethy)

114. Modern British Economy Since World War II—(Also listed as Economics 114.) The growth and development of the British economy since the Second World War. Major topics include the E.E.C., the British Pound, North Sea Oil, and “Thatcherism.” (DR:5)
4-5 units, Aut (Crafts)

115X. British Economic Policy and European Economic Integration—(Also listed as Economics 115X.) Introduction to international economic policy through a British perspective. Concentration on Britain and the World Economy, with special reference to the E.E.C. (DR:5)
4-5 units, Spr (Crafts)

127X. Decolonization and After: The British and French Experiences: 1945-1980—(Also listed as Political Science 127X.) A seminar that examines the differences and similarities in British and French colonial policy. Also the differing processes of decolonization after 1945, and the present relationships with former colonies.
5 units, Spr (Abernethy)

132X. The British Empire and the Commonwealth—(Also listed as History 144V.) British imperialism in the 20th century and its legacy today. Topics are the Commonwealth as an element in international affairs, immigration from the Commonwealth, trade with and aid to the Third World.
4-5 units, Aut (Rizvi)

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-World War II era. Economic and diplomatic aspects, specific controversies such as Britain’s role in World War II, Yalta and its legacy, Suez, and unilateral disarmament.
4-5 units, Win (Holmes)

141. Authority, Hierarchy, and Resistance: Politics and Society in England, 1560-1660—(Also listed as History 141.) A historical introduction to this period which also includes a discussion of society and politics. Major themes include: social structure and social values; central and local government; systems of belief; religious and political dissent; the family; major intellectual trends.
5 units, Aut (Bryson)

143B. British History 1870-1970—(Also listed as History 143B.) The development of Britain from the high-water mark of her power in the 1870s to her more modest position in today’s world. Evolution traced chronologically: economic decline, world wars, the abdication of the Empire. Themes are explained in their international context simultaneously with those internal developments which have contributed to the creation of the democratic franchise, the growth of central government, the establishment of a welfare state, and the gradual though uneven improvements in the living standards of the people. (DR:5)
4-5 units, Win (Tyack)

169. Darwin’s Century: Science and Belief in the Victorian Age—The changing relationship between scientific and religious beliefs in the 19th century, particularly in relation to the emergence of evolutionary theories of the origin of species and societies.
5 units, Aut (Durant)
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, Win (Tyack)

Tutorials in Science and Engineering may be arranged.

LITERATURE AND ARTS

131. Values, Ethics, and Law—An analysis of the values and standards of conduct in light of traditional ethics; the widening dimensions of human self-interpretation in light of modern scientific, political, and legal developments; and the problems of planning for the future.
5 units, Win (McLaughlin)

142V. Archeology and the Making of the British Landscape—A historical study of man's impact on the land of England from prehistoric times to the end of the Middle Ages. Emphasis is on what can be seen, Stonehenge, hill forts, Roman villas, medieval towns, and archeological techniques.
4-5 units, Win (Rowley, Miles)

174. Literature and Society in 19th-Century Britain—Survey of 19th-century literature in its social setting. Topics include education, the city, the woman question, art and architecture, the working classes, religion, medievalism, and aestheticism.
4-5 units, Aut (Staff)

176X. History of English Architecture—(Also listed as Art 176X.) A chronological study of the development of English architecture from the early Middle Ages to the 20th century, using examples from Oxford and places within easy. Analysis is on 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, Aut (Tyack)

181. The Early 20th-Century Novel and Its Legacy—Novels studied include works by Conrad, Woolf, Lawrence, Joyce, Rhys, Swift, and Carter.
4-5 units, Spr (Mateer)

182. The Modern British Comic Novel—(Also listed as English 182.) An overview of British comic fiction in this century, including works by Waugh, Greene, Amis, Murdoch, Spark, Lodge, and Pym.
5 units, Win (L'Heureux)

183. Modern Drama—(Also listed as English 183.) The great innovators of modern drama, Ibsen, Chekhov, and Strindberg, and their influence on contemporary plays in production in and around London.
5 units, Win (L'Heureux)

STANFORD PROGRAM IN TOURS

Director: Paul LeMoal
Assistant Director: Claude Doubinsky
Assistant Director: Anne Durand
Faculty: Jean Noel Billard, Gerald Chaix, Robert Cohn, Olivier Dufresne, Annie Galinie, Andre Gorgues, Nancy Green, Michelle Jomaron, Guy LeBoucher, Francois Perdoux, Paul Switzer

SURVEY COURSES

It is suggested that each quarter students take one survey course from among the following:

115X. History of Art: The Renaissance in Italy and France—Students are acquainted with great periods, monuments, and masterpieces of French art. Lectures focus on the architecture and interior decoration of castles, churches, and cities, on French painting and sculpture, and the chief artistic techniques used over the centuries. Field trips are organized to cities and museums.
4 units, Win (DuFresne)

119. Introduction to French Art: Romanesque to Renaissance—(Also listed as Art 119.) French art from the Fuedal Ages to the onset of the Modern Period. Approach is both historical and analytical; students become acquainted with major works and artists through lectures and slides, complemented with field trips to museums, castles, churches and archeological sites. Periods covered are Pre-Romanesque, Romanesque, Gothic, and Late Gothic.
4 units, Aut (DuFresne)

121X. Painting and Society in France—The artist's position in relation to French society and the French state since the 17th century. Special emphasis on the history of painting.
4 units, Spr (Dufresne)

129. Mythologies Historiques de la France: de Jeanne d'Arc a Mitterand—(Also listed as History 129.) The great French historical figures from Joan of Arc to President Mitterand approached chronologically with a double focus: their roles in history, and their mythical status in the collective imagination of the French as conveyed by books, iconography, comic strips, and films.
4 units, Spr (Chaix)
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<tr>
<th>Course</th>
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<tr>
<td>130A</td>
<td>Survey of French History: 1715 to the Present — (Also listed as History 130A.) Chronological and thematic survey of French history since Louis XIV. Covers political, social, and economic developments, with emphasis on the emergence of republicans in France, and its subsequent evolution. <strong>5 units, Aut (Green)</strong></td>
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<td>131T</td>
<td>French Literature Survey: 17th Century — (Also listed as French 131T.) The works and authors that made the most significant contributions to western literary culture. The 17th century is viewed as the Age of Classicism. A brief introduction to the main features of Renaissance Humanism as they relate to intellectual developments in the 17th century, lectures on the pessimistic vision of the French moralists (Pascal, La Rochefoucauld, La Bruyere, Madame de Lafayette) and on some of the most important plays of Corneille, Racine, and Moliere. (DR:2) <strong>4 units, Aut (Doubinsky)</strong></td>
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<tr>
<td>132T</td>
<td>French Literature Survey: 19th Century— (Also listed as French 132T.) The evolution of the 19th century French novel focusing on works by Stendhal, Balzac, Flaubert and Zola. These novelists are studied in detail for their intrinsic literary qualities but also because, taken together, they trace the progression of realism in French fiction. (DR:2) <strong>4 units, Win (Doubinsky)</strong></td>
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<td>133T</td>
<td>Survey of French Literature: Twentieth Century— (Also listed as French 133T.) Some of the masterworks of the 20th century French novel. Introductory lectures on 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) <strong>4 units, Spr (Doubinsky)</strong></td>
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<td>132X</td>
<td>Les Problemes contemporains de la croissance economique— (Also listed as Economics 132X.) The concept of economic growth including its definition and measurement, short term and long range consequences, relationship to inflation, and its specific expression on the French economy. (DR:5) <strong>5 units, Aut (Leboucher)</strong></td>
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<td>135</td>
<td>Social History of Modern France from the Third Republic to the Present— (Also listed as History 135.) Issues in the social history of France since the commune. Emphasis on historiography and original texts. <strong>4 units, Win (Green)</strong></td>
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<td>139</td>
<td>France and Europe and the Economic Crisis— 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 function of the international monetary system. Theoretical solutions and concrete policy options are discussed. <strong>5 units, Win (Leboucher)</strong></td>
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<tr>
<td>140</td>
<td>Foundations of Probabilistic Reasoning — (Also listed as Statistics 140.) The historical development of modern probability theory and its application to the social and physical sciences. Emphasis on the contributions of French philosophers and mathematicians (most notably Pierre Simon de Laplace). <strong>4 units, Spr (Switzer)</strong></td>
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<tr>
<td>140X</td>
<td>France and the Third World— (Also listed as Political Science 140.) Introduction to France’s interactions with the Third World from the standpoint of France’s two main geopolitical perspectives: Africa and the Middle East. A brief historical introduction to France’s legacy of colonization and the economic, military, and technical issues that it raised. Deals with France’s relations with both Maghreb (Tunisia, Algeria, Morocco) and Black Africa. Beginning with DeGaulle’s policies, and French policies and cooperation agreements through the present de-stabilizing activities of Cuba and Libya. Second half of the course deals with France’s role in the Middle East. Topics include 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) <strong>5 units, Win (Billard)</strong></td>
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4-5 units, Aut (Cohn)

115T. L'Existentialisme Littéraire — (Also listed as French 115T.) The literary expression of existentialism through the studies of representative works. Emphasis on 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 centered on Camus and Sartre.

4 units, Win (Jomaron)

131W. The New French Cinema: A Sociological Approach—(Also listed as Sociology 131W.) Based on some of the most novel French films, lectures and discussions focus on technical and social conditions of film production, reception, criticism, ideological and documentary functions. Familiarizes American students with methods of film analysis and the problems of modern French society.

4 units, Win (Jomaron)

141. French Theater: The Avant-garde—The works of Ionesco, Beckett, and Genet as a way of understanding the cultural mutation that overtook Western societies in the aftermath of World War II.

4 units, Spr (Perdoux)

173. The Symbolist Poets—(Also listed as French 262T.) Seminar on the works of Baudelaire, Mallarmé, Verlaine, Rimbaud, Laforgue, and Valéry. Readings are in French.

4-5 units, Aut (Cohn)

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 de textes.

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)

STANFORD PROGRAM IN VIENNA

Director: Siegfried Korninger
Associate Director: Hedwig Thimig
Language Program Coordinator: Margaret Mehrl
Faculty: Gabriel Bachmaier, Roswitha Benesch, Peter Gerlich, Hans Heinrich, James Howell, Max Larsen, Maximilian Peyfuss, Wendelin Schmidt-Dengler, Charlotte Teuber, Jan Triska, Karl Vocelka

SOCIAL SCIENCES AND NATURAL SCIENCES

40X. The Economics of Contemporary Europe—The major industrial economies of Western Europe from the viewpoint of economic structure, planning and policy, and economic performance. The Common Market and one or two examples of planned Eastern European economies are also considered.

4-5 units, Win (Howell)

52X. Macroeconomic Analysis and Policy—Develops an analytical understanding on equilibrium, instability, and change in the products, money, and labor markets of a modern industrial economy. Illustrative material is drawn from both the U.S. and Europe.

4-5 units, Win (Howell)

123. Austria and Southeast Europe—(Also listed as History 123.) The role of Austria in the history of Southeastern Europe examined from the time of the Ottoman onslaught through the Christian liberation, the two World Wars and the Soviet aftermath.

4 units, Win (Howell)

126. Politics in Eastern Europe—(Also listed as Political Science 126.) Seminar examining the political systems of the eight Eastern European states in terms of their historical development, policy-making processes, and their system maintenance and adaptation. Attention to Eastern Europe as a region in world politics.

5 units, Spr (Triska)

127. Comparative European Politics—Comparative study of the variety of governments operating in Central Europe at the present time. National variations and conditions of success or failure are analyzed. Origins, develop-
opment, and effects of European social and political institutions.

4 units, Aut (Gerlich)

130. Introduction to International Law—(Also listed as Political Science 130.) A broad overview of the theories, concepts, and present tendencies of international law as a policy process in the critical area of international interaction. Provides some practical experience in the methods of analyzing cases and problems in light of international legal principles.

5 units, Spr (Triska)

130X. Eastern Europe Since 1945—(Also listed as Political Science 130X.) The moving forces and main trends of post World War II political, economic and social development in Eastern Europe. Using comparative techniques, different patterns and variations are explained by the interplay of external and domestic factors. Emphasis on the analysis of decision making processes under the specific economic social and political constraints characteristic of the East European area.

4 units, Win (Heinrich)

135. Eastern Europe Today—The patterns of development that resulted from the imposition of a Marxist-Leninist regime on societies with widely different socioeconomic levels and cultural traditions. Emphasizes the contrasting perspectives of the Soviet Union, continuity and security, with the internal view of the smaller East European states.

4 units, Win (Bachmaier)

150. International Institutions in Vienna—An examination of regional and global attempts to bring about a well-ordered international system. Proceeds from a study of international law to an examination of the scope and function of international institutions, including the rise of non-governmental agencies as complementary factors.

4 units, Win (Teuber)

151. Global Relations: The Threat of Conflict and the Quest for Order—The rise of multipolarity in world politics; the effects of domestic or regional politics on the foreign policy of distant powers; old and new concepts of international relations. Includes attendance at international conferences and interviews with statesmen as part of a student project.

4 units, Win (Vocelka)

170. Survey of Habsburg History, 1867 to the Present—An introduction to the historical problems of Central Europe from the last decades of the Habsburg Monarchy to the development of the 2nd Austrian republic, and the present system in Eastern Europe. Topics such as industrialization, cultural development, secularization, administrative centralization, and the national tensions of a multi-national empire. The rise of Fascism in Austria is analyzed in detail.

4 units, Win (Benesch)

171. The Nationality Problem from Empire to Republic—Seminar on one of the major issues of Central European history in the 19th and 20th centuries, the disintegrative and integrative function of nationalism. Analyzes selected problems of nationalities in the context of culture and politics, including the continuation of minority problems in the two Austrian republics.

4 units, Win (Vocelka)

LITERATURE AND ARTS

5. Opera and Operetta in Vienna—The historical development of the German opera as drama, suggesting the continuity of such traditional Viennese genres from the comic opera to the opera of fantastic idealism. Other topics include the Singspiel tradition, German Romantic opera, symbolic structure in Wagner, and expressive and naturalistic elements of Berg, and the development of the Viennese waltz and operetta and the changing self-image of Viennese society as viewed through opera. The specific operas for discussion are coordinated with the current repertoire of the Vienna Opera. (DR:2)

4 units, Aut, Spr (Larson)

6. The Viennese Tradition in Instrumental Music from Haydn to Mahler—A non-technical introduction to the development of symphonic and chamber music in Vienna from Early Classic to Late Romantic. Haydn, Mozart, Beethoven, Schubert, Brahms, Bruckner, Mahler, and Strauss. Enables the student to recognize and analyze the characteristic styles of these major figures, and to understand their achievements within their aesthetic tradition and social context. (DR:2)

4 units, Win (Larsen)

12. Art and Museums: Art of the 19th and 20th Centuries—A survey of 19th and early 20th century painting, with emphasis on the holdings of the major galleries and museums in Vienna. Austrian and European movements are discussed.

4 units, Aut, Spr (Benesch)

100. Seminar: Art in Austria, 1860-1918—Major works of the period by Klimt, Schiele, Hofmann, Wagner, and others, are examined and compared. Stress is on individual research under the guidance of the seminar leader, and on the ability of students to analyze art works visually. Limited to 12 students.

4 units, Win (Benesch)
101C. Drama in Vienna Theatres — (Also listed as Drama 101C.) A survey of typical Austrian dramatic forms which reflect the social and political conditions of their times during the 19th and 20th centuries. Students will attend performances in Vienna when possible. (DR:2)  
4 units, Win (Thimig)

167. Austrian Literature—(Also listed as German 167.) A survey of the major Austrian literary works of the 19th and 20th centuries. (DR:2)  
4 units, Aut (Korninger)

243. The Intellectual Scene Since 1900—(Also listed as German 243.) An introduction to the literary, cultural, and political contributions of Austrian intellectuals, such as Freud, Wittgenstein, Schnitzler, Hofmannsthal, and Kafka. (DR:3)  
4 units, Spr (Schmidt-Dengler)

GERMAN LANGUAGE PROGRAM

70. Intensive German—The equivalent of German 3, using the Lo-Stro text with supplementary material which will concentrate on the speaking and comprehension of everyday German.  
6 units, Aut, Win, Spr (Mehrl, Staff)

80. Intermediate Intensive German—Review of grammar, reading of texts and essay writing, plus concentration on speaking and comprehension.  
6 units, Aut, Win, Spr (Mehrl, Staff)

90. Advanced Intensive German—Concentration on increasing the student's active vocabulary, including reading, essay writing, and limited grammar review.  
6 units, Aut, Win, Spr (Mehrl, Staff)

STANFORD PROGRAM IN HAIFA

Director 1986-87: Mark Mancall

STANFORD PROGRAM IN PARIS

Director 1986-87: Hans Weiler

STANFORD PROGRAM IN SALAMANCA

Director: Isabel Criado

OXFORD SUMMER FOCUS
PROGRAM 1987

ALTERNATIVE HEALTH CARE DELIVERY SYSTEMS

During the Summer Quarter of 1987 Overseas Studies will offer an eight-week Summer Focus program on Alternative Health Care Delivery Systems under the direction of Professor Count Gibson of the Stanford Medical School. For more information, please contact the Overseas Studies Office.

SUMMER PROGRAM IN KRAKOW

During the Summer Quarter of 1987, Overseas Studies will offer an eight-week program of courses on International Relations and Polish History and Culture, in conjunction with the Jagiellonian University in Krakow, Poland under the direction of a member of the Stanford faculty. For more information, please contact the Overseas Studies Office.

PHILOSOPHY


Chairman: Michael Bratman

Director of Graduate Study: Jon Barwise

Director of Undergraduate Study: Stuart Hampshire

Professors: Jon Barwise, Nancy Cartwright, Solomon Feferman (on leave), Dagfinn Føllesdal (Spring, Summer only), Julius Moravcsik (on leave), David Nivison (on leave Autumn, Spring), John Perry, Patrick Suppes, Thomas Wasow

Associate Professors: Peter Galison (on leave Autumn, Winter), Wilbur Knorr (on leave)

Assistant Professors: John Dupré, John Etchemendy, Eckart Förster, Richard Pruitt, Jean Roberts (on leave Autumn)

Courtesy Professor: Denis Phillips

Lecturers: William Beardsley, Daniel Conway, Valerie Hartouni

Visiting Professors: Ruth Doell (Autumn only), Robert Goldblatt (Autumn only)

Visiting Associate Professors: Richard Creath (Winter, Spring), Helen Longino (Autumn only), Norton Wise (Winter only)

Visiting Assistant Professors: John Bogart, Nicholas Denyer (Autumn, Winter), Jane Maienschein (Winter, Spring)

Consulting Associate Professors: David Israel, C. Raymond Perrault, Brian Smith
Offerings and Facilities

Philosophy concerns itself with fundamental problems. Some of these are rather abstract and deal with such issues as the nature of truth, justice, value and knowledge; others are more concrete and their study may help guide our conduct or enhance our understanding of other subjects. In addition, philosophy examines the efforts of past thinkers to understand the world and our experience of it.

Although it may appear to be an assortment of different disciplines, there are features common to all philosophical enquiry. These include an emphasis on methods of reasoning and the way in which our judgments are formed, on criticizing and organizing our beliefs, and on the nature and role of fundamental concepts.

Students of almost any discipline can find something in philosophy which is relevant to their own specialties. For those interested in the sciences, philosophy provides a framework within which the foundations and scope of a scientific theory can be studied, and it may even suggest directions for future development. Since philosophical ideas have had an important influence on human endeavors of all kinds—artistic, political, even economic—students of the humanities will find their understanding deepened by some acquaintance with philosophy.

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 ten 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
      3) Ethics: 170 or 171
      4) Metaphysics and Epistemology: one from 181-187
      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 ten 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 Courses and Degrees. 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 "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 to total 8 units from the following: 100, 101, 102, 103, 105, 111, 112, 113, 124, 226.

4. Three history of science courses to total 12 units from the following: 138A,B,C, 140, 145, 151, 152, 154, 169, 169, 237A,B,C.

5. Three philosophy of science courses to total 12 units from the following: 159, 162, 164, 165, 166, 167, 242A,B,C.

Students should note that additional courses satisfying sections 3, 4, or 5 may be listed in future catalogs.

6. At least six courses in the major must be completed at Stanford with a grade 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 average, demonstrated ability in philosophy, and progress towards satisfying the requirements of the major.

Students applying for the Honors Program should submit an intended plan of study for the remainder of their junior and senior 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 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 spread 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.
   c) History of Philosophy: Philosophy 100 or 102.

2. Religious Studies courses:
   Twenty units, including at least two courses in diverse religious traditions (e.g. an Eastern and a Western or a literate and a preliterate tradition) and including at least one seminar.

3. General major courses:
   An additional five courses (approximately 20 units) divided between the two departments. No more than 5 of these units may come from courses numbered under 99 in either department. Each student must also take at least one undergraduate seminar in religious studies and one undergraduate seminar in philosophy.

4. Special Concentration:
   With the aid of an advisor, students will pursue a specialized form of inquiry in which the combined departments have strength, e.g., American philosophy and religious thought, philosophical and religious theories of human nature and action, philosophy of religion. Courses for this concentration must be approved in writing by the advisor.

5. Directed Reading and Pass/No Credit Units:
   a) Units of directed reading for fulfilling requirements of the joint major will be allowed only with special permission.
   b) No more than 10 units of work with a grade of Pass will count toward the joint major.

HONORS IN THE JOINT MAJOR

Students pursuing a joint major in Philosophy and Religious Studies may also apply for honors by following the procedure for honors in one or the other department.

COTERMINAL DEGREE

The Philosophy Department offers a coterminal degree at both the undergraduate and master’s level. Please see either the Director of Undergraduate Studies or the Master’s Advisor to be admitted to the appropriate level of the program, and have your proposed coursework approved in writing.

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 stu-
dent 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 grades 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.

Oral Examination—Students in both the general and special programs are required to take an oral examination in the quarter during which the candidate expects to receive the degree. In the event of failure more courses may be required, and then the examination may be attempted one more time only.

GENERAL PROGRAM
The student must have a minimum of 36 units in philosophy, of which 32 must be in courses numbered above 99. The requirement has three parts:

1. Undergraduate core—Students must have when they enter, or complete early in their program, the 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 or 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 110 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.

3. Specialization—Students must take at least three courses numbered over 110 in one of the 5 areas.

SPECIAL PROGRAM IN THE HISTORY AND/OR PHILOSOPHY OF SCIENCE
Only students with substantial preparation in philosophy or in the history of science or in one of the natural or social sciences will be admitted. Entering students whose primary preparation has been in science may be required to satisfy all or part of the undergraduate core requirement as described in the General Program. Students whose preparation has not been in science may be required to take additional science courses.

COURSE REQUIREMENTS
1. At least four courses in the Philosophy Department in the history or philosophy of science. At least two of these must be graduate level courses, or graduate sections of undergraduate courses, and at least one of the four must be in the philosophy of science and one in the history of science.
2. In most cases, one upper division or graduate course outside the philosophy department in the natural or social sciences or in history.
3. Remaining courses are to be chosen in consultation with an advisor, and must be approved by the advisor. Students centering on philosophy are expected to take the graduate core course in philosophy of science.

SPECIAL PROGRAM IN THE PHILOSOPHY OF LANGUAGE
Only students with substantial preparation in philosophy or linguistics will be admitted. Entering students whose primary preparation has been in linguistics may be required to satisfy all or part of the undergraduate core requirement as described in the General Program. Students whose preparation is primarily in philosophy may be required to take additional courses in linguistics.

COURSE REQUIREMENTS
1. Philosophy of language: Two approved courses in the philosophy of language numbered over 180.
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 and 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 "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.

PROFICIENCY REQUIREMENTS

1. The four core seminars (each lasting one and a half quarters, meeting two times per week for two hours and taught by two faculty members):
   a) Philosophy of Science 251 A and B.
   b) Ethics 270 A and B.
   c) Metaphysics and Epistemology 280 A and B.
   d) Philosophy of Language 281 A and B.

2. First-order Logic 160A.

3. Ancient History Examination.

4. Modern History Examination.

5. Breadth Requirement: A course in Eastern or Continental philosophy, or some other course establishing additional breadth. Courses offered outside the Philosophy Department should be approved in advance by the advisor.

Language Requirements—There is no departmental language requirement, but a dissertation committee may demand that a student demonstrate competence in languages needed for research.

Teaching Assistance—All Philosophy Ph.D. students are required to do six quarters of teaching assistance at 25% time.

Oral Examination and Dissertation—The University oral examination is taken after completion of an acceptable first draft of the dissertation, and is primarily a dissertation defense. The dissertations must be completed and approved within five years from the date of approval of candidacy. A candidate taking more than five years will be required to reinstate candidacy through obtaining approval of the whole department.

The dissertation must be submitted to the committee in substantially final form at least four weeks before the University deadline in the quarter in which the candidate receives the degree.

SPECIAL GRADUATE PROGRAMS

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.

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.

A student may be exempted from one from list A and one from list B:

<table>
<thead>
<tr>
<th>List A</th>
<th>List B</th>
</tr>
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<tbody>
<tr>
<td>One core seminar</td>
<td>160A (but take 57)</td>
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<tr>
<td>Both history exams</td>
<td>One history exam</td>
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</tbody>
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Ph.D. MINOR IN PHILOSOPHY

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 grades 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
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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."

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 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

Check 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 include selections from Greek literature and prose, Greek philosophical writings, and selections from the Hebrew and Christian traditions. Recommended for entering students. (DR: 1; three-quarter sequence)
5 units, Aut (Denyer) 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 are studied in historical context. Authors include St. Augustine, St. Thomas Aquinas, Avicenna, Dante, Shakespeare, More, Machiavelli and Descartes. In addition to such achievements, the seminar sides of western culture are also examined such as slavery and anti-semitism. (DR: 1; three-quarter sequence)
5 units, Win (Perry) MWF 10 plus 2 hour section
5C. Ideas in Western Culture: Ideas of Human Liberation—Conceptions of the problems and possibilities of human life in the light of the breakdown of traditions in religion, science, literature, and society in the 19th and 20th centuries. Readings from Voltaire, J.S. Mill, Oscar Wilde, William James, T.S. Eliot, J.P. Sartre and others. (DR:1; three-quarter sequence)

5 units, Spr (Fellesdal) MWF 10 plus 2 hour section

10. God, Self and World: Introduction to Philosophy—An introduction to some of the basic problems, concepts and methods of Western philosophy. Problems about the nature and existence of God, minds and things are approached through a close study of both contemporary and classical philosophical texts. (DR:3)

5 units, Aut (Dupré) MWF 11 plus section

20. Introduction to Moral Theory—Topics include: What makes acts and policies right? To what extent can disagreements on moral matters be settled by reasoning and by argument? These questions are approached through a review of still influential classics of moral philosophy. The social and political implications of different moral theories are examined. (DR:3)

5 units, Win (Hampshire) MWF 11 plus section

30. Public Morality: Introduction to Political Philosophy—Natural law and natural rights; justice and equality; liberty and authority; the common good and social utility. What happens when private and public morality conflict? Emphasis on the development of social contract doctrines and liberal democratic theory, their modern descendants, and criticisms from the point of view of alternative ideologies.

5 units, Spr (Hartouni) MWF 11 plus section

42. Philosophy of Religion—(Enroll in Religious Studies 42.) Traditional and modern problems concerned with religion: belief and evidence; omnipotence and evil; foreknowledge and freedom of the will.

3 units, Aut (Gelber) MWF 11

46. Introduction to Chinese Philosophy—(Same as 120, Asian Languages 46, Religious Studies 55.) The history of Chinese philosophy to 200 B.C., together with a brief introduction to Classical Chinese as used by early philosophers. (Majors enroll in 120.) (DR:3*)

4 units, Spr (Ivanhoe) MWF 10

sections by arrangement

57/157. Introduction to Logic.

57. Section 1. Computer-based course; no lectures. Axioms and rules of inference for sentential and first-order predicate logic. Elementary applications to a wide variety of domains. Individual choice of topics for a grade beyond pass. Students progress through course at 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 course. Study of propositional and predicate logic, emphasizing translating English sentences into logical symbols and constructing derivations of valid arguments. (DR:6)

5 units, Aut, Win, Spr (Staff)

60. The Growth of Scientific Knowledge—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 Haack. Case studies of Copernican and Einsteinian revolutions with historical scrutiny. Readings from philosophers, historians and the original texts. (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 such questions as 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, Win (Maienschein) MWF 11

77. Ethics in International Relations—Problems of human rights as the basis for discussing cross-cultural views of norms and values; dominant Western conceptions; similarities and differences between problems of domestic and international morality; divergent types of obligations and rights; and implementation of ideals in the international community.

4 units, Spr (Bogart) MWF 10

79. Philosophy of Law—Topics include the nature and function of law, the relations between legal and moral norms, the role of the judiciary under different systems, and the nature of legal reasoning. Major theories considered are historically and in their application to selected current problems under the U.S. Constitution. Prerequisite: One course in ethics or political theory or consent of instructor.

4 units, Win (Bogart) MWF 10

80. Mind, Matter and Meaning—Intensive and rigorous survey of some central and perennial topics in philosophy: skepticism and the possibility of knowledge; perception and "the
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given" the distinction between analytic and synthetic truths; meaning, verification, sense and reference; induction, causality and explanation; the relation between mental and physical phenomena; our knowledge of other minds. Provides background for advanced work. A writing intensive course. Prerequisite: One philosophy course (strictly enforced).

5 units, Win (Bratman) MWF 1:15 plus section

HISTORY OF PHILOSOPHY

Courses 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.) An examination of 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.) Survey of Medieval and Renaissance philosophy with a focus on the implications of believing the world is a product of a creator God. Time and eternity, free will and determinism, necessity and contingency, through Medieval and Renaissance debates. Readings include 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) TTh 8:35-9:50

103. 19th Century Philosophy—Ideas and conceptions that shaped 19th century philosophy. Fichte, Hegel, Marx, Kierkegaard, Nietzsche.

4 units, given 1987-88


4 units, given 1987-88

106. William James—A critical study of the relationship between James' *Principles of Psychology* and *Pragmatism*.

4 units, Aut (Pruitt) MWF 1:15

111/211. Plato—(Graduate students register for 211.) A survey of Plato's metaphysics and epistemology.

4 units, Win (Denyer) TTh 2:15-3:30

112/212. Aristotle—(Graduate students register for 212.) The development of Aristotle's metaphysics and its implications for his psychology, ethics, and philosophy of science. Readings from the *Categories, Metaphysics, Posterior Analytics, De Anima, Nicomachean Ethics, and Parts of Animals*.

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

119. Spinoza and Leibniz—A comparative study of the two philosophies, with particular attention to their theories of knowledge and of explanation. The assigned texts are Spinoza's *Ethics* and a collection of readings from Leibniz's principal works.

4 units, Aut (Hampshire) TTh 10-11:15

120. Introduction to Chinese Philosophy—(Same as Philosophy 46. For philosophy majors.)

127. The Vienna Circle—(Same as History of Science 127.) Surveys the history of 20th century positivism, concentrating on the central epistemic doctrines of Schlick and Carnap. The latter part of the course assesses how well these doctrines survive an extended attack by Quine.

4 units, Win (Creath) MWF 1:15

131/231. Kant's Critique of Practical Reason—(Graduate students register for 231.) A historical and systematic study of Kant's ethics and philosophy of religion, with special attention to Kant's second *Critique*.

4 units, Aut (Förster) MWF 9

133/233. Friedrich Hölderlin: Philosopher and Poet—(Same as German Studies 260/360.) His thought in relation to the philosophy of German Idealism (Fichte, Schelling, and notably Hegel), and the development of his poetic and poetic discourse. To be read: Hegel, some early writings and "Preface" to the *Phenomenology*; Hölderlin, major theoretical statements, *Hyperion*, selected poems from the early period to the later hymns.

4 units, Spr (Förster, Mueller-Völlmer) MWF 11

134. Phenomenology and Its Background—A survey of the development of phenomenology and its contemporary philosophical significance, an analysis of the writings of Husserl and others.

4 units, Sum (Follesdal)

135. Hermeneutics and Critical Theory—An introduction to two of the most important and
influential schools in 20th century German philosophy and the work of four leading representatives of these schools, i.e. Heidegger, Gadamer, Habermas, and Apel.  

4 units, Spr (Förster) TTh 11-12:15

HISTORY OF SCIENCE


138A. Ancient Period—(DR:3. Also satisfies Area 6 when taken in sequence with 138B.) 4 units (Knorr) given 1987-88

138B. Middle Ages to Newton—(DR:3. Also satisfies Area 6 when taken in sequence with 138A.) 4 units (Knorr) given 1987-88

138C. Newton to Einstein—(DR:3) 4 units, Spr (Creath) MWF 1:15

140. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Same as History of Science 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 (Knorr) given 1987-88

145. The Scientific Revolution—(Same as History of Science 145, VTSS 132, History 139.) Social, intellectual and institutional background of the period that established modern science, the 17th century. Stress on theories of matter and motion, especially 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 17th century texts and modern historical studies.

4 units, Win (Maienschein) MWF 2:15

152. The Darwinian Revolution and the Problem of Heredity—(Same as History of Science 152.) As a result of the Darwinian revolution, the biological question of what makes offspring the same as their parents became what makes offspring vary? We will examine what Darwin said about heredity and subsequent contributions leading to the establishment of genetics, and the intellectual structure and impact of evolutionary theory generally; specifically asking what is revolutionary about the "Darwinian Revolution."

4 units, Spr (Maienschein) MWF 2:15

LOGIC AND PHILOSOPHY OF SCIENCE

155. Empirical Truth and Approximation—The nature of hypothesis and theories in physics with special reference to the problems of data presented by ancient and classical astronomy.

3 units, Spr (Vuillemin) MW 1:15

156. Popper, Kuhn, and Lakatos—Three controversial figures in recent philosophy of science. Popper: scientific method 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, Spr (Phillips) MW 1:15-3:05

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 a computer-based course; 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)

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 (Etchemendy) MWF 9

160A. First-order Logic—The syntax and semantics of sentential and first-order logic, with an introduction to the basic concepts of model theory. Gödel's Completeness Theorem and its consequences (such as the Löwenheim-Skolem Theorem and the Compactness Theorem) are discussed and applied. Prerequisite: 159 or consent of instructor.

4 units, Win (Etchemendy) MWF 9

160B. Computability and Logic—A precise definition of "effective procedure" through Turing machines, register machines and recursive functions. Church's Thesis explained. These are used to develop Gödel's work on the undecidability of arithmetic, culminating in his famous Incompleteness Theorem. Also, other undecidable problems. Prerequisite: 160A.

4 units, Spr (Skowcroft) MWF 9

161. Semantics of Computation—An introduction to the basic concepts and tools used in the semantical analysis of programming languages, as well as embedded computational systems, like robots. Topics include denotational and operational semantics and the theory of situated
automata. Prerequisites: 160A, B. Concurrent enrollment in 160B with permission of instructor.

4 units, given 1987-88

162. Foundations of Measurement—(Same as Psychology 158A, B, C.) Detailed treatment of fundamental theories of measurement from a formal standpoint. Some attention to their empirical adequacy. Basic representation theorems for extensive, conjoint and difference measurements are a main topic. Organizational meeting 3:15 on the first class day of each quarter.

3 units, Aut, Win, Spr (Suppes)


4 units, Win (Dupre) MWF 10


4 units, Win (Wise) 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 (Bratman) MWF 1:15

171. Political Argument—Focuses on the relationship between morality and the law; specifically on the moral justifiability of legal coercion. Topics include paternalism, legal moralism, and welfare distribution through taxation. Main readings Mill and Hobson.

4 units, Aut (Bogart) 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. Focus on Quine, Goodman (philosophy); W.C. Williams, Wallace Stevens (poetry); R. Rauschenberg, J. Johns (painting. Modernism/post-modernism; Marcel Duchamp, John Cage; relationship between art and life; conceptions of art; dada, neo-dada.

4 units, Win (Pruitt) TTh 11-12:15

177/227. Feminism and Political Theory—(Graduate students register for 277.) Part I considers what various types of political theory (liberal, Marxist, socialist) say about the position and role of women, as well as feminist criticisms of those theories. Part II looks at more concrete political/ethical problems which have been of particular concern to feminists, e.g., affirmative action, pornography, abortion.

4 units, Spr (Roberts, Dupre) TTh 11-12:15

EPISTEMOLOGY, METAPHYSICS AND PHILOSOPHY OF LANGUAGE

Philosophy 80 or permission of the instructor is a prerequisite for the 180 series.

180. Philosophy of Language—The basic issues in the relationship between language, mind and world through the work of Frege, Russell, Tarski, Carnap, Quine, and Wittgenstein. Prerequisites: 80 and some background in logic.

4 units, Spr (Perry, Etchemendy) TTh 8:35-9:50

183/283. Meaning and Experience—(Graduate students register for 283.) (Same as Literature)
linguistics 138.) A study of the interrelationships between meaning and experience, with emphasis on how our judgments concerning meaning may be based on empirical evidence. Philosophers discussed include 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, given 1987-88

185. Philosophy of Rational Decision—Introduction to the problems of decision under uncertainty. Subjective probability, methods of deliberation. Prisoners' Dilemma/Newcomb's Problem, belief change, criteria for rationality, causal decision theory. Prerequisite: A course in philosophy and some familiarity with probability theory.
4 units, Win (Denyer) MWF 10

186. Philosophy of Mind.
4 units, Win (Denyer) MWF 1:15

194 Series. Undergraduate Seminars in Philosophy — A series of advanced undergraduate seminars. Enrollment limited to 12 in each seminar. Preference is given to undergraduate majors. Students should sign class lists in Philosophy Department office during pre-registration period. For those in the Philosophy Honors Program these seminars serve as a preparation for writing an honors thesis.

194A. Nietzsche's Critical Philosophy.
3 units, Aut (Conway) Th 1:15-3:05

194B. Representation, Philosophy, and Human Nature—A historical-critical course of philosophers and some art historians who either claim or attack the claim that representation (of the world, ourselves, others) is fundamental both to doing philosophy and being human. Possible authors include Descartes, Sartre, Bergson, James, Marx, Goodman, Sellars, Hacking, Rorty, Alpers.
3 units, Aut (Pruitt) T 1:15-3:05

194C. The Golden Rule.
3 units, Win (Nivison) T 3:15-5:05

194D. Chomsky: Language, Mind, and Responsibility—The philosophical implications of Noam Chomsky's writings on linguistics, psychology and politics. Topics are selected from: generative grammar, the innateness hypothesis, unconscious knowledge, explanation in psychology, realism and mental representation, abstraction and idealization, political responsibility, and the concept of community.
3 units, Win (Magnus, Neale) Th 1:15-3:05

194E. Knowledge and Self-Knowledge—A review of some problems in the philosophy of mind: desire, belief, emotion, and decision.
3 units, Spr (Hampshire) T 1:15-3:05

194F. Topic in Ethics to be announced.
3 units, Spr (Bogart) Th 1:15-3:05

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

211. Plato's Philosophy—(Same as 111.) For graduate students.
212. Aristotle's Philosophy—(Same as 112.) For graduate students.
231. Kant's Critique of Practical Reason—(Same as 131.) For graduate students.
233. Friedrich Hölderlin: Philosopher and Poet—(Same as 133.) For graduate students.
237A,B,C. Methods in the History of Science—(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 will pursue an individual research topic in consultation with the instructor.
3 units, Aut (Galison, Cartwright) T 4:15-6:05

Win, Spr (Maienschein) 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: Quantum Mechanics.
3 units, given 1987-88

3 units, given 1987-88

3 units, Spr (Suppes, Vuillemin, Follesdal) T 3:15-5:05

251A,B. Philosophy of Science—Intensive one and a half-quarter seminar in the philosophy of science, for first and second year students in doctoral program and possibly others with consent of instructor.
2 units, Win, 4 units, Spr (Cartwright, Dupré) MW 3:15-5:05

255. Seminar on Equity and Social Choice Theory—(Same as Political Science 267.)
3 units, Win (Hammond, Ferejohn, Suppes) M 3:15-5:05
264. Topics in the Philosophy of Linguistics—
(Same as Linguistics 231L.) Seminar on the
goals and methods of theoretical linguistics,
addressing such issues as the relationship be-
tween theory and data in linguistics, the "psy-
chological reality" of linguistic analyses, and
Katz's "platonism". Readings are drawn from
both the linguistic and philosophical literatures.
Prerequisite: Graduate standing in Linguistics
or Philosophy, or consent of instructor.
3 units, Aut (Wasow) T 10-12

265A,B. Semantics and the Logic of Natural
Language—(Same as Linguistics 231.) Two
quarter sequence treating a substantial frag-
ment 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 seman-
tic analysis, presenting rules of inference.
3 units, Win, Spr (Barwise) TTh 10-11:50

266. Seminar on Representation—Issues of
representation and modelling in philosophical
inquiry, especially in semantical analyses of
language, mind, and computation. Investigates
representation by both criticizing its implicit
treatment in the model theoretic and formal
linguistic traditions, and exploring some ex-
plicit new accounts.
3 units, Aut (Smith) T 10-11:50

270A,B. Moral Philosophy—Intensive 1½-
quarter seminar in moral philosophy, for first
and second year students in doctoral program
and possibly others with consent of instructor.
2 units, Win, 4 units, Spr, given 1987-88

272. Graduate Seminar: History and the
Theory of Politics—The implications of some
philosophies of history in political theory and
practice. Burke, Machiavelli, Vico, Rousseau,
Hegel, and Marx.
3 units, Spr (Hampshire) F 1:15-3:05

277. Feminism and Political Theory—(Same
as 177. For graduate students.)

280A,B. Metaphysics and Epistemology—In-
tensive one and a half-quarter seminar in meta-
physics and epistemology, for first and second
year students in doctoral program and possibly
others with consent of instructor.
4 units, Aut, 2 units, Win, given 1987-88

281A,B. Philosophy of Language—Intensive
one and a half-quarter seminar in philosophy of
language, for first and second year students in
doctoral program and possibly others with con-
sent of instructor.
4 units, Aut, 2 units, Win (Perry,
Etchemendy) MW 3:15-5:05

283. Meaning and Experience—(Same as 183.
For graduate students.)

326. Epistemological Problems of Artificial
Intelligence—(Same as Computer Science
236.) Formalisms for representing what a gen-
eral intelligence 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 counter-factuals. Connections
with philosophy, especially philosophical logic
and epistemology. Some familiarity with first
order logic is assumed. Offered alternate years.
3 units, Win (McCarthy) TTh 1:15-2:30

331. Seminar in Confucian Ethics—(Same as
Asian Languages 331, Religious Studies 238.)
Prerequisite: Consent of instructor.
3-5 units (Nivison) not given 1986-87

346. Seminar on Mind and Action — Discus-
soin of selected problems in the philosophy of
mind and action. Topic for 1986-87: Intention,
rationality, and moral theory.
3 units, Spr (Bratman) T 3:30-5:20

370. Graduate Seminar in Ethics.
3 units, Aut (Bogart) F 1:15-3:05

390A,B. Model Theory—(Enroll in Mathemat-
ics 290A,B.) Language and models of the first
order predicate calculus. Validity and definabil-
ity. Complete and decidable theories; applica-
tions to algebra. Saturated models, ultraproducts,
categoricity in power. Infinitary languages. Pre-
requisites: 160A,B and 158 or equivalent.
3 units, given 1987-88

391A,B. Recursion Theory—(Enroll in Mathe-
atics 291A,B.) Theory of recursive functions
and recursively enumerable sets. Turing ma-
achines and alternative approaches. Definability
in formal systems. Godel's incompleteness
theorems. Recursively unsolvable problems in
mathematics and logic. Introduction to recur-
sive ordinals and hierarchies. Prerequisites: 158
and 160A,B. or equivalent.
given when teaching staff available

392A,B. Proof Theory—(Enroll in Mathemat-
ics 292A,B.) Gentzen's natural deduction and
or sequential calculi for first order predicate
logic. Normalization, cut-elimination procedures. Extensions to infinitary calculi; ordinal complexity of proof trees. Subsystems of analysis and their reduction to constructive theories. Prerequisites: 160A,B or equivalent.

393A. 3 units, Aut (Staff) given 1987-88
393B. 3 units, Win (Staff) given 1987-88

394. Topics in Logic—(Enroll in Mathematics 294.) Topics vary from year to 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.

3 units, Spr (Simpson) TTh 1:15-2:30

396. Seminar on Issues in Logical Theory. 3 units, Win (Israel) T 4:15-6:05

450. Thesis. any quarter (Staff) by arrangement

PHYSICS

Emeriti: (Professors) Paul H. Kirkpatrick, Robert Hofstadter
Chairman: Alexander L. Fetter
Associate Professors: J. Richard Bond, Blas Cabrera, Savas Dimopoulos, Robert B. Laughlin
Assistant Professors: Bryan Lynn, C. Jeff Martoff, Peter Michelson
Acting Assistant Professors: Karsten Danzmann, Zein-Eddine Meziani, Jack 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 superconducting electron linear accelerator is currently under development 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), is under construction and when completed in early 1987 will provide electron-positron collisions at about 100 GeV.

Professor Mason Yearian is the Director of the High Energy Physics Laboratory; Professors Fairbank, Schwettman, Cabrera and Michelson are on the staff of the Laboratory. The staffs of the other branches of the W. W. Hansen Laboratories of Physics and the Stanford Linear Accelerator Center are mentioned elsewhere (see Applied Physics Department, Stanford Linear Accelerator Center).

One of the most important facilities is the Physics Library, which includes current subscriptions and back sets of important journals together with textbooks, scholarly treatises in English, French, German, and Russian, and the collected works of the most eminent physicists. It is a center for the reading and study of physics at all levels.

Course work is designed to provide students with a sound foundation in both classical and modern physics. The department also offers courses in gravitation, and students who wish to specialize in this field or in astronomy, astrophysics, or space science should also consult the Astronomy Course Program in this bulletin.

Undergraduates are also offered laboratory work at several levels. 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 physics and atomic collision physics, intermediate energy physics, high energy physics, coherent optical radiation, and solid state physics. The fields of astrophysics, microwave physics, plasma physics, ferrites, biophysics, and others of a similar nature are offered in the Applied Physics Department and in the Biophysics Program.

The number of graduate students admitted to
the Physics Department is strictly limited. Students should complete application by January 1 for the following Autumn. 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 Physics 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 also the study of a modern language. The requirements of Physics 55, 56, and 57 may be waived upon approval of the Physics Undergraduate Study Committee.

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 had a lesser background in science and mathematics. Students contemplating a major in physics are urged to consult with the instructor of Physics 61 at the earliest possible date to see which sequence would be the most suitable for them. Students who decide to enter the physics program after the freshman year would normally be advised to take the Physics 61, 62, 63 sequence, provided they had previously taken Mathematics 41, 42, and 43.

Sample programs in physics and mathematics under the two sequences are shown below. Students should consult their advisors about the course distribution requirements in other areas. The sequence of courses during the first two years is relatively inflexible, but considerable freedom exists during the upper-class years. Students are urged to work out, in consultation with their advisors, a program which will best fulfill their individual aims. The Undergraduate Office of the Physics Department has more detailed information on how to obtain a bachelor's degree in physics. This should be carefully studied by prospective majors, especially if they intend to make use of Stanford's programs abroad. Under some circumstances the department will permit, by petition, flexibility in the requirements so that the student may fit a period abroad into the program.

SEQUENCE I

FIRST YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Physics 51, 53. Mechanics, Electricity, Magnetism</td>
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<tr>
<td>Physics 54. Electricity, Magnetism Laboratory</td>
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<tr>
<td>Math. 41, 42, 43. Analytic Geometry and Calculus</td>
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SECOND YEAR*

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<tbody>
<tr>
<td>Physics 55, 57. Light and Heat, Modern Physics</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Physics 56. Light and Heat Laboratory</td>
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<tr>
<td>Physics 110, 111. Int. Mechanics</td>
<td>3</td>
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<tr>
<td>Math. 44, any additional Math course numbered 100 or higher. Advanced Calculus</td>
<td>3</td>
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<tr>
<td>Math. 130, 131, 132. Ordinary Differential Equations Partial Differential Equations</td>
<td>3</td>
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THIRD YEAR*

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<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Math. 106. Complex Variables (3)‡</td>
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FOURTH YEAR*

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<tbody>
<tr>
<td>Physics 105, 106, 107. Int. Physics Laboratory Seminars</td>
<td>3</td>
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<tr>
<td>Physics 120, 121, 122. Int. Electricity and Magnetism</td>
<td>3</td>
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<tr>
<td>Physics 130, 131, 132. Quantum Mechanics</td>
<td>3</td>
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<tr>
<td>Math. 106. Complex Variables (3)‡</td>
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</table>

*Students can follow either of the two course sequences. The 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 had a lesser background in science and mathematics. Students contemplating a major in physics are urged to consult with the instructor of Physics 61 at the earliest possible date to see which sequence would be the most suitable for them. Students who decide to enter the physics program after the freshman year would normally be advised to take the Physics 61, 62, 63 sequence, provided they had previously taken Mathematics 41, 42, and 43.

Sample programs in physics and mathematics under the two sequences are shown below. Students should consult their advisors about the course distribution requirements in other areas. The sequence of courses during the first two years is relatively inflexible, but considerable freedom exists during the upper-class years. Students are urged to work out, in consultation with their advisors, a program which will best fulfill their individual aims. The Undergraduate Office of the Physics Department has more detailed information on how to obtain a bachelor's degree in physics. This should be carefully studied by prospective majors, especially if they intend to make use of Stanford's programs abroad. Under some circumstances the department will permit, by petition, flexibility in the requirements so that the student may fit a period abroad into the program.
### SEQUENCE II

#### FIRST YEAR*

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<tbody>
<tr>
<td>Physics 61, 62, 63. Advanced</td>
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<tr>
<td>Math. 43H, 44H, 45H. Analytic Geometry, Calculus, Advanced Calculus</td>
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#### SECOND YEAR*

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<td>Physics 110, 111, 112. Int. Mechanics</td>
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<tr>
<td>Math. 106. Complex Variables (3)†</td>
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#### THIRD YEAR*

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<tr>
<td>Physics 130, 131, 132. Quantum Mechanics</td>
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#### FOURTH YEAR*

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<tbody>
<tr>
<td>Physics 200, 201. Advanced Physics Laboratory</td>
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### PHYSICS 543

**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 "B" average in courses 130, 131, 132, 170, 171, 172, 200, 201, 210, 211, 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 grade average of "B" during the last five quarters is required in the courses taken toward the Ph.D. degree.

Prior to making an application for Ph.D. candidacy, each student is required to pass a written comprehensive examination on undergraduate and first year graduate physics. This exam is given annually on the Thursday and Friday preceding the start of the Autumn Quarter. The examination should be taken at the end of the summer after the first year graduate courses have been taken. After completion of the thesis he or she must take the University oral examination (defense of thesis). The Physics faculty believes that it is valuable for a scientist to have facility with a foreign language for cultural reasons and in order to establish better contact at meetings in foreign countries.

The Physics Department does not require a minor, but students are advised that the following mathematics courses have been found useful for graduate study in physics, especially for theoretical work: 206, 210, 220, 254, 256.

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 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 Physics 170, 171, and 172, with the appropriate prerequisites. All prospective physics minors must receive approval of their Physics course program (at least one year before the award of the Ph.D.) from the Physics Graduate Study Committee.

The office of the Physics Department has more detailed information on how to obtain an advanced degree in Physics. This should be consulted by prospective candidates for advanced degrees.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the School of Education section of this bulletin or address inquiry to the Credential Administrator, School of Education.

The degree of Master of Arts in Teaching is offered jointly by this department and the School of Education. The degree is intended for candidates who have a teaching credential and who wish to strengthen further their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. A suggested minimum program in the teaching field of physics would be Physics 57, 64A, 64B, 105, 110, 111, 120, 121, and Mathematics 130, 131. Detailed requirements for the degree are outlined in the "School of Education" section.

FELLOWSHIPS AND ASSISTANTSHIPS

The Physics Department makes an effort to support all its graduate students. The support is through fellowships, teaching assistantships, research assistantships, or a combination of some of these. Application for financial aid will be sent to students with the application for admission.

COURSES

There are four series of beginning courses. The Ten Series (11, 14, 15, 19) is recommended for the humanities or social science student who wishes to become familiar with the methodology and content of modern physics. These quarters are independent of one another. The Twenty Series (21, 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 train-
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 1986-87

15. Cosmic Horizons—Familiarizes the non-science student with modern cosmology. After discussing the physical laws that govern the universe, its evolution is traced from the initial primeval fireball, through the formation of galaxies, stars, and planets to the development of life. Exotic astronomical objects, such as quasars, pulsars, and black holes, are discussed. Some algebra will be 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)

19. An Introduction to Physics (Physics for Poets)—A presentation from non-technical, non-mathematical viewpoints of the aims, methods (experimental and theoretical) and achievements in the attempts to understand the basic principles governing the physical world. Each topic is usually introduced through the historical background, but the emphasis is on present knowledge and current problems. Likely topics: classical mechanics, relativity, and quantum mechanics. (DR:7)

3 units, Aut (Staff) 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. Prerequisite: Working knowledge of elementary algebra and trigonometry. Calculus will be used as a language and developed as needed. (DR:7)

3 units, Aut (Quinn) MWF 10 or 11

plus one hour discussion by arrangement

Sum (Staff) MTWThF 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 (Quinn) by arrangement

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

plus one hour discussion by arrangement

Sum (Staff) MTWThF 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

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, (Schwettman) lec MWF 9 or 11; and 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 42 or 21, or consent of instructor. (DR:7)
   4 units, Spr (G. Fisher) lec MWF 9 or 10 and discussions by arrangement

54. Electricity and Magnetism Laboratory—Concurrent or prior registration in 53 is required. Mandatory P/NC grading.
   1 unit, Spr (G. Fisher) by arrangement

55. Light and Heat—Reflection and refraction of light, lens systems; light and electromagnetic waves; temperature, properties of matter, introduction to kinetic theory of matter. Prerequisites: 53 and Mathematics 43 or 23, or consent of instructor. (DR:7)
   4 units, Aut (Little) lec MWF 9 or 10 and discussions by arrangement

56. Light and Heat Laboratory—Concurrent or prior registration in 55 is required. Mandatory P/NC grading.
   1 unit, Aut (Little) by arrangement

57. Modern Physics—Relativity, experimental basis of quantum theory, Schrödinger equation, atomic structure, nuclear structure, high energy physics, elementary particles. Prerequisite: 55. (DR:7)
   3 units, Win (Ritson) TTh 11-12:15

58. Modern Physics Laboratory—Concurrent or prior registration in 57 is required. Mandatory P/NC grading.
   1 unit, Win (Ritson) by arrangement

61, 62, 63. Advanced Freshman Physics—An introduction to some topics in Newtonian mechanics, special relativity, electricity and magnetism, atomic physics and quantum mechanics from an advanced viewpoint. 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 (Yearian) TTh 9-10:50
   62. 4 units, Win (Cabrera) TTh 9-10:50
   63. 4 units, Spr (Cabrera) TTh 9-10:50

64A, 64B. Intermediate Physics Laboratories—Experimental work in mechanics, heat, electricity and magnetism, optics, atomic and nuclear physics. One set of apparatus for each experiment is available so that one or two students will perform a given experiment during a particular laboratory session. Prerequisite: 61.
   64A. 1 unit, Win, Spr (Ritchie) by arrangement
   64B. 1 unit, Win, Spr (Ritchie) by arrangement

105, 106, 107. Intermediate Physics Laboratory Seminars—A year-long series of mini-courses in important experimental techniques between two weeks and eight weeks, depending on the subject matter; courses must be taken in sequence. Topics include electronics, detectors and radioactive sources, optics and lasers, statistics and data handling, microwaves, low temperatures and computer interfacing. Physics 105, 106 and 107 are required for all Physics majors. Each course schedules a one hour weekly lecture, usually Friday noon. Prerequisites: 100, or 64A and 64B, or 54 and 56; concurrent registration in the 120 series.
   105. Laboratory Seminar I: Electronics. 3 units, Aut (Phillips) by arrangement
   106. Laboratory Seminar II. 2 units, Win (Danzmann) by arrangement
   107. Laboratory Seminar III. 2 units, Spr (Schwettman) by arrangement

110, 111. Intermediate Mechanics—Mechanics of systems of particles and rigid bodies. Coordinate transformation and vectors; Newtonian mechanics; linear and nonlinear oscillations; Hamilton’s principle, Lagrangian and Hamiltonian dynamics; central forces, planetary motion; collisions; non-inertial reference systems; rigid body dynamics; coupled oscillations; and introductory fluid mechanics. Prerequisites: 51 and Mathematics 130.
   110. 3 units, Win (Michelson) MWF 9
   111. 3 units, Spr (Michelson) MWF 9

120, 121, 122. Intermediate Electricity and Magnetism—Vector analysis, electrostatic fields, including multipole expansion; dielectrics. Special relativity and transformation between electric and magnetic fields. Maxwell’s equations. Static magnetic fields, magnetic materials. Electromagnetic radiation, plane wave problems (free space, conductors and dielectric materials, boundaries). Dipole and quadrupole radiation. Wave guides and cavities. Prerequisites: 53 and prior or concurrent registration in 110. Concurrent or prior registration in Mathe-
130, 131, 132. Quantum Mechanics—The origins of quantum mechanics, wave mechanics and the Schrödinger equation, Heisenberg's matrix formulation of quantum mechanics, solutions to one dimensional systems, separation of variables and the solution to three dimensional systems, the central field problem and angular momentum eigenstates, spin and the coupling of angular momentum, Fermi and Bose statistics perturbation theory and other approximation techniques. Scattering theory: partial wave expansion, Born approximation, Green's functions. Reference is made to problems in atomic and nuclear physics with a view to explaining the basic phenomenology of these disciplines. Invariance principles and conservation laws are discussed in the context of quantum theory. Prerequisites: 57 or equivalent and 110, 111. Concurrent or prior registration in 120, 121, 122, and Mathematics 130, 131.

130. 3 units, Aut (Meziani) MWF 11
131. 3 units, Win (Meziani) MWF 11
132. 3 units, Spr (Meziani) MWF 11

145. Physics of Nuclear Weapons—Physics and technical issues of radioactivity, nuclear chain reactions, weapons effects; also nuclear proliferation, arms control, advanced weapons development, and weapon deployment and use in warfare. Enables students to understand and critically evaluate technical issues in national security policy and the political process of arms control. Prerequisites: 21 or 51, concurrent enrollment in 25 or 53, or consent of instructor. (DR:8)

3 units, Spr (Martoff) MT 3:30-4:45

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 (Schawlow) MWF 11

167. Essential General Relativity—(Formerly Physics 192. One quarter for senior-level students and advanced juniors.) Mathematical development emphasizes the component tensor calculus rather than the abstract differentiable manifold approach. Cosmological solutions will be obtained and discussed. Prerequisites: 110, 120 plus Math 131.

3 units, Win (Michelson) MWF 11

168. History and Philosophy of 20th Century Physics—(Enroll in Philosophy 168, History 139A, VTSS 133.)

4 units, Win (Wise)

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 (Fairbank) MWF 9
171. 3 units, Win (Little) MWF 9

172. Physics of Solids—Introduction to the principal types of solids, with emphasis on thermal, electrical and magnetic properties. Elementary treatment of phonons in solids, electrons in metals, energy bands. Applications to semiconductors, rectification, superconductors, para- and ferromagnetism, magnetic resonance. Prerequisite: 171.

3 units, Spr (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.

any quarter (Staff) by arrangement

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 of their senior year and 201 no later than Winter Quarter of their senior year. Prerequisites: 105, 121, and 131.

200. 3 units, Aut, Win (Meyerhof) Spr (Danzmann) Sum (Staff) by arrangement
201. 3 units, Aut, Win (Meyerhof) Spr (Danzmann) Sum (Staff) by arrangement

205. Honors Program—Experimental or theoretical honors project and thesis in physics under supervision of a faculty member. Prerequisites: Superior work in physics as an undergraduate major and approval of the Honors Committee. It is strongly urged that the student who elects to do an honors thesis begin the
planning of the project no later than the middle of the student's junior year.

1-3 units, Aut, Win, Spr (Danzmann)
Sum (Staff)


3 units, Aut (Wagoner) MWF 10


3 units, Win (Wagoner) MWF 10

212. Group Theory and Mathematical Physics.

not given 1986-87


220. 3 units, Aut (Bond) MWF 9
221. 3 units, Win (Bond) MWF 9

222. Classical Gravitation—Concepts in gravitation, equivalence principle and the red shift, tensor analysis, Einstein’s field equations, Schwarzschild solution and observable effects in the solar system, electrodynamics and hydrodynamics in gravitational fields, gravitational radiation, structure of collapsed stars, introduction to cosmology. Prerequisites: 211 and 221.

3 units, Spr (Bond) MWF 9

alternate years, not given 1987-88


230. 3 units, Aut (Galic) WF 11-12:30
231. 3 units, Win (Galic) WF 11-12:30
232. 3 units, Spr (Galic) WF 11-12:30

234. Spectroscopy and Quantum Electronics—Characteristics and techniques for measurement of spectra from radiofrequency, through microwave, infrared, visible, ultraviolet and shorter wavelengths, with examples from atomic, molecular and solid state spectroscopy. Uses of spectral lines in lasers and other quantum electronic devices. New spectroscopic methods using tunable lasers: high resolution saturation spectroscopy, two- and multi-photon spectroscopy, nonlinear mixing of coherent waves, study of coherent transient phenomena. Prerequisite: 230.

3 units, Spr (Staff) MWF 2:15

alternate years, given 1987-88

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)

alternate years, not given 1987-88
241. 3 units, Win (Hanna) alternate years, not given 1987-88

252. Introduction to High-Energy Physics—
An introduction to the elementary-particle phe-
nomena. Leptons and their interactions. The
quark model. Quantum numbers and their flow
in the fundamental interactions. Kinematics
and dynamics of particle collisions at high
energy. Particle accelerators. Methods of detec-
tion and identification of elementary particles.
Prerequisite: 132. Recommended: 221 and 231.
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 (Hanna) TTh 12:15-1:05

270. Statistical Mechanic—Ensemble theory,
thermodynamic functions, classical ideal gas,
imperfect gas, chemical reactions, quantum
statistics, solids, magnetism, phase transitions.
Prerequisite: 171. Concurrent or prior enroll-
ment in 232 and Mathematics 106 is required.
3 units, Spr (Wagoner)

271, 272. Solid State Theory — (Enroll in
Applied Physics 239 and 240 respectively.)
271. 3 units, Aut (Harrison)
272. 3 units, Win (Harrison)

273. Cooperative Phenomen — (Enroll in
Applied Physics 241.)
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 upon topics studied.
Prerequisites: 25 units of college physics
and consent of instructor. If taken under the
supervision of a faculty member outside the
department, approval of the Physics Depart-
ment Chairman is required.
any quarter (Staff) by arrangement

299. Teaching of Physics—Techniques of
teaching Physics by means of lectures and lab-
oratories. All teaching assistants in Physics are
required to register for this course.
0-3 units, Aut (O’Shaughnesssy)

315 Computational Physics—(Enroll in Applied
Physics 315.)
3 units, Win (Doniach)

330,331,332. Quantum Field Theory—Intro-
duction to the concepts and methods of quan-
tum field theory. Autumn—Quantization of
scalar and Dirac fields, Feynman diagrams.
Quantum Electrodynamics. Elementary elec-
trodynamic processes: Compton scattering,
$e^+ e^-$ annihilation. Soft photons and infrared
divergences. Winter—Loop diagrams, electron
(g-2), renormalizaiton, Ward Identities, the re-
normalization group, perturbation theory
anomalies. Spring—Local gauge invariance,
Yang-Mills fields, spontaneous symmetry
breaking and the Higgs mechanism, functional
integral methods, quantization of Yang-Mills
fields, asymptotic freedom, Quantum Chromo-
dynamics. Prerequisites: 211, 221, 232.
330. 3 units, Aut (Peskin) MW 11-12:30
331. 3 units, Win (Peskin) MW 11-12:30
332. 3 units, Spr (Brodsky) MW 11-12:30

336. Advanced Topics in Theoretical Physics:
Theory of Electroweak Interactions—Analysis of
the standard model of Glashow, Salam, and
Weinberg: Neutral- and charged-current pro-
cesses. Properties of the Z° boson. Analysis of
neutrino-counting experiments. Renormaliza-
tion of the standard model, and l-loop effects on
physical processes. The l-loop effects of new
fermions and scalars. Prerequisite: 331.
3 units, Aut (Lynn) TTh 9-10:30

337. Special Topics.
3 units, Win (Laughlin)

340. Theory of Many-Particle Systems—Ap-
lication of quantum field theory to the non-
relativistic, many-body problem including
methods of temperature-dependent Green’s
functions and canonical transformations.
Theory of finite-temperature, interacting Bose
and Fermi systems with applications to super-
fluidity, superconductivity, and the electron
gas. Prerequisite: 232; prior enrollment in
Applied Physics 241 is recommended.
3 units, Aut (Laughlin) TTh 1:15-2:30

341,342. Advanced Atomic and Nuclear Phys-
ics—Theory and phenomena of many-body
bound states. Winter—Review of nonrelativis-
tic atomic structure and spectroscopy; relativ-
istic effects; configuration mixing; multiple-
photon transitions; parity nonconservation in
atoms; photoelectric effect; Raman, Rayleigh,
and Compton scattering; Stark and Zeeman
effects; High-Z (overcritical) atoms. Spring—
Bethe-Salpeter equation; lamb shift, hyperfine
splitting; Positronium structure and decay; pre-
cision tests of Quantum Electrodynamics; non-
relativistic nuclear structure and spectroscopy;
quantum field theory and nuclear physics;
electroweak effects in nuclei. Prerequisites: 232,
341. 3 units, Win (Lynn) TTh 9-10:30
342. 3 units, Spr (Lynn) TTh 9-10:30

351,352. Elementary Particle Physics—Phe-
nomena of elementary particle interactions, and
their theoretical interpretation. Winter—Intro-
duction to the Standard Model; features of
high-energy interactions of hadrons; deeply inelastic lepton-hadron scattering; structure functions; the parton model; QCD, gluons and scaling violations; jets and quark fragmentation in pp and e+e- annihilation to hadrons; radiative corrections in QED and QCD; running coupling constants; experimental measurements of the strong coupling; Monte Carlo techniques.

Spring—Hadron spectroscopy in the static quark model; properties of heavy quarks and quarkonium systems. Weak interactions: Muon, pion, and beta decay; weak mixing angles; The K_L-K_S system on CP violation; charged and neutral current neutrino scattering; the standard model of electroweak interactions; determinations of sin^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 (Burke) MWF 9-10
352. 3 units, Spr (Feldman) MWF 9-10

357,358,359. Theoretical Physics of Particles and Fields—Advanced topics in theoretical high-energy physics. Topics change from quarter to quarter and from year to year to survey the elements of formalism needed for theoretical research. Topics for 1986-87:


357. 3 units, Aut (Dimopoulos) TTh 1-2:30
358. 3 units, Win (Dimopoulos) TTh 1-2:30
359. 3 units, Spr (Dimopoulos) TTh 1-2:30


368. 3 units, Aut (Susskind) TTh 11-12:30
369. 3 units, Win (Susskind) TTh 11-12:30


3 units, Spr (Fetter) TTh 1:15-3:05 alternate years, not given 1987-88

385A. 3 units, Win (Huberman)
385B. 3 units, Aut (Doniach)
385C. 3 units, Spr, not given 1986-87

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 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

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
Chairman: Stephen D. Krasner
Associate Professors: Terry M. Moe, Daniel I. Okimoto
Assistant Professors: Judith L. Goldstein, Nina P. Halpern, Terry L. Karl, Condoleezza Rice (on leave)
Courtey Professors: Steven H. Chaffee, Lawrence Friedman, Roger Noll
Affiliated Professors: Michael W. Kirst, Robert L. Rabin
BACHELOR OF ARTS

The minimum requirements for recommendation for the degree of Bachelor of Arts with Political Science as the major are:

1. Completion of 45 units of political science, including:
   a) A minimum of 25 units of work taught by the Department of Political Science faculty. (No more than 20 units of political science transfer work may be accepted toward the 45 political science units.)
   b) An advanced course or seminar (numbered 100 or above) in at least three of the following fields: public administration and public policy, comparative politics, international relations, political theory, American politics.
   c) At least one seminar, which may be included in fulfillment of b), above.

2. The completion of 15 additional units which relate in a direct way to one or more of the student’s interests in political science. These courses, which may be in political science (including a departmental honors thesis) or in other departments, must be approved by the student’s advisor.

No more than 10 units of directed reading may be counted as credit toward the major. Directed reading, however, may not be used to fulfill a field requirement. Courses used to fulfill the major requirement must be taken for standard letter grades, although courses in excess of the required 60 units may be taken on a Pass/No Credit basis.

Public Policy Emphasis—The student who wishes to receive the A.B. degree with a focus on public policy may elect a concentration in public policy within the political science major. The program will introduce the student to political and economic institutions and processes, to analytical techniques, and to substantive courses in public policy. For further information, the student should consult with relevant members of the faculty.

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 equivalent of a 3.3 average in political science courses when they apply.

The Honors Thesis Program is based on the assumption that good writing takes time. Students are therefore strongly discouraged from attempting to complete an honors thesis in less than two quarters. While details will always be worked out on an individual basis between students and their thesis advisors, the following patterns are typical: (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 total of 10-15 units).

Successful completion of the Honors Thesis Program, and graduation with honors in political science, requires (a) completion of all requirements for the major and (b) successful completion of a thesis of honors quality. Honors work done for credit (Political Science 199) may not be counted toward the required 45 units in political science, but may be counted as all or part of the additional 15 units which relate to the student’s interest in political science.
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.

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 Aptitude Test of the Graduate Record Examination. Applicants whose native language is not English or who have not studied in an English-speaking country for at least one and a half years must take the Test of English as a Foreign Language (TOEFL). For details concerning these tests, see the Information Bulletin. Overseas applicants who may not receive the Information Bulletin promptly, should write directly to the Educational Testing Service, Box 955, Princeton, New Jersey 08540. The application deadline is January 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 the autumn 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 ten units of work from related departments may be accepted in lieu of a portion of the work in political science. Courses must be numbered above 100, and a grade of "B-" or better must be attained in each course. 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 THE TEACHING OF POLITICAL SCIENCE

The degree of Master of Arts in Teaching is offered jointly by this department and the School of Education. The degree is intended for candidates who have a teaching credential 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 administration. A special field, e.g., public law or urban politics, may also be offered. Students will concentrate on two of these fields by fulfilling, depending on the field, combinations of the following: written qualifying examinations, research papers, quantitative methods
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 ten units with a grade of "B" or better in the third field from among the formal graduate level courses in the five divisions of the department. The third field cannot be satisfied by courses taken as a requirement for a first or second field. A third field in theory requires two courses in addition to the 5 units necessary to fulfill the program requirement. A third field in methodology requires two courses in addition to the two core courses offered by the department. Students may also use two courses in separate fields but with a common topic to meet the third field requirement, provided that neither course is part of a field in which the student is examined. Students may also use appropriate courses taught in other departments. Selection of either of these options requires prior approval from the student's advisor and the Director of Graduate Studies.

2. The Ph.D. candidate is required to demonstrate competence in a language or a skill that is likely to be relevant to his or her dissertation research. Competence is required in:
   a) a foreign language; and/or
   b) a skill or skills such as statistics, mathematics for social science, computer science, interview techniques or historiography.

The level of competence needed for successful completion of the research shall be determined by the student's advisor. In consultation with the advisor, the student shall propose a program of preparation in a language and/or relevant research skill. In some cases, it may be necessary for the student to show competence in both a language and relevant research skills.

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. At the discretion of the Director of Graduate Studies, if the candidate has not completed sufficient previous instruction in methodology, he/she will take 5 quarter units of graduate instruction in methodology.

5. Early in the third quarter in residence, each first-year graduate student will submit to the student's advisor a statement of purpose. This statement will indicate the student's proposed major fields of study, the courses taken and those planned to be taken to cover those fields, the student's plan for meeting language and/or skill field requirements, plans for scheduling of comprehensive examinations, and/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. Following the plan outlined in (5), 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 are given in the third week of the Autumn and Winter Quarters, and late in the Spring Quarter. Students should expect to complete these examinations and papers by the end of their second year.

7. During a student's sixth quarter, he or she will file an Application to Candidacy for the Ph.D., which encompasses concrete course plans and records. This document, along with a student's examination performance, will be reviewed by the faculty at a regular meeting. If it is approved, a student will then be advanced to candidacy.

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, who will be asked to comment.

9. A candidate for the Ph.D. in Political Science may be asked to serve as a teaching assistant in the department for three quarters. Two quarters must be served. The department considers teaching experience an essential part of the Ph.D. program. It is not recommended that this requirement be satisfied during the candidate's first year of graduate study, but the requirement will normally be satisfied by the end of the candidate's third year.

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 "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)

9. Introduction to Public Opinion—An introductory survey of public opinion, reviewing evidence on how well informed the average American is about politics; on how consistent their opinions about political issues are likely to be; on how they conclude what they are in favor of; and on how tolerant (both politically and racially) they tend to be.

5 units, Aut (Sniderman)

10. American National Government—Winter Quarter is an 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. Spring Quarter treats the major institutions of American government (Congress, the Presidency, Supreme Court, parties, and elections) within a critical perspective emphasizing American capitalism, liberal democracy, and the theory of pluralism. (DR:5)

5 units, Win (Jacobson)
Spr (Manley)

20. Introduction to Comparative Politics—Introduces a number of approaches to the comparative study of political systems, including 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, such as political parties. (DR:5)

5 units, Spr (Halpern)

22. The World Outside the West in the Age of European Imperialism—(Same as Anthropology 22 and History 22.) Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western institutions and ideas, from the early 19th century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Mexico, China, and Nigeria. Strongly recommended: Anthropology/History 21. (DR:5*)

5 units, Win (Abernethy, G. Collier, Duara)
35. International Politics — Emphasizes a variety of approaches to the study of world politics including realism, idealism, Marxism, and bureaucratic politics. World War I, superpower intervention since 1945 and international economic relations, and the normative and policy implications of different theories. Enrollment limited to 450. (DR:5)

5 units, Aut (Krasner)

50. The Idea of Freedom in Western Political Thought — An introductory survey of political thought since Machiavelli and the Reformation, with attention to the major conceptions of freedom and the conditions of the development of political and social freedom.

5 units, Spr (Drekmeier)

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 registration 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.


5 units, Win (Bendor)


5 units, Win (Moe)

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

5 units, Win (March) TTh 8-10

108. Organizational Leadership — (Same as Sociology 165.) The problems of leadership in complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. Special attention to the role of major executives.

5 units, Aut (March) given 1987-88

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-World War II Germany. Analysis of the role of the state in the Federal Republic of Germany and the German Democratic Republic. Special emphasis: (a) problems of representation; (b) policy conflict (energy, education, environment); (c) legitimacy and governability. (DR:5)

5 units, Win (Weiler) given 1987-88

112. Problems of Democratization in Southern Europe and Latin America — The recent demise of authoritarian rule in these two regions; their contrasting modes of transition to political democracy and processes of democratic consolidation. Emphasis on Spain, Portugal, Brazil, Argentina.

5 units, Win (Schmitter, Puhle)

113A. The Politics of Development in Latin America — Survey of the principal political systems of Latin America. (Brazil, Mexico, Argentina) and the major non-capitalist country (Cuba). (DR:5)

5 units, Spr (Packenham) given 1987-88

114. Theoretical Approaches to Japanese Politics — An introduction to Japan's political system with special emphasis on the relationship between politics and the economy. (DR:5*)

5 units, Win (Okimoto)
114K. The Political Economy of Development
—Introduction to major theories of political development. Stresses the relationship between economic and political factors.
  5 units, Win (Karl)

115. Government and Politics in China—An overview of 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, Aut (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, although coming out of similar cultural and political traditions, have diverse status patterns, party systems, union organization, patterns of social mobility, education systems. Examines the way varying social structures and values emerging out of different histories affect national styles and institutions.
  5 units, Aut (Upset) MWF 9

117. Interest Politics—The theoretical foundations for the comparative analysis of interest associations in advanced capitalist/industrial societies. Particular emphasis on pluralist and corporatist arrangements and the contrast between North American and Western European experiences.
  5 units, Aut (Lipset) MWF 9

119. Socialism in Latin America—An examination of socialist experiences in Latin America. The interrelationships between political, economic, and cultural change. Emphasis is given to the historical and international contexts relevant in each case. (DR:5)
  5 units, Win (Fagen) given 1987-88

119A. The Soviet Union: Politics and Society Since 1917—(Same as History 123A.) Survey of major trends and developments since the Revolution, and discussion of alternative interpretations, elite conflicts, role of ideology, social stratification, and changing values. (DR:5)
  5 units, Spr (Dallin)

124. Latin American Dependency—An assessment of fundamental concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency in Latin America. (DR:5)
  5 units, Spr (Packenham)

125F. Seminar: Development and the International System — The external constraints on development in the Third World, and the interaction between national and international factors. Prerequisite: 35. Recommended: Previous work in International Relations, Economics, and/or Political Science.
  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, Political Science 35 is an introduction to international relations and thus provides a desirable background for more advanced work.

The courses in international relations offered by the Political Science Department can generally be divided into two groups: those dealing with global political, military, and economic problems; and those dealing with the foreign relations of specific nations or geographic regions. Students concentrating in international relations are encouraged to select their courses from both these groups.

Students with interests in international relations are encouraged to refer to the International Relations section of this catalog, which lists international relations courses in other departments.

132. International Communism—(Same as History 117.) Communism as an international movement, both under the Comintern and since its dissolution, with emphasis on organization, ideology, and appeals; discussion of tensions and cleavages among and within communist parties social bases of support; and patterns of successes, failures, and adaptation. (DR:5)
  5 units, Win (Dallin)

133. Peace Studies—The purpose is to make faculty, staff, and students 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 their teachers will not come out with answers but with a better understanding of the fundamental questions that need answering. The atmosphere is one of intellectual exchange. Outstanding scholars lecture, but only to provide a common underpinning for individual comprehension and mutual discussions.
  3 units, Win (Dornbusch, Drekmeier, Moses, Ross)

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 to the attempt by both countries to balance domestic concerns with expanding international responsibilities. Several cases of policy formulation and conduct provide an analytical basis for comparison including: weapons procurement, nuclear arms control, and crisis management. Prerequisite: 138A.

5 units, Aut (Blacker, Holloway)

138A,B,D. Arms Control and Disarmament — (Same as Values, Technology, Science and Society 154A,B.) The introductory course, 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 the post World War II period. Political, technological, and conceptual problems of national security policies and arms controls are stressed. Also the analyses of strategic military doctrines and to 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, focusing on the substantive and procedural aspects of arms control negotiations. Core faculty is assisted by various 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 (Lewis, Blacker)

138B. Seminar: Arms Control.
5 units, Spr (Lewis)

138D. Topics in Arms Control.
5 units, Aut (Lewis, Blacker)

138E. Seminar: Accidental or Unintentional Nuclear War—The likelihood of nuclear war occurring through accident, miscalculation, misunderstanding, or inadvertence. An analysis of past accidents in the world’s nuclear weapons systems, the impact of false alerts, human fallibility, systems fallibility reflecting command, control, and component failure, the security of nuclear fuel and weapons, terrorism and potential theft by non-state actors, the nature of decision making crises, and the synergy between accidents and crises. Mechanisms of risk reduction, anticipatory planning, crisis prevention and management, and the means of translating such measures from theory to practice. Limited enrollment. Recommended: 138A.

5 units, Aut (George, Abrams)

139. Seminar: Chinese Foreign Policy—The Chinese traditional pattern of foreign relations, the goals and tools of post-1949 Chinese foreign policy, the domestic sources of foreign policy, and the foreign policy-making process. Recommended: Previous work on contemporary China.

5 units, Win (Halpern)

139A. Japanese Foreign Policy—Analysis of the postwar evolution of Japanese foreign policy in terms of historical background, external environment, and domestic institutions. (DR:5+)

5 units, Aut (Okimoto)

140A,B,C. Ethics of Development in a Global Environment (EDGE)—(Same as Anthropology 133A, B, C; Education 274A, B, C; Engineering 297A, B, C.) Presents a series of speakers on current development issues with emphasis on problems of poorer nations. Autumn Quarter speakers discuss basic world resources (energy, food, housing, population and environment) and the political development and dependencies of developing regions. Winter Quarter speakers address 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 speakers address the roles of individuals in national and international institutions dealing with the problems of developing countries. Speakers represent a wide range of political, professional, and national backgrounds and present candid and often differing points of view. Gives students working in developing countries or in institutions dealing with developing countries a better knowledge of the challenges they face and the 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

144J. America in Vietnam—(Same as American Studies 222.) The social, political and cultural aspects of America’s involvement in the Vietnam War.

5 units, Spr (Goldstein)

145J. American Foreign Policy—Introduction to American foreign policy, its formulation and implementation, and specific problems which have been influential in its development in the post-World War II era. The modes of foreign policy analysis and the internal and external constraints facing American central decision-makers. Topics include 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. Prerequisite: 35 or equivalent.

5 units, Aut (Bernstein)

147. Seminar: Comparative Nuclear Policies — The nuclear programs of the United States, Britain, the Soviet Union, China and France. The reasons for developing nuclear weapons, the organization of R&D, the establishment of the nuclear industry, the role of scientists and of the military in policy-making are examined in political systems that are very different. The focus is on nuclear weapons, but the connection with nuclear power is also analyzed. Admission by permission of the instructor.

5 units, Spr (Holloway)

149. Directed Reading/Research in International Relations—Advanced individual study in international relations.

any quarter (Staff) by arrangement

POLITICAL THEORY

150. Ancient and Classical Political Thought — From the beginnings of political speculation in preliterate societies to the Stoics, Greek thinkers are emphasized.

5 units, Aut (Drekmeier)

154J. Marxist Theory—An intensive exploration of the political and social thought of Karl Marx. The development of Marx’s thought, from its inspiration in the work of G.W.F. Hegel; with emphasis on the relationship of Marx’s methodology and the political content of his theory. Some attention is be paid to the English liberal empiricism which rivalled German dialectics in the 19th century, in order to provide a comparative perspective on Marx’s politics and method. Also, the perspective brought to Marx’s work by 20th century Marxists and Hannah Arendt.

5 units, Win (Ring)

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.) Considers 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 both traditional political theory and contemporary American feminist theory.

5 units, Win (Ring)

169. Directed Reading/Research in Political Theory—Advanced individual study in political theory.

any quarter (Staff) by arrangement

AMERICAN POLITICS

180. Civil Rights and Civil Liberties in the United States—Law and politics, how each affects the other, how both impact our notions of freedom, equality, privacy, and due process. The great controversies of our society—race and sex discrimination, affirmative action, freedom of speech, freedom of the press, abortion, school prayer, capital punishment, and the right to die. The laws, lawyers and judges who fashion our constitutional doctrines as they render decisions on the fundamental moral and social issues which shape our values and politics.

5 units, Spr (Steyer)


5 units, Spr (Horn)

182F. Introduction to American Law—(Same as American Studies 179.) A general 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 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, Sociology 138.) Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt
(religious law), and the Republic of Botswana (traditional law) to identify the historical, philosophical, social, and cultural factors which contribute to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights—especially at death, the handling of 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. This course covers Winter and Spring Quarters starting January 28. Students must register for both quarters.

2 units, Win plus 3 units, Spr (Barton, Gibbs, Merryman) MWF 2:15

183F. The Development of American Law—(Same as American Studies 171, Law 105.) The growth and development of the American legal institutions. Emphasis is on crime and punishment; slavery and race relations; the role of law in developing the economy; and the place of lawyers in American society, from Colonial times to the present.

5 units, Aut (Friedman) given 1987-88

186K. American Education and Public Policy—(Same as History 158B, Education 105.) Drawing on history and political science, this course treats policy issues in education. Who influences schooling and how? How have American schools responded to human diversity? What consequences does schooling have? What are the prospects for reform in public education? Lectures and small group discussions.

3 units, Aut (Kirst, Tyack) MWF 2:15-3:05

187. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—(Same as Education 220B.) Overview of relationships between political analysis and policy formulation in education; focus on alternative models of the political process, the nature of interest groups, political strategies, community power, the external environment of organizations and the implementations of policy. Applications to educational settings and problems emphasized.

4 units, Win (Kirst) MW 11-12:30 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, i.e., the turnout decision, the candidate choice, i.e., 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 are discussed.

5 units, Aut (Brody)

192. Seminar: Political Psychology—An introduction to the principal topics in political psychology, including consistency theory, preference estimation, personality, and categorization.

5 units, Aut (Sniderman)

192R. Seminar: The Politics of Unemployment—The policy problem of unemployment is as old as the recognition that forces, apart from the individual’s initiative and willingness to work, from time to time make it impossible for the individual to make a living. With this recognition there have come public attempts to solve the problem or mitigate its effects. The politics engendered by these attempts stem from questions of who will pay, who will benefit; and how can the problem of disincentives to honest labor be avoided? Seminar proceeds historically and analytically in order to approach understanding of the problem of unemployment as a public policy problem.

5 units, Win (Brody)

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 study of the procedural law involved in litigating civil rights cases has the goal of developing skills in the analysis of case law and social policy. For juniors and seniors.

5 units, Win (Steyer)

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, Aut (Ferejohn, Baron)
**201B.** 5 units, Win (Ferejohn, Baron)

**203A,B. Political Data Analysis I and II—**
203A is an introduction to fundamentals of research design, measurement, computing and parametric and non-parametric statistics. Instruction includes lectures, discussions of examples in political science literature, and computer assisted analyses of political data sets. 203B is an examination of special problems encountered in quantitative analyses of political data and methods for alleviating those problems. Instruction includes lectures, computational assignments, and critiques of major political research.

**203A.** 5 units, Win (Moe)
**203B.** 5 units, Spr (Moe)

**204A,B. 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 modelling political institutions. Open to graduate students in the social sciences and to others with consent of instructor.

**206M. Bureaucratic Politics—**Survey and critical evaluation of the literature on bureaucratic politics. Topics are divided into three general categories; public bureaucracies as organizations; public bureaucracies and the political environment; and formal models of bureaucratic behavior.

**209. Directed Reading in Public Administration.**

*any quarter (Staff) by arrangement*

**212K. Seminar: Latin America in Comparative Perspective—**The major theoretical approaches to Latin America, focusing specifically on the differences in development patterns between South America and Central America.

**215A,B. Japanese Political Economy—**The role of state and private enterprise in Japan's capitalist economy. Coverage of the international economy, political and economic institutions, policies and practices, and performance. First term, readings; second term, research paper.

**215A.** 5 units, Aut (Okimoto)
**215B. U.S./Japan Trade Simulation.**

5 units, Win (Okimoto)

**220. Seminar: Capitalists and Workers—** Studies comparatively the efforts of capitalists and workers in North America and Western Europe to organize collectively and influence public policy. Emphasis on the structure and role of business associations and trade unions with data from nine nation research projects (Austria, Canada, W. Germany, Italy, The Netherlands, Spain, Sweden, Switzerland, and the United Kingdom). Also includes United States and France.

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. Special attention will be given 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.

**221S. Education and Radical Change: African Experiences—** (Same as Education 395.) Schools as sites of protest; education as a core element in development strategy. For the former, education and student protest in South Africa. For the latter, the experiences of Guinea- Bissau and Tanzania and, through student research presentations, Angola, Mozambique, and Zimbabwe. Explores education in strategies for change by examining the role(s) of schools in society.

**225. Seminar: The Political Economy of Reform in Socialist Countries—** The emergence and nature of the Stalinist and post-Stalin politico-economic systems in the U.S.S.R., Eastern Europe, and China. Focuses on selected reform efforts in these countries, analyzing the interaction of political, economic, and social factors in producing the reform efforts and conditioning their success or failure.

5 units, Spr (Samoff) given 1987-88

**226. Democracy and Society in Comparative Perspective—** (Same as Sociology 247.) Will focus on the conditions which appear related to the emergence and institutionalization of democracy, as well as the factors making for insta-
bility and breakdown. After examining the analytical and theoretical literature, the seminar will look at a number of case studies in Europe, America and the Third World.

5 units, Spr (Lipset, Diamond) T 2:15-5:05

226C. Graduate Colloquium: Problems in Soviet History and Politics—(Same as History 319A.)
5 units, Spr (Dallin)

228A,B. Seminar: The U.S. and the U.S.S.R. as Regional Powers—A research seminar on the progressive alienation between restive, frustrated social forces, on the one hand, and obsolete political structures in Eastern Europe and in Latin America on the other hand. Focus is on the dilemma of the two regional powers and how to deal with social change without harming their regional interests.

228A. 5 units, Win (Packenham, Triska) given 1987-88
228B. 5 units, Spr (Packenham, Triska) given 1987-88

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. Admission by permission of the instructor.

5 units, Win, Spr (Holloway)

241A. International Political Economy—Examines major theoretical approaches emphasizing structural/mercantilism, liberalism, and Marxism as applied to a variety of historical and contemporary issues. Includes lectures and class presentations on readings.
5 units, Win (Krasner, Meyer)

242L. Seminar: Theories of International Conflict—Comprehensive survey of the leading theories of the causes of war and their application to a variety of historical cases. Open to graduate students and to undergraduates. Prerequisite: 35 and consent of the instructor.
5 units, Win (Lévy)

243. Seminar: International Relations Theory—The major trends in the North-South and East-West conflicts since World War II and an examination of data and current literature pertaining to projections and possible alternatives between now and the year 2000.
5 units, Aut (Goldstein)

248. Seminar on International Cooperation in Educational Development: The Role of International Organizations—(Same as Education 207X.) The role of international and bilateral organizations involved in development assistance, especially in the field of education. These organizations are seen as part of an interlocking system of political/economic power and cultural/intellectual objectives. Case studies deal with the World Bank, UNESCO, OECD, regional development organizations such as the African Development Bank or the European Development Fund, and bilateral programs.
5 units, Spr (Weiler, Stromquist) M W 1:15-3:05

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.

262. Seminar: Thought and Action—(Same as Modern Thought and Literature 262.) The relation between knowing and doing, and making and doing; the ranges from the ideological presuppositions of psychological theories, the nature of revolutionary consciousness, the various types of knowing and types of ideology, to the responsibilities of science and the role of knowledge as a factor of production.
5 units, Aut (Drekmeier)

264. Seminar: Social Theory and Modern Political Thought—The contributions of Max Weber, Emile Durkheim, and Sigmund Freud to the understanding of political behavior, institutions, and values.
5 units, Win (Drekmeier)

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 reflect equitable allocations.
3 units, Win (Hammond, Ferejohn, Suppes) M 3:15-5:05

269. Directed Reading in Political Theory.
any quarter (Staff) by arrangement

AMERICAN POLITICS

282F. Seminar: Courts and Public Policy—The social science literature on the role of courts as institutions that make (or break) public policy. Fields include regulation of business, civil rights, and criminal justice. Open to law students and political science graduate stu-
Students. Students must register both quarters to receive 5 units of credit.

2 units, Win (Friedman)
3 units, Spr (Friedman)

289A.B. Research Seminar: The U.S. Congress in Theoretical Perspective—The historical development of Congress, congressional structures and processes (including the committee system, the budgetary process, and congressional leadership and parties), congressional elections, policy-making, constituency representation, and relations with other political institutions (the presidency, the bureaucracy, national parties, interest groups). Discussion and evaluation of alternative theoretical perspectives for understanding how and why Congress works as it does. 289A centers on readings, 289B on research and the presentation and discussion of research papers.

289A. 5 units, Win (Jacobson)
289B. 5 units, Spr (Jacobson)

292A. Seminar: American Political Institutions—Theories of American politics, interest groups, political parties, Federalism.
5 units, Aut (Ferejohn)

292B. Introduction to Political Behavior—An introduction to analysis of public opinion, ideology, political tolerance and political values, racism, and voting.
5 units, Win (Brody, Sniderman)

292C. Seminar: American Political Economy—The historical development of the American political economy from the perspective of two theories that purport to explain it: pluralism and Marxian class analysis. Among the topics: the Constitution, populism, progressivism, the New Deal, the welfare state, and Reaganomics.
5 units, Spr (Manley)

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, Aut (George)

4 units, Win (March) TTh 10-12

311. Seminar: Major Theories in Comparative Politics—Various modes of defining, explaining, and evaluating democratic, authoritarian, and totalitarian political systems in national units. Works of Almond, Dahl, Linz, Huntington, Moore, Cardoso, and others are considered.
5 units, Aut (Staff)

312. Seminar: Modern Democracy, Political, Social and Economic—The theoretical and empirical literature on the historical emergence of political democracy, its subsequent consolidation into institutions of territorial and functional representation, and its contemporary extension into new arenas and issues.
5 units, Spr (Schmitter)

313. Seminar: Development and the International System—Participants address a number of key issues raised by external constraints and influences on development in the Third World. Emphasis is on the interaction between national and international factors.
5 units, Spr (Fagen)

323. Seminar: Transitions From Authoritarian Rule—Research-oriented seminar on the nature and conditions and transitions from authoritarian rule in various world regions. The first six weeks include lectures, readings, and critical discussions of basic concepts, theoretical perspectives, methodological approaches, and empirical studies. The last four weeks involve individual work and student reports. Open both to students who wish to write research papers and to students who seek help in designing and planning theses or other future research.
5 units, Spr (Packenham)

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

5 units, Win (Weiler) given 1987-88

332. Research on Decision Making and Strategic Interaction in International Relations.
5 units, Win (George) by arrangement


380A. 5 units, Aut (Ferejohn)
380B. 5 units, Win (Ferejohn)
380C. 5 units, Spr (Ferejohn)

CENTER FOR POPULATION STUDIES

Faculty: Marcus W. Feldman, Director (Biology), W. Brian Arthur (Food Research), Luigi L. Cavalli-Sforza (Genetics and Medicine), Paul A. David (Economics and History), Kingsley Davis (Hoover), William Durham (Anthropology), A. Meredith John (Food Research), Samuel Karlin (Mathematics), Jonathan Roughgarden (Biology)

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, and in the sociology and anthropology of population.

The Center for Population 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 center 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)

164. Ecological Anthropology—(Same as Human Biology 134.)
3 or 5 units, Aut (Durham)

168. Medical Anthropology.
5 units, Aut (Barnett)

235. Cultural Dynamics.
5 units, Win (Siegel)

250. Nutritional Problems of Developing Nations—(Same as Human Biology 110.)
3 units, Win (Martorell)

260. Topics in Urban Anthropology.
5 units (Yanagisako) not given 1986-87

275. Demographic Anthropology.
5 units, Spr (Skinner)

BIOLOGICAL SCIENCES

178. Biology of Natural Populations.
4 units, Spr (Mooney)

1 units, Win (Arthur, Feldman, John)

3-5 units, Spr (Ehrlich)

283. Theoretical Population Genetics.
3 units, Aut (Feldman)

286H. Theoretical Ecology.
6 units, Sum (Roughgarden)

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, Spr (Roughgarden)

ECONOMICS

5 units, Win (Yotopoulos)

5 units, Win (Arthur)

FOOD RESEARCH INSTITUTE

5 units, Win (Yotopoulos)

5 units, Win (Arthur)
5 units, Aut (John)

1 unit, Win (Arthur, Feldman, John)

250. Nutritional Problems of Developing Nations—(Same as Human Biology 110.)  
3 units, Win (Martorell)

256. Demographic Methods.  
5 units, Aut (John)

386. Seminar: Demography.  
3 units, Aut (Arthur, John)

GENETICS

205. Human Population Genetics and Genetic Epidemiology.  
3 units, Win (Cavalli-Sforza)

HUMAN BIOLOGY

60. Population Studies Colloquium.  
1 unit, Win (Arthur, Feldman, John)

120. Human Nutrition.  
4 units, Aut (Martorell, Bray)

130. Human Population Genetics and Genetic Epidemiology.  
3 units, Win (Cavalli-Sforza)

134. Ecological Anthropology—(Same as Anthropology 164.)  
3 or 5 units, Aut (Durham)

5 units, Win (Arthur)

137. Determinants of Human Population Processes.  
5 units, Aut (John)

150A. Biosocial Aspects of Birth Control.  
6 units, Win (Djerassi)

MATHEMATICS

3 units, Spr (Feldman, Karlin)

SOCIOLOGY

5 units, Win (Arthur)

284. Demographic Methods.  
5 units, Aut (John)
the program is directed toward the integrating of a substantial body of theoretical and factual information, and the development of creative scholarly skills, by independent study, small seminars, and extended research experience. Particular emphasis is laid on the planning of an individual program for the student that will combine his or her specialized interests with the body of basic general psychology essential for all students who are undertaking concentrated study in the field. During the Autumn Quarter, students will participate in a weekly seminar concerned with the methods and approaches to psychological research. At that time, students will initiate an independent research project 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 thesis. Students will present their completed projects at a convention near the end of Spring Quarter.

SPECIALIZATION TRACKS

Students in the major program, including those in the Honors program, may elect to specialize in one of five tracks, namely, Academic 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 5-9 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 (aptitude and advanced psychology) on the Graduate Record Examination as part of the application. This examination may be taken at most universities and colleges (see your registrar for further information).

**MASTER OF ARTS**

The Department of Psychology offers a Master of Arts program to students who are already enrolled in another doctoral or professional program at Stanford. This is a two-year program requiring at least 27 units in psychology beyond the equivalent of an undergraduate major in psychology. The major focus of the doctoral program is on research training, and admission is highly selective.

Applicants for admission must file a report of their scores (aptitude and advanced psychology) on the Graduate Record Examination as part of the application. This examination may be taken at most universities and colleges (see your registrar for further information).

**DOCTOR OF PHILOSOPHY**

In addition to fulfilling the residence requirement for the degree, the following requirements are stipulated:

**First-Year Course Requirement**—During the first year of graduate study, the student is required to take 207 (Pro-seminar for First-Year Graduate Students), 152 (Analysis of Data), and 153 (Statistical Theories, Models and Methodology). In addition, the student must take at least one core course selected from Group H and one core course selected from Group S (listed below).

**GROUP H**

206. Behavioral Neuroscience
208. 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 9 units of course work each quarter. At the end of the first year of graduate study, the student must file with the department a written report of his or her first-year research activities.

**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 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.

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.

THE DOCTORAL TRAINING PROGRAM

As indicated by the requirements described above, a student may concentrate in any one of several areas within psychology. Regardless of area, however, the training program places emphasis on the development of research competence, and students are encouraged to develop those skills and attitudes that are appropriate to a career of continuing research productivity.

Two kinds of experience are necessary for this purpose. One involves the learning of substantial amounts of technical information. A number of courses and seminars are provided to assist in this learning, and a student is expected to work out a program, with his or her advisor, that will permit the student to secure such knowledge in the most stimulating and economical fashion.

A second aspect of training is one that cannot be gained from the courses or seminars. This is the firsthand knowledge of, and practical experience with, the methods of psychological investigation and study. These methods do not exist in the abstract; they are ways of behaving with the people or animals who are being studied. They are skills, and they require guided practice for their perfection. Students are provided with whatever opportunities they need to reach those levels of competence representative of doctoral standing. Continuing research programs, sponsored by members of the faculty, offer direct opportunities for experience in the fields represented by the faculty's many research interests.

Each student will achieve competence in somewhat unique ways and at a somewhat unique rate. Each student and advisor share in planning a program which will lead to the objectives discussed. The student is expected to spend one-half of his or her time on research and will normally take no more than 9 units of course work per quarter.

FELLOWSHIPS, SCHOLARSHIPS, AND ASSISTANTSHIPS

Research and teaching assistantships, United States Public Health Service traineeships, and
some University Fellowships are available. The type of support offered may vary from year to year. The department, of course, depends on the fact that a number of its students receive outside awards. Qualified applicants are asked to take the initiative in applying for predoctoral fellowships from the National Science Foundation, the Danforth Foundation, Ford Foundation, and the United States Public Health Service among others. Applications may be made by college seniors planning to work for a higher degree. Students should apply early in the fall of their senior year. For information concerning application forms and procedures, consult representatives from the financial awards office of your home institution.

TEACHING REQUIREMENT

The department views experience in supervised teaching as an integral part of its graduate program. Regardless of the source of financial support, all students are expected to participate in four quarters of teaching. Students will be discouraged from holding teaching assistantships during their first year. The student typically progresses from closely supervised teaching to more and more independent work. Typically, this might involve giving a section in statistics or a lab course in the student’s special area initially, then serving as a teaching assistant in introductory psychology, next co-teaching a small advanced course, and finally giving a supervised but essentially independent seminar.

STUDENT EVALUATIONS

First-year evaluation—It is the policy of the department to evaluate the progress of each graduate student at the end of the first year of graduate study. As a part of the evaluation procedure, each student is required to file with the department a report of the first year research activities. Students should discuss this report and the evaluation procedures with their advisor as early as possible in their first year. The report is due on June 1st. If the student fulfills the academic promise displayed upon entrance, he or she is invited to continue to the doctorate.

The first-year evaluation is made primarily on the basis of three factors:
1. The quality of research carried out in the first year.
2. Performance in courses (especially required courses).
3. Recommendations of the advisor (including a commitment on the part of that advisor to continue in that role.)

Second-year evaluation—A similar evaluation is conducted at the end of the second year of graduate training. The same criteria are involved in the second year as the first year; however, the student is not required to file a paper with the department. Students who do not make satisfactory progress during the second year may be dropped from the program.

APPLIED COGNITIVE PSYCHOLOGY PROGRAM

The department is establishing a graduate program in applied cognitive psychology, in which the theory and methods of cognitive psychology are applied to practical, real-world problem domains. The domains of interest to psychology are those in which human cognitive activity is paramount—such as medical diagnosis, technical instruction and training. They include also domains traditionally covered in “human factors” and “engineering psychology”, man-machine systems and human-computer interactions. The current course offerings include “Survey of Applied Psychology”, “Applying Cognitive Psychology to Computer Systems” and “Advanced Seminars in Applied Psychology”. The department has established affiliations with research psychologists at the nearby Xerox Palo Alto Research Center. These scholars participate in teaching and student supervision, and provide on-site experience in applied psychology research during the summer and during the academic year. A second research setting and resource is the nearby NASA/AMES aero-space laboratories. Some research psychologists at AMES are affiliated with the department and offer relevant courses for graduate students. The department seeks to expand its contacts with local and national companies, to expand its program of course offerings, and to arrange for research internships for graduate students in these applied research settings.

COGNITIVE SCIENCE PROGRAM

Psychology is participating along with the Departments of Computer Science, Linguistics, and Philosophy in an interdisciplinary program of cognitive science. The program is intended to provide students with an interdisciplinary education as well as a deeper concentration in psychology. Doctoral students are eligible to participate in the Cognitive Science Program. Students who complete the requirements within psychology and the cognitive science requirements will receive a special designation in cognitive science along with the Ph.D. in psychology. To receive this field designation, students must complete 30 units of approved courses, 18 of which must be taken in two
disciplines outside of psychology. The list of approved courses can be obtained from the Department Secretary located in the Psychology Department.

PSYCHOLOGY COLLOQUIUM

The Psychology Colloquium meets on most Wednesday afternoons at 3:45. Topics of current interest are presented by speakers from Stanford and other institutions. Graduate students are expected to attend.

SUMMER SESSION

The courses announced for the Summer Session are those regularly scheduled in the department curriculum. Additional courses may be announced in the Summer Session Bulletin, to be issued in February, 1986.

COURSES

OPEN TO ALL STUDENTS

Additional courses not listed here are frequently offered in the areas of their special research competence by selected postdoctoral or terminal Ph. D. personnel. These are listed in the quarterly Time Schedules, and the course descriptions are circulated in advance.

1. General Psychology—A survey of the major topics, theories, and research results of contemporary psychology. Topics include personality development, motivation and emotional adjustment, social behavior, learning, perception, and the physiological basis of behavior. (DR:4)

4 units, Aut (Quattrone) MW 1:15-2:30
Win (Arkin) MWF 10
Spr (Arkin, Zimbardo) MWF 11

1A. General Psychology Discussion Section
- Optional supplement to Psychology 1. Small discussion groups led by graduate teaching assistants. Prerequisite: Concurrent enrollment in 1.

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

60. Statistical Methods—Acquaints the student with the elements of statistical description (measures of average variation, correlation, etc.) and, more importantly, develops an understanding of statistical inference. Emphasis is on those statistical methods of principal relevance to psychology and related social sciences. NOTE: Students who receive credit for 60, will not be given credit for Statistics 60. (DR:6)

5 units, Aut (Pavel) MTWThF 9
Win (Vallone) MTWThF 9
Spr (Staff) MTWThF 9

80. Applications of Social Psychology—The application of social psychological theory and research to a variety of issues and problems, including the following: evaluating the impact of social interventions, strategies and shortcomings in personal and social decision making, effects of mass media and other sources of social persuasion, 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, Aut (Ross) TTh 1:15-2:30

102A. Perception—A review of the basic processes of vision and hearing. Topics include basic anatomy of the eye and ear, speech perception, color vision, depth perception and more. (DR:4)

3 units, Aut (Wandell) MWF 10

102B. Visual Sensing by Humans and Computers—(Graduate students register for 202B.) Topics in basic visual science including the physiology of human vision, basic human visual performance, and computational algorithms that characterize both physiology and performance.

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

102C. Visual Sensing by Humans and Computers—(Graduate students register for 202C.) Topics in the application of visual science to the design of images (e.g. television, computer terminals, avionics displays) for viewing, and the design of sensor systems for analyzing the content of image data (e.g. assembly line part inspection, object recognition).

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

104. Special Laboratory Projects—Independent study. Offered for pass/no credit. Can be repeated for credit. Prerequisites: 1 and 60, and consent of instructor.

1-6 units, any quarter (Staff) by arrangement

106. Introduction to Cognitive Psychology—A survey and analysis of the major topics in cognitive psychology, including perception, memory and thought. Emphasis on contemporary research and theory. Prerequisites: 1 and 60.

4 units, Win (B. Tversky) MW 1:15-3:05

107. Introduction to the Nervous System—(Same as Biological Sciences 153.) A survey of neural interactions underlying behavior. Prerequisite: 1 or equivalent and elementary biology.

4 units, Win (B. Teorsky) MW 1:15-3:05

alternate years, not given 1987-88

108. Basic Neuropsychology—An orientation in those facts of brain anatomy and physiology relevant to the analysis of behavioral processes. Prerequisites: 1 or equivalent, and elementary biology.

4 units, Win (Pribram) MWF 10
109. The Neuropsychology of Perception, Attention, and Memory—An analysis of the structure of our sensations and memories as they are determined by physiological encoding mechanisms. Examination of neuronal machines which produce our perception of color, brightness, movement, and shape as well as the selective and 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, with primary emphasis on the infancy, early childhood, and middle childhood years. A broad introduction to the nature of change during childhood and to theories of development. Prerequisite: 1 or equivalent. (DR:4)

3-5 units, Aut (Flavell) MWF 11

113. Adolescence—Current writings of prominent investigators, clinicians, and theorists in adolescent development, particularly self-psychology, gender, cognition, and attachment, are examined in their relationship to the development of psychosocial identity. Issues are a culturally induced delay versus a distinct developmental stage, cultural stereotypes, autonomy versus connectedness, and the interrelations between adolescence as a developmental stage, youth as culturally induced delay, and young adulthood as the ultimate goal. Addressed in a discussion group.

3 units, Win (Walters) TTh 2-3:35

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, Spr (Lepper) TTh 10-11:30

116. The Psychology of Women—(Same as Feminist Studies 176.) Theories of the psychological development of women; investigation of biological and cultural factors influencing personality and behavior.

3 units, Aut (Matteo) TTh 10-11:30

117. Observation of Children—Seminar focuses 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. Prerequisite: 111 recommended.

3-5 units, Win, Spr (Bing School Staff) T 3:30-5 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 focuses 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 (Bing School Staff) Th 3:30-5 and by arrangement

119. Undergraduate Seminar: Feminist Research Methods in the Social Sciences—(Same as Feminist Studies 107.)

3 units, Win (Matteo) M 3:15-5:15

120. Cognitive Development—A survey of major topics and issues concerned with cognitive development, developmental changes in memory, conceptual organization, logical reasoning, and communication skills. Prerequisite: 1.

3 units, Spr (Markman) MWF 11

121. Social Psychology—The study of interpersonal behavior. A survey of relevant research concerning attitudes, groups, person perception, and selected topics in social psychology. Prerequisite: 1 or equivalent.

3-4 units, Spr (Quattrone) MW 1:15-2:45

122. Children's Literature: A Psychological Perspective—Considers through readings, writing assignments, and class discussions, the many ways of looking at children's literature (defined as literature appropriate for 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. The contributions of writers and illustrators i.e. 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 (B. Shepard) given 1987-88

123. Women and Health—(Same as Feminist Studies 146.) The health concerns of women including menstrual cycle disorders, contraception, infertility, pregnancy, menopause; eating disorders; occupational health problems; stress management; addictive disorders; rheumatoid arthritis; aging; exercise and nutrition. Interactions between women and the health care system are also considered.

3 units, Win (Matteo) TTh 10-11:15

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 (Ellsworth) given 1987-88
127. Afro-American Psychology—An introduction to ethnic psychology, specifically, the psychological dimensions of the Black experience in America. Through lectures and readings, Black psychology is explored from its evolution as a concentration area in the social sciences to the present concerns that impact Black Americans mental health. Students are encouraged to expand upon the methodological constructs employed in the study of Black Americans.

3 units, Spr (Hudson) MWF 10

129. Person Perception, Self-Perception and Stereotyping—The psychology of person perception: how does a person form impressions of others, of themselves, and of the members of racial, ethnic, and stigmatized groups. Topics include the attribution process; interpersonal misunderstanding; the determinants of emotional states; unconscious control of behavior; self-deception; self-presentation; racism; and the self-fulfilling prophesy.

3-4 units, Win (Quattrone) TTh 1:15-2:30

130. Infancy—Development in the first two years of life. Topics include 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, Win (Fernald) TTh 1:15-2:45

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, Spr (Weinberger) MWF 10

134. The Affective Disorders—(Graduate students register for 234.) The current evidence on the experience of depression and mania in adults and children, including gender differences, socio-economic class differences and cultural differences in depression. Evaluates the genetic, biochemical, psychodynamic, cognitive and behavioral theories of affective disorders and the treatments prescribed by these theories.

3 units, Aut (Nolen-Hoeksema) TTh 10-11:15

135. Seminar in Cross-Cultural Psychology—(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, Win (Nolen-Hoeksema) MWF 11

136A. Abnormal Psychology Discussion Section—Optional supplement to Psychology 136. Small discussion groups led by graduate teaching assistants. Prerequisite: Concurrent enrollment in 136.

1 unit, Win (Nolen-Hoeksema) by arrangement

137. The Interpersonal Basis of Abnormal Behavior—The role of interpersonal problems and interpersonal processes in producing different forms of psychopathology, ranging from neurotic reactions to schizophrenia. It combines the clinical (case study) approach with the usual empirical approaches to clarify the origin, nature, and treatment of emotional disorders. Prerequisite: 136.

3 units (Horowitz) given 1987-88

138. Carl Jung and Analytical Psychology—An introduction to C.G. Jung, focusing upon the person of Jung himself, his seminal philosophical perspectives and their impact upon modern thought and life. The formation of analytical psychology is considered 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

141. History of Psychology—(Same as History of Science 141.) The development of psychological theory from a historical perspective. Major systematic positions such as structuralism, Gestalt theory, behaviorism, and psychoanalysis. The historical roots of major contemporary positions. Prerequisites: Students should usually have taken 3 courses in Psychology.

4 units (Hastorf) not given 1986-87

144. Counseling and Therapy: An Introduction—(Same as Education 130.) Some major approaches to counseling and psychotherapy. Emphasis on social learning strategies. Case studies on a variety of personal, social, and academic problems. Recommended: 1.

3 units, Spr (La Fromboise)

145. Psychological Foundations of Education—(Same as Education 215.) Introductory application of psychological principles to educational practices. (DR:4)

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

146. Language and Thought—(Same as Linguistics 145.) Survey of 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. Consideration of language functions in natural contexts and their relation to the processes by which language is produced, understood, and acquired. (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. Recommended: 107, or Biological Science 43, or Human Biology 4A.

4 units (Wine) given 1988-89

149. Laboratory Course in Behavioral Neurophysiology—(Same as Human Biology 170.) Selected aspects of behavioral neurophysiology covered in group lectures, with a focus on the recording of single neuron activity from the mammalian brain in the context of behavioral learning. Students are trained as a group in standard laboratory technique; manufacture of microelectrodes, surgical implantation, recording, behavioral training and histological reconstructions. Smaller working groups (perhaps 3 per group) will conduct a mini experiment, in part of their own planning.

3 units, Win (Thompson) TTh 3:15-5:15 and by arrangement

152. Analysis of Data—(Same as Education 250A.) Analysis of variance and covariance; correlation and regression; analysis of categorical data. Proficiency with statistical computer packages. Prerequisite: Statistics 160; consent of instructor.

4 units, Win (Rogosa) MWF 11-12:30

153. 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 include: random variables, expected value, correlation, Chebyshev and other inequalities; the binomial, Poisson, and normal distributions; limit theorems; small sample distributions; estimation and hypothesis testing; simple analysis of variance; elementary principles of sample design.

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 (Snow) MWF 10

156. Decision and Judgment—(Graduate students register for 256.) The major theoretical developments and empirical findings regarding human judgment and decision making. Focuses on the contrast between the logical (or normative) and the psychological (or descriptive) approaches to the analysis of judgment and choice. The limitations of the classical rational model and their implications.

3 units, Aut (A. Tversky) TTh 11-12:15

157. The Psychology of Judgment and Decision Making—(Graduate students register for 259.) The strategies and shortcomings of human inference, judgment and decision making. Contributions from social psychology and cognitive psychology are integrated so as to understand the processes by which people construe and respond to the actors and events in their social experience. Questions of individual vs. collective rationality, and certain "applied" problems including conflict resolution, clinical prediction, and evaluation of news media stories receive emphasis. NOTE: The concerns of this course and 156/256, though overlapping in some respects, are complementary. The two courses are not redundant.

3 units, Spr (Ross) MW 1:15-2:30

158A,B,C. Foundations of Measurement—(Same as Philosophy 162.) Detailed treatment of fundamental theories of measurement from a formal standpoint. Some attention to their empirical inadequacy. Basic representation theorems for extensive, conjoint and difference measurements are a main topic.

3 units, Aut, Win, Spr (Suppes) by arrangement

163. Mathematical Psychology—(See 215.)

164. Mathematical Representation of Structures in Psychological Data—(See 218.)

165. Graduate Seminar: On Selected Topics in Cognition—(See 219.)

166. Cognitive Introduction to Artificial Intelligence—(Same as Computer Science 123.) (Graduate students register for 266.) Introduction to the core concepts of artificial intelligence, including 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. Prerequisites: Computer Science 106A or equivalent.

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

167A. Peer Counseling: Bridge Community—Instruction in peer counseling. Topics include verbal and non-verbal attending and communication skills, the use of open and closed questions, working with feelings, and summarization and integration. Methods of instruction include lectures, individual training, group exercises and discussion, role-play, and videotaped practice. Students develop and apply the above skills in a variety of contexts. Enroll for credit in only one quarter.

2 units, Aut, Win, Spr (D'Andrea, Staff)

M 3:15-5:05

167B. Peer Counseling: Chicano Community—Instruction in basic counseling. Topics in
clude verbal and non-verbal attending and communication skills, the use of open and closed questions, working with feelings and summarization and integration. Also examines 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 3:15-5:45

167C. Peer Counseling: The Black Community—Instruction in peer counseling with Blacks. Topics include 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—The goal is to train staffers for the student-run Contraceptive Information Center at Cowell. Instructors and guest speakers provide a thorough training in contraceptive issues. Topics include reproductive anatomy and physiology; the effectiveness, mechanism of action, and usage of available birth control methods; all aspects of abortion; and counseling techniques. Sexually transmissible diseases, future methods of contraception, and sexuality are also discussed. 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 pm

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 1987-88

177. Social Psychology of Physical Deviance and Disability—(Same as Human Biology 177.)
184B. Paraprofessional Internship Program—(Same as 184A.)
3-5 units, Win (L. Carlsmith) M 2:15-4:05 and by arrangement

184C. Paraprofessional Internship Program—(Same as 184A and 184B.)
3-5 units, Spr (L. Carlsmith) M 2:15-4:05 and by arrangement

185A, B, C. Experience-based Study on the Meaning of Being Handicapped—A comprehensive look at a number of handicaps; the life experience of the individual affected as well as that of his or her family. Also the roles of the doctor, the therapist, the Special Ed. Teacher, the counselor, and other professionals involved in the life of the handicapped person. Weekly seminars; students also teach swimming to children and adults with different handicaps (mental, physical, emotional, learning, etc.) for at least 3 hours each week, keep an ongoing journal, and participate in a final group or individual action project.
3-5 units, Aut, Win, Spr (L. Carlsmith) Th 7:30-9:30 p.m. and by arrangement

187. Computational Models of Cognition—Computational models of information processing, covering relevant current research in both Artificial Intelligence and Cognitive Psychology. Using computer simulations to test psychological theories. Applications of psychological research to building Artificial Intelligence 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 instructors and limited to 15. Prerequisites: Advanced undergraduate standing and either 106, Computer Science 223 or equivalent experience.
2-3 units (Pavel) by arrangement, given 1987-88

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.) Focus is on 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 is on the interaction on psychological variables and the activity of the pituitary-adrenal system. Also the concepts of stress and coping from a theoretical perspective. Prerequisites: Human Biology Core; consent of the instructor.
3 units, Win (Levine) TTh 4:15-5:05

190A. Early Experience—(Same as Human Biology 143.) Emphasis on experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function. The material covers both animal and human research and deals with behavioral and physiological function. Prerequisite: Consent of instructor.
3 units, Win (Bandura) M 2:15-4:05

191. Undergraduate Seminar: Behavior Change—The social learning approaches to personal and social change. Prerequisite: Consent of instructor.
3 units, Win (Bandura) M 2:15-4:05

192. Undergraduate Seminar: Aggression—The determinants of individual and collective aggression. Prerequisites: 1 and consent of instructor.
3 units, Spr (Bandura) M 2:15-4:05

193. Psychobiology of Learning and Memory—Neural systems and mechanisms that underlie learning and memory; coding, storage, and retrieval of information in the mammalian brain. Approaches to this field in human and animal studies, including invertebrate models, are considered and topics range from habituation and classical conditioning to cognition and language. Prerequisites: Human Biology 4A or Biology 43 or Psychology 107.
3 units (Thompson) given 1987-88

194. Undergraduate Seminars—The 194 seminars are not a series, and may be taken in any order.

194A. Undergraduate Seminar: Parent-child Interaction—Topics include: varieties of child-rearing methods; factors influencing the nature of parent-child interaction; mutual influences between parents and children; how family interaction changes with the growth of the child. Prerequisite: Consent of the instructor.
3 units, Spr (Maccoby) T 10-12

194C. Undergraduate Seminar: Perceptual Development—Topics include neural development and plasticity in the visual system, infant perception of pattern, form, color, and depth, the development of auditory and speech perception, and intermodal perception in infancy.
3 units, Aut (Fernald) T 3:15-5:05

194E. Undergraduate Seminar on the Development of Children's Knowledge About the
Mind—Prerequisite: Consent of Instructor.  
3 units, Win (Flavell) M 1:15-3:05

195. Undergraduate Seminar: Psychology History—The theories and methods relevant to understanding life histories. Longitudinal studies are reviewed. Prerequisite: Consent of instructor.  
3 units, Spr (Hastorf) Th 10-12

199. The Psychology of Mind Control—Analysis of a broad range 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 (e.g., hypnosis, "love-bombing", sensory deprivation), agents of persuasion (e.g., charismatic leaders, salesmen, therapists, gurus), contexts (e.g., total environments, "normal appearances") and vulnerabilities of target populations. A practical goal of the course is to design effective resistance strategies.  
3-4 units, Win (Zimbardo) TTh 3:15-5:05

PRIMARILY FOR GRADUATE STUDENTS

Undergraduate students may be admitted only by consent of instructor.

202B. Visual Sensing by Humans and Computers—(See 102B.)

202C. Visual Sensing by Humans and Computers—(See 102C.)

206. Behavioral Neuroscience—The neurobiological substrates of behavior. Topic areas are mostly organized in terms of categories of behavior. The neuroanatomical, neurophysiological, neurochemical, hormonal and pharmacological aspects of these behavioral phenomena are explored.  
3 units, Spr (Thompson) TTh 1:15-2:45

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 (Hastorf) TTh 11-12:30

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. Memory and Cognition—A survey of major topics in human memory which emphasizes the information-processing approach. Topics include 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, Aut (Bower, B. Tversky) MWF 11

211. Developmental Psychology—Prerequisite: Graduate standing in psychology or consent of instructor.  
3 units, Win (Fernald, Flavell, Markman) TTh 10-12

212. Social Psychology—Prerequisite: Graduate standing in psychology or consent of instructor.  
3 units, Win (Lepper, Ross) TTh 1:15-3:05

213. Personality—Prerequisite: Graduate standing in psychology or consent of instructor.  
3 units, Aut (Weinberger) WF 1:15-2:55

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—(Undergraduates register for 163.) A survey of mathematical theories of choice behavior, decision-making, psychophysical judgments, utility and motivation, learning, memory, and concept formation. Prerequisite: Graduate standing in psychology of consent of instructor.  
3 units (Pavel, Thomas, Tversky, Wandell) given 1987-88

216. Abnormal Psychology—Selected literature in abnormal psychology approached from a cognitive and interpersonal perspective. It attempts to integrate psychoanalytic and behavioral views of the nature, origin, and treatment of abnormal behavior. Prerequisite: Graduate standing in psychology of consent of the instructor.  
3 units, Spr (Horowitz) TTh 11-12:30

218. Mathematical Representation of Structures in Psychological Data—(Undergraduates register for 164.) Theory and methods of multidimensional scaling, hierarchical clustering, and related methods for discovering and representing structures underlying matrices of similarity and multivariate data. Prerequisite: Graduate standing in psychology or consent of instructor.  
3 units (Shepard) given 1987-88
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.) An examination of the issues involved in designing a cognitive architecture. Topics include 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 106, 166, Computer Science 123, 223, or equivalent experience.
   3 units, Spr (Rosenbloom) TTh 11-12:15

224. Survey of Research Topics in Artificial Intelligence—(Same as Computer Science 520.) A survey of current research in AI. Topics vary from year to year. Examples of current research topics are machine learning and discovery, speech or image or language understanding, automatic programming, formal reasoning, nonmonotonic logic, game playing, intelligent computer assisted instruction, knowledge representation and expert systems. Involves distinguished outside lecturers who are specialists in these research topics. Prerequisite: Computer Science 223A or equivalent.
   1 unit, Spr (Nilsson)

225. Psychology and Law Proseminar—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, Aut (Rosenhan) T 2:15-4

228. Mechanisms of Fluid and Macromolecular Secretion—Glandular secretions and muscle contractions are the sole output of the CNS. Course examines how fluid is transported across specialized epithelial sheets by ion transport molecules and ion channels, water then following by osmosis; and how ion and macromolecular transport is controlled by intracellular messengers (which are in turn controlled by neurotransmitters and hormones).
   2-3 units, Spr (Wine) Th 3:15-5:05

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, Spr (Nolen-Hoeksema) TTh 2:15-3:45

231. The Auditory Process—(Same as Hearing and Speech Sciences 292.) A systematic survey of our current knowledge of the operation of the auditory system. Emphasis is on acquiring a knowledge of the acoustic signal, and on an understanding the methods of measuring a sensor process. Prerequisite: Consent of instructor.
   3 units, Aut (Schubert) by arrangement

232. Selected Topics in Psychoacoustics—(Same as Hearing and Speech Sciences 392.) A detailed study of the normal auditory mechanisms with emphasis on using psychoacoustic methods of analysis. Evaluation of current theories regarding auditory processing of information. Prerequisite: Consent of instructor.
   3-4 units, Aut, Win, Spr (Schubert) by arrangement

233. Peripheral Auditory Mechanisms—(Same as Hearing and Speech Sciences 393.) Study of the mechanisms and electrophysiology of the middle and inner ear. Analysis of the ear as a transducer and of the neural encoding process. Prerequisite: Consent of instructor.
   3 units, Spr (Schubert) by arrangement

234. The Affective Disorders—(See 134.)

235. Seminar in Cross-Cultural Psychology—(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, cultural adaptation of existing counseling interventions, and present mental health service delivery models with emphasis on cultural appropriateness, bicultural competence, and clinical efficacy with ethnic minority groups.
   3 units, Win (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, Win (Flavell) Th 3:15-5:05

239. Advanced Cognitive Development—A critical examination of current theory and research in cognitive development. Topics include: Piagetian and other theoretical approaches; developmental aspects of perception, attention, memory, comprehension, communication, and social cognition. Prerequisite: 21 or consent of instructor.
   3 units (Flavell) given 1987-88
240. Language Acquisition I—(Same as Linguistics 240.) Review of present knowledge of processes of language acquisition from a linguistic point of view. Survey of recent and past literature. Prerequisites: Linguistics 10 or 230, or consent of instructor.
3 units, Aut (E. Clark) MW 2:15-3:30

242. Conceptual Organization and Development—Theories and research in conceptual organization and development critically evaluated. Consideration of 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 (e.g., natural kind terms, family resemblances), by recent arguments about how the acquisition of category terms is guided by constraints children place on possible word meanings, as well as by more traditional theories of cognitive development.
3 units, Win (Markman) M 2:15-4:05

243. General Developmental Seminar — Prerequisite: Consent of the instructors.
1-2 units, Win (Fernald, Flavell, Maccoby, Markman) by arrangement

246B. Graduate Seminar: The Development of Communication—An ethological approach to the study of early language development, concerned both with the phylogeny and ontogeny of human communication. Topics include 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, Spr (Fernald) by arrangement

247. Advanced Social Development—Current theory and research on social development. Topics include attachment, aggression, prosocial behavior, moral development, gender differentiation, self-regulation and self-concepts, and parent-child interaction. Prerequisite: 211 or consent of instructor.
3 units, Aut (Maccoby) T 10-12

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 3:15-4:35

250. Individual Counseling Methods — (Same as Education 234.) Techniques for helping individual clients learn successful procedures for coping with problems such as shyness, depression, anxiety, obesity and aggression.
3 units, Aut (J. Krumblotz) alternate years, given 1987-88

251. Topics in Language Acquisition: Acquisition of Morphology and Syntax—(Same as Linguistics 248L.) Forms and uses of noun modifications; compounding, adjectival phrases, prepositional phrases, and relative clauses.
4 units, Win (E. Clark) by arrangement

4 units (Thoresen) given 1987-88

254. Principles of Personality Change — Prerequisite: Graduate standing.
3 units, Aut (Bandura) M 2:15-4:05

255. Graduate Seminar: Selected Topics in Personality and Abnormal Psychology—Prerequisite: Consent of instructor.
3 units, Aut (Horowitz) by arrangement

256. Decision Making—(See 156.)

257. Individually Supervised Practicum—Can be repeated for credit. Prerequisites: Graduate standing in psychology and consent of instructor.
3-5 units, Aut, Win, Spr (Staff) by arrangement

257A. Practicum in Teaching—Enrollment limited to students serving as teaching assistants in selected psychology courses. Can be repeated for credit.
3-5 units, Aut, Win, Spr (Staff) by arrangement

259 The Psychology of Judgment and Decision Making—(See 157.)

264. Selected Topics in Human Learning—Recent empirical and theoretical analyses of verbal learning, of learning from text, of 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. Prerequisite: 210 and consent of instructor.

3 units, Aut (Bower) Th 1:15-3:05

266. Cognitive Introduction to Artificial Intelligence—(See 166.)

269. Graduate Seminar in Personality Research—Can be repeated for credit. Prerequisite: graduate standing in psychology.

1-2 units, Aut, Win, Spr (Weinberger) T 12:30-2

272. Special Topics in Psycholinguistics—Prerequisite: Consent of instructor. May be repeated for credit.

3 units, Win (H. Clark) by arrangement

275. Graduate Research—Research of intermediate nature whether or not to be used toward master's thesis; to be undertaken with members of departmental faculty. Prerequisite: Consent of instructor.

(Staff) by arrangement


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

278. Graduate Seminar: Internal Representation—Can be repeated for credit. Prerequisite: Consent of instructor.

1-3 units (Shepard) given 1987-88

250. Doctoral Research—For dissertation. Prerequisite: consent of instructor.

(Staff) by arrangement

282. Research Seminar on the Representation of Similarity Relations—A review of new theoretical and empirical developments regarding the perception and representation of similarities. The geometric approach to similarity contrasted with alternative approaches based on feature matching and clustering.

1-3 units, Aut (A. Tversky) T 4-6

283A. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 386A, Business 494A, Operations Research 366A.) The analysis of decision making from both normative and descriptive perspectives, particularly in the face of uncertainty.

1-2 units, Aut, Win (Arrow, A. Tversky, Wilson) by arrangement

285. Applying Cognitive Psychology to Computer Systems—Issues in applying psychology to various domains with emphasis on computer-user interaction and on using models of human abilities and limitations in solving real problems. Methodology including model building and testing. The computer related topics include the model-based approach to design computer-user interfaces, software psychology, and knowledge representation. Prerequisite: Consent of the instructor.

1-3 units, Win (Pavel) W 1:15-3:05

289A. Advanced Seminar in Perception, Cognition and Human Performance—Research-oriented in-depth analyses of selected current topics with emphasis on problems related to computer system, 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) W 1:15-3

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

306. Seminar in Brain Substrates of Learning and Memory—Prerequisite: Consent of the instructor.

1-3 units, Aut (Thompson) W 12:15


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—Prerequisite: Graduate standing and consent of the instructor.

1-3 units, Win (Quattrone) F 1:15

315. Proseminar in Social Psychology—Enrollment limited to graduate students in Social Psychology Training Program.

1-3 units, Win (Zimbardo) W 12-2

351. Issues in Child Custody—(Same as Law 243.) Seminar limited to 20 graduate and law students. Admission by consent of instructors. Focus on how information from psychology and other behavioral sciences can be utilized in the development of legal policies affecting children, primarily child custody decisions. It 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.

3 units, Aut (Wald, Maccoby) T 4:15-6
353. Psychopathology and Mental Health Law—(Same as Law 329.) Prerequisite: Consent of instructor.
4 units, Spr (Rosenhan) Th 6:30-9 p.m.

355. Jury Decision Making—The institution of the jury from a variety of perspectives. The social and historical forces, and important legal decisions that helped to shape 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 (Hans, Rosenhan) M 2:15-4:05

PUBLIC POLICY PROGRAM

Director: Roger Noll
Associate Director: John Ferejohn
Affiliated Faculty: Bill Bianco (Public Policy), Tim Bresnanhan (Economics), John Manley (Political Science), Robert McGinn (Industrial Engineering), Terry Moe (Political Science), Lincoln Moses (Statistics), Roger Noll (Economics), David Rogosa (Statistics), W. Richard Scott (Sociology)

STATEMENT OF PURPOSE

A central aspect of contemporary American society is the expanded role of government. With this expanded role has come an increased complexity of government in its organizational forms, in the nature of its policies, and in its informational requirements. Public policies rely for their effectiveness upon the nature of the responses of actors and organizations in the private sector; hence effective public policy analysis and operation needs to be based on a thorough understanding of social, political, and economic factors. Similarly, private sector decision-makers must increasingly deal with public sector responses to private initiatives.

The Public Policy Program offers undergraduates an interdisciplinary approach to the analysis, management, and design of public sector programs and institutions. The core courses of the program are designed to provide a strong background in analytical skills, an appreciation for the operation of large organizations in the implementation of public programs, and training in humanistic studies to prepare the student to understand the sharp conflicts in values that unavoidably pervade many policy issues.

UNDERGRADUATE PROGRAM

BACHELOR OF ARTS

Students planning formally to undertake the Bachelor of Arts in Public Policy should submit proposed courses of study to the Public Policy Program office for approval. Proposals should be made on application forms available from the Public Policy Program office, and should be designed with the assistance of an advisor, selected from among the affiliated faculty or program staff.

Completion of the program in Public Policy requires 75 units of coursework:
1. 35 units of prerequisite courses: Political Science 10 or Political Science 170, Industrial Engineering 100 or Sociology 160, Statistics 60 and 61, and Economics 1, 51, and 52.
2. The 25-unit sequence of core courses (see below for descriptions).
3. Following the core courses, majors must complete 15 units of coursework in some problem-focused area, such as energy policy, health care, food and nutrition policy, or the economics of regulation.

The core courses are open to all students who have fulfilled the prerequisites for a specific course. The 15 units of post-core coursework will be chosen by students in consultation with their advisors from the program. At least one of the courses comprising these 15 units should be a small seminar course, involving a piece of individual research. A maximum of 10 units may be taken on a pass/no credit basis in fulfillment of the major requirements. Students wishing to write an honors thesis in the program should contact program staff.

COURSES

101. Politics and Public Policy—An overview of the domestic policy-making process. Emphasis on how different actors (elected officials, bureaucrats, and interest groups) attempt to 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 (Bianco)

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.) Philosophical and ethical aspects of public policy. Analysis of ethical and value conflicts in policy-making and use of case studies to explore their complexity and role in the design of socially responsible public policy. Topics: "freedom," "rights," "justice," "the public interest" and other key terms in public policy discourse. Applications to cases from biomedical policy (abortion, euthanasia, *in vitro* fertilization), environmental policy (wilderness, energy, amenity rights), and public policies with international dimensions (food and hunger, population).

5 units, Aut (McGinn)

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 three topic areas—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.) Focusing upon applications of statistical methods, rather than methodology per se, considers 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 (Rogosa)

180. Washington D.C.: Issues and Players—Designed for undergraduates who will be interning in a government agency the summer 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, Spr (Milton)

185A, B. Legislative Process—The behavior of individual congressmen, the form and content of legislation they enact, and other features of the legislative process in terms of legislator’s goals and the institutional structure of Congress (the formal structure—the committee system, bicameralism, and various rules of procedure, as well as informal norms). Also, the tactics used by outside actors (bureaucrats, the President, and interest groups) to affect the congressional policy-making process. Prerequisite: Political Science 10.

185A. 5 units, Aut (Bianco) M 1:15-4:05
185B. 5 units, Win (Bianco)

198. Directed Readings in Public Policy. 1-5 units (Staff) by arrangement

199. Honors Thesis. 1-5 units (Staff) by arrangement

200. Senior Seminar—Designed to give Public Policy students the opportunity to write a seminar-length paper on a topic in political science or 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 in which the question of how to conduct “good” research in the discipline of political science and public policy is discussed. Prerequisite: Permission of the instructor.

2 units, Spr (Bianco)

**RELIGIOUS STUDIES**

Chairman: Edwin M. Good

Professors: Lawrence V. Berman (on leave Autumn), René Girard (French and Italian and, by courtesy, Religious Studies), Edwin M. Good, Van A. Harvey (on leave 1986-87), David S. Nivison (Asian Languages, Philosophy, Religious Studies on leave Autumn and Spring), Lewis W. Spitz (History and, by courtesy, Religious Studies)

Associate Professors: Arnold M. Eisen, Lee H. Yearley

Assistant Professors: Carl W. Bielefeldt, Hester G. Gelber

Lecturer: Paul H. Mosher

Visiting Professor: Robert G. Hamerton- Kelly

Visiting Associate Professor: James H. Foard

Acting Assistant Professor: Anne C. Klein

**OFFERINGS**

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 (3, 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 10 units of which can be taken Pass/No Credit), including 9 to 15 units in introductory courses (1-89), at least two of which must be in diverse religious traditions (e.g., Eastern and Western, pre-literate and literate); at least 40 units in courses numbered above 100, including no fewer than three seminars.

The bachelor’s degree with honors in Religious Studies may be earned by students who are endorsed by their advisors and by the undergraduate director and who meet additional requirements, available from the 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 “Philosophy” in this bulletin or in the guidelines which are available from the undergraduate director.

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 9 units.

Each student demonstrates reading knowledge of at least one foreign language before enrolling for the second required graduate seminar.

DOCTOR OF PHILOSOPHY

University regulations regarding the Ph.D. are found in the “Degrees” section in this bulletin. The following requirements are in addition to the University’s basic requirements. Complete information is contained in the Handbook of Graduate Religious Studies, available from the departmental secretary.

Residence — Each student completes three years (nine quarters) of full-time study, or their equivalent, in graduate work beyond the Bachelor of Arts degree, to a minimum of 90 units of graduate work in addition to the dissertation, of which the last 60 units must be taken at Stanford.

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, Western religions, modern Western religious thought, and American religions. 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

Until the beginning of the last four weeks of the quarter, a student may add units of credit to a fixed unit course provided the student’s total registration does not exceed the normal load limits. The increase, subject to the approval of the instructor, may be up to one hundred percent of the published unit value of the course.

Courses listed below numbered 1B-89 expect work at an introductory level. Those numbered 101-289 expect work at an advanced undergraduate level.

INTRODUCTORY

1B. Comparative Religious Personalities — Comparison and contrast of mystics, and intellectuals selected from Christianity, Islam, and Judaism.

3 units, Win (Berman) MWF 11

1C. Comparative Religious Thought — Differences and similarities among a variety of religious traditions on selected topics. The topic for 1986-87 will be the human encounter with death and views of the afterlife. Limited enrollment.

3 units, Win (Foard) MWF 9

1D. Religions of the East — (Formerly Religious Studies 12.) Ideas and practices of Chinese, Japanese, and Buddhist religious traditions and the role of these traditions in Asian cultures. Limited enrollment. (DR:3*)

3 units, Spr (Foard) MWF 9

1E. Eastern and Western Conceptions of the Self — (Formerly Religious Studies 40A.) Analysis of and comparison among models of the self in various traditions, notably classical Greek, Christian, Confucian, Buddhist, Taoist, and Freudian. Limited enrollment. (DR:4*)

4 units, Spr (Yearley) MWF 11

1F. Eastern and Western Conceptions of Virtue.

4 units (Yearley) not given 1986-87


3 units (Staff) not given 1986-87

14. Introduction to Buddhism — An introduction to the history, thought, and practice of Buddhism. The fundamentals of Buddhist thought as taught during its first centuries in India, the changes of emphasis and style in the later Indian Mahayana; and the various forms Mahayana took as it travelled to Tibet, China, and Japan. Readings center on primary source materials with expositions of this by scholars and teachers within their respective traditions. Limited enrollment.

3 or 4† units, Aut (Klein) MWF 10

18. Zen Buddhism — History, teachings, and practices of Ch'an and Zen Buddhism. Limited enrollment. (DR:3*)

3 or 4† units, Spr (Bielefeldt) MWF 10

23. Judaism — The historical development of Jewish religious thought and practice, from the Biblical period to the present. Emphasis on texts reflecting that development: scriptural, liturgical, midrashic, legal, historical, and philosophical. Limited enrollment. (DR:3*)

3 units, Aut (Eisen) TTh 8:30-9:50
24A. Christianity—Exploration of meaning of being Christian in the world. Ideas about the Christian community and their social and political effects and varying conceptions about Christ that go along with such ideas.
4 units, Win (Gelber) MWF 1:15

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.
3 units, Win (Berman) MWF 9

42. Philosophy of Religion—Classic questions in philosophy of religion revisited: the existence of God, the problem of evil, free will and determinism, the ethics of belief. Readings include traditional and modern texts.
4 or 5 units, Aut (Gelber) MWF 11

52F. Readings in Philosophy and Religious Studies—(Same as German 52F.)
3-4 units, Spr (Staff) MWF 12

55. Introduction to Chinese Philosophy—(Same as Philosophy 46, Asian Languages 46.) The history of Chinese philosophy to 200 B.C., together with a brief introduction to Classical Chinese as used by early philosophers. Limited enrollment.
4 units, Spr (Ivanhoe) MWF 10, sections by arrangement

TOPICS IN RELIGION

116. Japanese Buddhism—(DR:3)
5 units (Staff) not given 1986-87

119. Hindu and Buddhist Meditation.
5 units (Staff) not given 1986-87

121A. The Hebrew Bible.
4 units upon completion of 121B (Good) not given 1986-87

121B. The Hebrew Bible—(See 121A.) Prerequisite: Completion of 121A.
2 units (Good) not given 1986-87

124B. Christianity to the Year 1000—(Formerly Religious Studies 17A.)
5 units (Staff) not given 1986-87

124C. Medieval and Renaissance Christianity—(Formerly Religious Studies 17B.)
5 units (Staff) not given 1986-87

126. Age of the Reformation—(Same as History 110.)
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.
5 units, Spr (Berman) MW 8:30-9:50

132. Jesus in the Gospels.
5 units (Hamerton-Kelly) not given 1986-87

5 units (Bielefeldt) not given 1986-87

140. Religious Ethics.
5 units (Staff) not given 1986-87

141. Renaissance Humanists and Reformers—(Same as History 213.)
5 units, Aut (Spitz) TTh 2:15-4:05

144. Religious Self-Cultivation.
5 units (Yearley) not given 1986-87

147. Modern Christian Thought.
5 units (Harvey) not given 1986-87

148. Social Theory and Religion—Examination of classical texts on the role of religion in society (Weber, Durkheim, and Freud) as well as contemporary theorists such as Berger, Geertz, and Turner.
5 units, Spr (Eisen) TTh 10

149. Theories of Religion.
5 units (Staff) not given 1986-87

150. Systems of Buddhist Thought—History and teachings of the Lotus school in China and Japan.
5 units, Spr (Bielefeldt) MWF 1:15

151. Modern Jewish Thought—A survey of Jewish thought from Spinoza and Mendelssohn to the present, analyzing the major movements, figures, and issues in Judaism's confrontation with modernity. Prerequisite: 23 or consent of the instructor.
5 units, Win (Eisen) TTh 10

166. Theology of Paul—The theology of the apostle Paul in its historical context.
5 units, Win (Hamerton-Kelly) TTh 11 plus section by arrangement

167. Medieval and Renaissance Religious Philosophy—(Same as Philosophy 101.) Survey of Medieval and Renaissance philosophy with a focus on the implications of believing the world is a product of a creator God. Exploration of questions about time and eternity, free will and determinism, necessity and contingency, through Medieval and Renaissance debates. Readings include Augustine, Anselm, Aquinas, Scotus, Ockham, Erasmus, and Luther.
4 units, Win (Gelber) MWF 10

171. Augustine.
5 units (Staff) not given 1986-87

174. From Kant to Kierkegaard.
5 units (Harvey) not given 1986-87

† For 4 or 5 units, additional section by arrangement.
UNDERGRADUATE
DIRECTED READING

197. Senior Essay—Prerequisite: Consent of the instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

198. Honors Essay—Prerequisite: Consent of the instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

199. Individual Work—Prerequisite: Consent of the instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

SEMINARS FOR
UNDERGRADUATES
AND GRADUATES

215. Religions of Modern Japan—The religion and values of the Japanese people in the 20th century, including modernization, civil religion, and new religious movements.
   5 units, Spr (Foard) MW 2:15-4:05

228. Palestinian Jewry in the Time of Jesus—The history, society, politics, and religion of Judea and Galilee in the 1st century BCE and the 1st century CE. The Jesus movement and other Jewish groups; the zealots and the war with Rome.
   5 units, Aut (Hamerton-Kelly) MW 2:15-4:05

229. Religions of Abraham—Comparison of forms of Judaism, Christianity, and Islam.
   5 units, Spr (Berman) MW 2:15-4:05

   5 units, Aut (Bielefeldt) MW 2:15-4:05

232C. The Crucifixion.
   5 units (Gerber) not given 1986-87

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, Win (Girard, Hamerton-Kelly) TTh 4:15-6:05

234B. The Virgin Mary and Images of Power—(Same as Feminist Studies 150.) Exploration of the emergence of devotion to the Virgin Mary in the Middle Ages and beyond, focusing on the social and political meanings of the image. Emphasis on Mary in art through slides.
   5 units, Aut (Gelber) MW 4:15-6:05

235. Tibetan Wisdom Texts: Wisdom, Compassion, Death and Enlightenment—Analysis and discussion of three major areas of Tibetan Buddhist thought and practice. Special attention to the tensions and congruencies between doctrines of selflessness and compassion in sутra, and how tantric perspectives on the process of dying and death represent an extension of these issues. (Option to read in Tibetan texts for additional credit.)
   5 units, Win (Klein) MW 2:15-4:05

236A. Buddhism and the Play of Wisdom.
   5 units (Klein) not given 1986-87

238. Confucian Ethics—(Same as Asian Languages 331, Philosophy 331.)
   5 units (Nivison) not given 1986-87

239. The Golden Rule.
   5 units (Nivison) not given 1986-87

241A. Luther and the Radicals—(Same as History 213A.)
   5 units (Spitz) not given 1986-87

245. Comparative Religious Ethics.
   5 units (Yearley) not given 1986-87

249B. Psychology and Religion.
   5 units (Staff) not given 1986-87

254. Confucianism Since Wang Yang-ming—(Same as Asian Languages 144, Philosophy 124.)
   5 units (Nivison) not given 1986-87

257. Buddhist Theories of Knowledge and Liberation.
   5 units (Klein) not given 1986-87

258. Japanese Buddhist Studies: Japanese Buddhist Texts—(Same as Asian Languages 258.) Readings in the literature of medieval Japanese Buddhism; introduction to Japanese Buddhist studies. Prerequisite: Background in Japanese
   5 units, Win (Bielefeldt) by arrangement

258A. Buddhism and the Feminine.
   5 units (Klein) not given 1986-87

260. Contemporary Jewish Thinkers: Abraham Heschel and Joseph Soloveitchik—An examination of the writings in English of the two most important figures in postwar Jewish thought.
   5 units, Spr (Eisen) TTh 2:15-4:05

262. Sociology of Religion—(Same as Sociology 280.)
   5 units (Swidler) not given 1986-87

263. The Book of Job.
   5 units (Good) not given 1986-87

268. Francis of Assisi.
   5 units (Gelber) not given 1986-87

273. Aquinas' Ethics—Thomas Aquinas' analysis of virtues with some attention to his general theory of ethics. Prerequisite: Consent of the instructor.
   5 units, Win (Yearley) MW 2:15-4:05
274A. Sigmund Freud.
5 units (Yearley) not given 1986-87

274D. Friedrich Nietzsche.
5 units (Harvey) not given 1986-87

277. Religious Existentialists—(Same as German Studies 179K.)
5 units (Harvey) not given 1986-87

281. Encounters Between Modern Philosophy and Judaism: Kant—An examination of Kant's Religion Within the Limits of Reason Alone and responses to his critique of religion in general and Judaism in particular by Jewish thinkers such as Cohen, Buber, and Soloveitchik.
5 units, Win (Eisen) TTh 4:15-6:05

GRADUATE STUDENT DIRECTED READING

299. Individual Work—Prerequisite: Consent of the 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. Topic for 1986-87: Approaches to religious texts, using works of literary theorists such as Northrop Frye, Paul Ricoeur, Roland Barthes, Julia Kristeva, Jacques Derrida. Prerequisite: Consent of the instructor.
6 units upon completion of 302B, Aut (Good) TTh 2:15-4:05

302B. Problems in the Interpretation of Religion—(See 302A.) Prerequisite: Consent of the instructor; completion of 302A.
Win (Good) TTh 2:15-4:05

304A. The Historical Tradition in the Academic Study of Religion—Required of all graduate students in religious studies; may be repeated for credit. Prerequisite: Consent of the instructor.
6 units upon completion of 304B, Aut (Staff) given 1987-88

304B. The Historical Tradition in the Academic Study of Religion—(See 304A.) Prerequisite: Consent of the instructor; completion of 304A.
Win (Staff) given 1987-88

GRADUATE RESEARCH AND TEACHING

Topics vary from year to year based on student initiatives and faculty research interests.

319. East Asian Religions.
(Bielefeldt, Klein, Nivison, Yearley) by arrangement

(Berman, Good, Hamerton-Kelly) by arrangement

339. Medieval Western Religions.
(Berman, Gelber, Mosher, Yearley) by arrangement

349. Modern European Religions.
(Eisen, Harvey) by arrangement

359. American Religions.
(Eisen, Harvey) by arrangement

369. Social and Psychological Aspects of Religion—Prerequisite: Consent of the instructor.
(Staff) by arrangement

379. Religious Thought—Prerequisite: Consent of the instructor.
(Staff) by arrangement

389. Theory of Religion—Prerequisite: Consent of the 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 the 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)
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 Lit. and Slavic), Alexander L. George (Political Science), John Gurley (Economics), Alex Inkeles (Sociology and Hoover Institution), Mark Mancall (History), Richard Schubbach (Slavic), Lawrence Stahlberger, Emeritus (Slavic), William M. Todd (Slavic), Jan F. Triska (Political Science), Joseph VanCampen (Slavic), Wayne S. Vucinich, Emeritus, (History)
Associate Professors: Karol Berger (Music), William S. Eddelman (Drama), Gregory Freidin (Slavic), Sabine MacCormack (History)
Assistant Professors: Monika D. Frenkel (Slavic), Nancy S. Kollmann (History), Condoleezza Rice (Political Science)
Acting Associate Professor: Coit D. Blacker (Political Science)
Affiliated Professors: Donald L. Carpenter (Stanford Electronics Laboratory), Sidney Drell (Physics/ SLAC), John W. Lewis (Political Science)
Lecturers: Barbara Voytek (Anthropology), Wojciech Zalewski (Slavic and Stanford Libraries)
Visiting Professors: John J. Stephan (History), Andrei Sinyazsky (Slavic)
Visiting Associate Professor: Jonathan G. Haslam (History)
Visiting Lecturers: Frances Foster-Simons (Law), Robert Weinberg (History), Henry Nord (Sociology)
Instructor: Vera M. Henzl (Linguistics)
Affiliated Staff: Dorothy Atkinson (AAASS), Robert Conquest (Hoover Institution), John B. Dunlop (Hoover Institution), Joseph D. Dwyer (Hoover Institution), David Holloway (International Security and Arms Control)

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.

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

4. Complete, in addition to the 180 units required for the bachelor’s degree, a minimum of 40 units for the master’s degree. These units must be distributed as follows:
   a) A minimum of five graduate courses in the program field, three of which are to be taken in at least two departments other than that of the undergraduate major.
   b) The remaining courses required to make up the 40 units may include advanced undergraduate courses and may be taken in various departments, but all are to be in the Russian or East European field.
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: Richard D. Schupbach
Professors: Joseph A. Van Campen (on leave Spring), Lazar Fleishman, Joseph Frank, Richard D. Schupbach, William Mills Todd III (on leave, 1986-87)
Associate Professor: Gregory Freidin (on leave Winter and Spring)
Assistant Professor: Monika Frenkel
Lecturer: Wojciech Zalewski (Curator, Russian and East European Collection, Stanford Libraries)

OFFERINGS AND FACILITIES

The department accepts candidates for the degree of Bachelor of Arts, Master of Arts, and Doctor of Philosophy. Particular requirements for each degree are described below.

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 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 grade 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 (for a description see "Humanities Special Programs" in this bulletin) are to select with the help of their advisor a minimum of three general courses (9 units) in support of their major program.

HONORS PROGRAM

Majors with a minimum grade average of "B+" in Russian courses are eligible to participate in the department's Honors Program. Students may do honors work in Russian Literature or in Russian Language. Requirements are listed below.

RUSSIAN LITERATURE

1. Language prerequisites: Three years of Russian, and 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 grade of "B" or better on a thesis written during this period.

5. Strongly recommended courses in other disciplines: A course sequence in Russian History.

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, 211, 212, 213.

3. Slavic 199: Individual Work, 6 to 9 units during the candidate's senior year. To receive honors, the candidate must receive a grade of "B" or better on a thesis or project conducted under the close supervision of a member of the professorial staff.

RECOMMENDED
1. Strongly recommended courses in Russian literature: 145, 146, 147, 187, 188.

2. Recommended courses in other departments: Communications 100, 102, 107; Computer Science 105, 106, 109A, or 111; History 120; Linguistics 10, 200, 206, 215, 230, 240, 253; Mathematics 3; Philosophy 57, 181.

GRADUATE PROGRAMS
MASTER OF ARTS

Admission—The requirements for admission to the master's degree program in Russian are:
1. A Bachelor of Arts degree (or its equivalent) from an accredited college or university.
2. A command of the Russian language sufficient to permit the student to do satisfactory graduate work in his or her area of specialization.
3. A familiarity with Russian literature sufficient to permit the student to perform adequately in courses at the graduate level.

The applicant's previous academic training in Russian language and literature must normally serve as a tentative indication of competence. Accordingly, the department will not ordinarily consider applications from students who have not had at least three years of college Russian and some undergraduate training in Russian literature of the 19th and 20th centuries.

However, before registering for the first quarter's work in the department, all entering graduate students are required to take placement examinations in language and literature. Students who fail to perform satisfactorily on such examinations will be required to register for remedial courses in the area or areas in which they are deficient. Such remedial courses, which must normally be completed within the first three quarters of residence, will carry no credit toward either the A.M. or the Ph.D. degree.

Course Requirements—Candidates for the A.M. who are not also candidates for the Ph.D. should plan their course load to insure that they will be adequately prepared for the A.M. final examination by the end of their third quarter of work. Those who are also candidates for the Ph.D. degree with a concentration in language and linguistics should include in their first year's work any courses needed for the A.M. examination in that area. Candidates for the Ph.D. with a concentration in literature should attempt to include as many of the department's basic course offerings as possible in their first-year program in order to insure that they have sufficient time to complete the A.M. thesis during their fourth quarter of registration. In any case, the course work should be planned in consultation with the graduate advisor whose written approval of the overall course load is required.

Candidates for the A.M. degree must complete a program of 36 units, of which 27 units must be selected from the courses given by the department. The other 9 units may, with the approval of the candidate's advisor, be selected from courses in related fields. Of the 27 units based on the department's courses, a minimum of 9 must be in language courses, a minimum of 9 must be in literature courses, and the remaining 9 may be distributed in accordance with the needs and interests of the individual student, with the advice and approval of the student's departmental advisor.

It should be noted that no credit toward the A.M. degree will be allowed for first- or second-year courses in non-Slavic languages required for the Ph.D. degree.

Final Examination—Students not enrolled in the Ph.D. program may either submit an A.M. thesis or take a final examination. In the latter case, regardless of the area of specialization, the student will be required to demonstrate on a written examination (1) command of the phonology, morphology, syntax, and lexicology of contemporary Standard Russian sufficient to allow him or her to teach beginning and intermediate courses at the college level; (2) an ability to read contemporary Standard Russian sufficient to permit him or her to be a reliable guide to students studying contemporary Russian poetry or literary prose; and (3) sufficient familiarity with Russian literature of either the 19th or 20th century to handle successfully survey courses dealing with his or her chosen period.

The examination should be passed at the end of the final quarter 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
strenthen their academic preparation. Detailed requirements for the degree are outlined in the School of Education section of this bulletin. The program includes 45 units of which 25 must be in the teaching field and 12 in education. Specific language requirements are established in consultation with the department.

DOCTOR OF PHILOSOPHY: SLAVIC

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 an average grade of B+ or better; (2) In the case of students wishing to specialize in literature, written an acceptable A.M. thesis, to be completed before the end of the 4th quarter, or, in the case of students wishing to specialize in Slavic linguistics, passed a written examination based on course materials and a reading list. Failure to comply with the above two requirements will result in termination of candidacy for the Ph.D. degree. The terminated student may, at the discretion of the faculty, be given the opportunity to take the A.M. written examinations. If successful, the student will then be awarded the A.M. degree, but will not be accepted as a candidate for the Ph.D. degree.

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 grades 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 a grade of “B—” or better, Slavic 221, 222, and either Slavic 187 or
Slavic 188. They should also have taken Slavic 145, 146, and 147 or show equivalent training.)

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.

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.

144. The Art and Architecture of Imperial and Soviet Russia—Art and architecture in the changing historical context of 18th- and 19th-century Russia, the confrontation between avant-garde art and revolutionary politics between 1905 and 1930, and the triumph of social realism in Stalinist Russia. Slide illustrated, open to all students.

4 units, Win (Kollmann) given 1987-88

145/245. Survey of Russian Literature in English Translation I: The Age of Experiment (Graduate students register for 245.) The first part of a three-quarter survey of the Russian prose tradition covers the first 40 years of the 19th century. Considerable attention will be paid to the formative period of Russian prose, the lesser known contributions of poets and Romantic and popular writers. The 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 simultaneously of “local” literary and stylistic developments and of contemporary European trends. Open to all students, including freshmen. (DR:2)

4 units, Aut (Fleishman) MWF 10

146/246. Survey of Russian Literature in English Translation II: The Novel and Beyond (Graduate students register for 246.) Close reading of 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, including freshmen. (DR:2)

4 units, Spr (Frank) TTh 2:15

147/247. Survey of Russian Literature in English Translation III: A Fractured Culture (Graduate students register for 247.) The survey’s third quarter traces some of the major movements in the extraordinary historical and cultural ferment of 20th-century Russia: literature in exile (Nabokov, Solzhentisyn, Brodsky); underground literature (Pasternak’s Dr. Zhivago, Zamyatin’s We, Sinyavsky); and the best of literature officially published (Mayakovsky, Babel, Olesha, Rasputin, Trifonov). A continuation of 145 and 146, but may be taken independently of it. Open to all students, including freshmen. (DR:2)

4 units, Spr (Brown) MWF 10


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 (Van Campen, Staff) TTh 12 and 1:15

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 (Van Campen, Staff)
TTh 12 and 1:15

53. Second-Year Russian—Continuation of 52.
Reading centers on selected texts from 19th-century authors.

3 units, Spr (Van Campen, Staff)
MWF 12 and 1:15

53A. 2 units, Spr (Van Campen, Staff)
TTh 12 and 1:15

111-113. Third-Year Russian—Emphasis on reading, vocabulary building and textual analysis. It is strongly recommended that students take 114-116 in conjunction with this series.

Prerequisite: 53 or equivalent (with 114-116 only).

3 units, Aut (Schupbach)
Win, Spr (Frenkel) MWF 2:15

114-116. Third-Year Russian Conversation and Composition—Coordinated with and to be taken in conjunction with 111-113. These courses focus on the development of oral skills. Readings are from contemporary literature and journalistic sources.

2 units, Aut, Win, Spr (Staff) TTh 1:15

ADVANCED AND GRADUATE

167-168. Fourth-Year Russian Seminars I-III—Designed for students who would like to perfect their verbal and written skills while concentrating on major problems in Russian cultural history, as reflected in that country’s literature. Following an introduction to critical reading, the students will approach selected texts systematically both as “literature” and “documents” in the social and intellectual history of Russia. Open to all majors; the seminars are conducted in Russian (oral reports and short compositions are required).

3 units, Win (Van Campen)
MWF 12 and 1:15

167. Fourth-Year Russian Seminars I—Fundamentals of literary analysis and topics in Russian intellectual history. Three parts: a discussion of basic categories of text analysis and their application to a variety of genres (lyric poetry, short fiction, scholarly discourse); reading and discussion of a single work of fiction; and selected texts from Russian historiography and intellectual history. Requirements: Four short papers, discussion questions, two oral reports.

4 units, Aut (Freidin) TTh 10


4 units, Spr (Frenkel) TTh 2:15-3:45

177. Advanced Russian—Reading, conversation and composition.

3 units, Aut (Staff) TTh 3:15

178. Advanced Russian—Reading, conversation and composition.

3 units, Win (Staff) TTh 3:15

179. Advanced Russian—Reading, conversation and composition.

3 units, Spr (Staff) TTh 3:15

184. Introduction to Slavic Bibliography—Historical and evaluated analysis of Slavic bibliographic and research tools, with emphasis on 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, Win (Zalewski) Th 2:15-4:05

185. Russian Poetry of the 19th Century—A study of the major representatives of Sentimentalism, Romanticism, Realism, Pushkin, Lermontov, Tjutchev and others. Lectures and discussions in English. Readings in Russian. Graduate students may earn 4 units.

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

186. Russian Poetry of the 20th Century—A survey of main developments in Russian poetry in this century (Symbolism, Acmeism, Futurism, Constructivism). The focus is on close analysis of representative lyric poems of major modern poets (from Blok and Belyi to Pasternak and Tsvetaeva).

3 units, Spr (Fleishman) MWF 11

187. Old Russian Literature—A study of Russian literature, culture, and thought from the earliest times through the 17th century (some readings in the original).

4 units (Todd) not given 1986-87

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 1986-87

195. Advanced Topics in Russian Grammar I: Phonetics and Phonology of Russian—Discussion of the phonetics and phonology of contemporary standard Russian, with emphasis on
the relationships between inflectional categories and sound features.

3 units, Aut (Schupbach) MWF 9

196. Advanced Topics in Russian Grammar II: Morphology—Russian inflectional morphology with special attention to the predictability of desinences and semantics of grammatical categories.

3 units, Win (Van Campen) MWF 2:15

197. Advanced Topics in Russian Grammar II: Dialects of Russian — Survey of the Slavic languages.

3 units, (Schupbach, Van Campen) not given 1986-87

199. Individual Work—Open to Russian majors or students working on special projects. May be repeated for credit. Consent of instructor or required.

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, Slavic Bibliography. Required of all entering graduate students and all honors majors in Russian literature.

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

211. Introduction to Old Church Slavic.

3 units, Aut (Van Campen) alternate years, given 1987-88

212. Reading of Old Church Slavic and Old Russian Texts. Prerequisite: 211.

3 units, Win (Van Campen) alternate years, given 1987-88

213. History of the Russian Literary Language—A survey of the major structural and semantic changes from the 10th to the 19th centuries. Prerequisites: 211 and 212.

3 units, Spr (Fleishman) MWF 1-2

220. Literary Translation—The translation into English of Russian literary texts as an exercise in critical analysis. Readings in the theory of translation, and criticism of existing translations. Each student produces as his principal course work a publishable translation of a literary text.

4 units, Win (Brown) not given 1986-87

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 1986-87

222. Early Soviet Prose: Osip Mandelstam, Isaak Babel and Mikhail Zoschenko—A study of these three writers in the literary, social and historical context of the decade following the 1917 Revolution.

4 units (Freidin) not given 1986-87

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. Attention is paid to non-Party authors, among them, Babel, Eikhenbaum, Mandelstam, Olesha, Tynianov, Zamiatin, and Zoschenko.

4 units, Spr (Freidin) not given 1986-87

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 1986-87

225. Problems of Romanticism in Russia.

4 units, Aut (Frenkel) W 2-4


4 units (Freidin) not given 1986-87

227. Boris Pasternak and the Poetry of the Russian Avant Garde—Pasternak’s work examined within a broad cultural context. The aim is to identify and analyze characteristic features of the Russian avant-garde poetics.

4 units, Spr (Fleishman) not given 1986-87

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, Aut (Fleishman) M 1:15-3:05

229. Russian Versification—History and theory of Russian versification from the 17th to the 20th century.

4 units, Win (Fleishman) TTh 11-12:30

230. Russian Formalism and Structuralism—The Russian Formalists’ contribution to literary criticism and theory; the relationship of Russian Formalism to critical movements in the West;
the Prague School, and the Soviet Structuralists. No knowledge of Russian is required.

4 units, Win (Brown) T 2:15

271. Solzhenitsyn—(Undergraduate students register for 155.) Study of the major work of Solzhenitsyn in the novel, short story, drama, and essay forms, and in the genre most characteristic of him: "literary investigation." No knowledge of Russian is required, but concentrators in Slavic are expected to do a major portion of the reading in Russian.

4 units (Brown) not given 1986-87


4 units, Win (Freidin) not given 1986-87

275. Dostoevsky and French Literature—(Enroll in Comparative Literature 375.)

277. Gogol—A study of his fiction, drama and essays with attention to problems of structuration and refraction of cultural contexts. Open to undergraduates with advanced training in Russian.

4 units (Todd) not given 1986-87

278. Tolstoy—Study of Tolstoy's creative evolution includes selections 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 1986-87

279. Dostoevsky—A study of Dostoevsky's shorter works in the context of European thought and literature.

4 units (Todd) not given 1986-87

280. 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, Frenkel, Schupbach, Todd, Van Campen) by arrangement

300. Graduate Seminar: Theory of Narrative—Studies of narrative (fictional, historical, sacred) as verbal structure, representation, rhetoric, and social institution. Readings include 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) not given 1986-87

300A. Graduate Seminar: Literature as Institutions—A study of literary production, dissemination, and reception in selected periods of Russian literature, from the Middle Ages to the present. Readings in social theory, literary criticism, and imaginative literature. Open to students without Russian only by permission of instructor.

4 units, Spr (Todd) MW 2-4

300B. Graduate Seminar: Theater as Model of Self and Society in Russian 19th Century Literature—Selection of texts includes Gore ot uma, Evgeny Onegin, Malenkie tragedii, Geroi nashego vremeni, Tolstoy's Ispoved', Besy, read (in Russian) in the context of semiotic theory.

4 units (Frenkel) not given 1986-87

300C. Introduction to Archival Research in Russian Literature and History.

3 units (Fleishman) not given 1986-87

For additional offerings in literature, see Comparative Literature.

Students interested in languages not listed for a specific language department should contact the Special Language Program, Department of Linguistics.

Sociology is concerned with the full spectrum of social behavior (of individuals, small groups, and societies) and the conditions, causes, and consequences of such behavior. Sociology is the exploration of these phenomena from a number of perspectives. The faculty has expertise in a number of areas.

Emeriti: (Professors) St. Clair Drake, Dudley Kirk
Chairman: Joseph Berger
Assistant Professors: Carol Conell, Jerald R. Herting, Leonard Hochberg, Ann Swidler (on leave, Autumn, Spring)
Consulting Associate Professor: Shmuel Eisenstadt
Consulting Associate Professor: Janet Johnston

OFFERINGS AND FACILITIES

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 (coterminous), or doctoral levels. Courses numbered 1-199 are open to all students without prerequisites, unless specifically indicated. Courses numbered 200-299 are open to advanced undergraduate students. Courses numbered 300 and above are normally offered to graduate students only.

The department returned to permanent quarters in Building 120 during 1982-83. The completely renovated facility houses faculty and graduate student offices and research facilities of the Center for Sociological Research.

**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 Processes
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 also provides 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 sociological knowledge, both theory and methods, can make to the solution of social problems. Problem areas considered include deviance, poverty, mental illness, alcoholism, as well as problems in the definitions of sex roles and the relations among ethnic groups. Foundation courses emphasize the special skills involved in applying sociological explanations and the special methodologies used in evaluation and policy-relevant studies. Careers linked to this area of study include social work, parole and probation, clinical sociology, evaluation and policy research positions.

**Social Psychology and Interpersonal Processes**—This field of inquiry focuses on the social organization of individual identity, beliefs, and behavior; and upon social structures and processes which emerge in and define interpersonal interactions. Processes studied include social acceptance and competition for prestige and status, the generation of power differences, the development of intimacy bonds, the formation of expectation states which govern performance in task oriented groups, and social pressures to constrain deviance. Foundation courses emphasize the effect of social processes on individual behavior and the analysis of group processes. Careers which relate to this study area include therapy and counseling of individuals, couples and families, and group work.

**Family Structures and Processes**—This area focuses attention on one of our most important and rapidly changing social institutions. Courses within this area will 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 support. Courses also deal with internal and external 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 encompasses both the study of individual behavior within organizations as well as the behavior of organizations as collective actors and the factors which affect their functioning. Organizations are the primary tool by which specialized goals are pursued in modern societies; they are found in every sector of modern life. Organizations studied include private profit taking firms and public organizations; voluntary associations and total institutions such as prisons; small, single purpose companies as well as giant diversified corporations. Foundation courses stress the environmental and technological factors which shape the structure of organizations and the social psychological and interpersonal processes which shape the behavior of individuals within organizations. Careers which relate to this study 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, and comparative perspectives are utilized. Foundation courses introduce students to one or more of these perspectives as well as to specific institutional areas. Careers
related to this area of study include law and governmental service.

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 these six areas; a few courses are relevant to more than one area of concentration. And within the four substantive areas, one or more Foundation Courses are identified which provide a general introduction to the area or some portion of it. Courses for the current academic year, classified by area, are as follows:

1. Applied Sociology
   Foundation Courses: 100, 101.
   Other Courses: 102-119; 125, 145, 150, 155.

2. Social Psychology and Interpersonal Processes
   Foundation Courses: 120, 121.
   Other Courses: 122-134; 220-239; 102, 104, 106, 161.

3. Family Structures and Processes
   Foundation Courses: 142
   Other Courses: 103, 104, 107, 110, 154

4. Organizational Behavior
   Foundation Courses: 160, 161.
   Other Courses: 161-169; 260-269; 114, 118, 125, 140, 143, 148, 240.

5. Comparative Social and Political Institutions
   Foundation Courses: 140, 141, 142, 143, 144.
   Other Courses: 135-159; 240-259; 109, 111, 119, 252, 283.

6. Research Methods
   Courses: 181, 182.

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 each student to tailor the degree program to fit her or his individual needs and interests. These programs, and the requirements for each, are described below.

CORE CURRICULUM

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 adviser and must not exceed 20 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). Students may count either Western Culture 11 or Western Culture 12 (the medieval and modern quarters of "Conflict and Change in Western Culture") for credit toward the Sociology major.

GENERAL SOCIOLOGY MAJOR

This program is designed for the student who wishes a broad, general exposure to the various facets of sociology. To qualify for this degree, the student must:

1. Complete the core curriculum requirements.

2. Take a minimum of 20 units in sociology courses numbered 100 or 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:

1. Complete the core curriculum requirements (one of the three foundation courses must be taken from the proposed area of specialization).
2. Take a minimum of 20 additional units from courses listed under the proposed area of specialization.

Undergraduate students who have a special interest in data analysis and research methods may complete the A. B. degree with a specialization in Research Methods. Students specializing in Research Methods must:
1. Complete the core curriculum requirements.
2. Take 381A, Sociological Methodology: Design and Analysis.
3. Take 10 units of 190 or 192, Undergraduate Directed Research or Undergraduate Research Apprenticeship.

HONORS PROGRAM

The Honors Program is designed for those energetic and interested students who are capable of carrying out an intensive, individualized program of study. Such programs involve close contact with one or more faculty as the student carries out an independent research project. Projects can often be developed in association with ongoing faculty research.

To be eligible for the Honors Program, the student must have completed an acceptable proposal endorsed by a member of the departmental faculty no later than the end of the Autumn Quarter of his or her senior year.

To qualify for Honors in the department, the student must:
1. Take 180A and 180B, Introduction to Sociological Research or its equivalent.
2. Take 195, Departmental Seminar for Undergraduate Majors.
3. Complete an Honors Thesis, for which up to 15 units of credit will be granted.
4. Complete a minimum of 60 units of course work in the major, 20 units of which may consist of related courses in other departments if approved in advance by a departmental advisor.

MAJOR IN SOCIAL SCIENCES (SOCILOGY)

This degree is designed for students interested in interdisciplinary work with some emphasis on sociology. The requirements for the bachelor's degree in Social Sciences (Sociology) are 60 units of course work with 40 units from sociology including an introductory course in sociology and a course in methodology (Sociology 180A and B, for example). The remaining 20 units are chosen from related departments (Communication, Economics, Political Science, Psychology, Anthropology, and Linguistics).
MASTER OF ARTS IN TEACHING

This degree is offered jointly by the department and the School of Education. The degree is intended for candidates with a teaching credential or relevant teaching experience who wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements are outlined in the School of Education section of this bulletin.

DOCTOR OF PHILOSOPHY

The department presumes that all students admitted will be recommended for admission to candidacy. For the first three quarters in residence all students have probationary status. During the Spring Quarter the department decides whether each student not yet admitted to candidacy will be: (1) admitted to candidacy; (2) terminated; or (3) continued on probation for an additional year. This decision is made by the entire faculty of the department and is based upon whether the student is making satisfactory progress toward the goal of a professional career of teaching and research in sociology. The decision to admit the student to candidacy implies that the student's position in the department is secure, subject only to continued satisfactory progress toward completion of remaining departmental and University requirements.

After admission to candidacy for the Ph.D., the student 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, 381A, 381B, and 381C. In addition, students entering with little background in statistics are required to take an elementary course in the first quarter after entering); (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

1A,B,C. Introduction to Sociology—An introduction to the study of social forms and processes and their impact on individual behavior. Emphases vary from quarter to quarter as described below:

1A. Introduction to Sociology—An examination of how humans connect themselves and thereby structure their experience. Topics
include small intimate relations, family groups, organizational and institutional settings, deviance, and the myth of personality. The rules and processes which determine the nature of our personal experiences are examined. (DR:5)

5 units, Aut (Staff) MWF 1:15
one section by arrangement

1B. Introduction to Sociology—Types of explanations of social behavior from the psychological to the institutional. Theories and research on the rise of the institutions of modern society, including the modern causality of the individual. Social arrangements that arise in this setting, from interpersonal relations through organizations and status groups to law and mass communication. (DR:5)

5 units, Win (Meyer) MWF 10; one section by arrangement

1C. Introduction to Sociology—The main theoretical approaches and problems in the study of social life. Topics include social origins of the "self," class and stratification, political power, religion, education, organizations, and family. Emphasizes continuing interaction between theory and methods in sociology. Readings include classic sociological theory (Marx, Weber, Durkheim) and contemporary case studies. (DR:5)

5 units, Spr (Staff) MWF 11
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 studied 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 these processes in terms of the theoretical ideas, empirical research, and clinical strategy. Enrollment limited. (DR:4)

3-5 units, given 1987-88

SOCIAL ISSUES IN CONTEMPORARY SOCIETY

103. Intimacy, Marriage, and Social Structure—In contrast to the colloquial view that intimate relations are somehow "private" and separate from the larger social world, this course examines how the cultural environment extends into even our most personal relationships. Interpersonal processes, ideologies, and larger social structures shape, distort, and inhibit personal intimacy and family life. Topics include (1) the role of sex in intimacy, (2) the tenuous link between love and marriage, (3) gender differences in patterns of intimacy, (4) the nature of intimate communication, (5) the delicate balance of career, love, and family, and (6) the relevance of feminist thought to understanding intimacy. Role plays and discussions expand on the readings and lectures. Open to all students. Enrollment limited to 100.

5 units, Spr (Talley) TTh 7-9 p.m.
one section by arrangement

104. The Sociology of Gender—The social definitions of masculinity and femininity, and social inequalities which are based on gender-specific social roles. Topics include 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

105. Poverty and Public Policy in America—Why does large-scale poverty persist in America and what are the effects of poverty on the individual? Lectures, class discussions, and individual projects explore the facts, myths, and theories of this social issue.

3-5 units, Spr (Staff) MWF 10

106. Deviance and Social Control—Sexual deviance, drug abuse, mental illness, crime in the streets and crime in the suites (corporate and governmental abuses). The social foundations of the detections, labeling and processing of people as "deviants." The institutions and agencies mandated to keep "the public order," how labeled persons are separated from the rest of society both physically and symbolically, and the consequences for those individuals and for society.

3-5 units, Spr, given 1987-88

107. Sociology of Mental Health—An overview of sociological perspectives on mental illness and the organization of mental health services. Topics include epidemiological, psychosocial, and sociocultural approaches toward mental illness; socioenvironmental 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 include depressive disorders, alcohol and drug abuse, psychosomatic disorders, and schizophrenia.

5 units, Spr (Cronkite) given 1987-88

108. Peace Studies—(Same as History 154, Political Science 133, Psychology 142.) Interdisciplinary course which examines the current international situation, beginning with historical examples and turning to underlying proc-
esses (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, Win (Dornbusch, Bernstein, Moses, North, Ross) TTh 2:15-4:05

110. Social Issues in Health Care—An overview of 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 include 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 1987-88

111. Social Issues in Health Care—An overview of 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 include 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 1987-88

112. Sex 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 Center for Research on Women (CROW) Wednesday noon lecture series. The three primary disciplines are economics, history and sociology, but professors of psychology and law also take part in the analysis.

4 units, Spr (Talbert, Staff)

113A. Female Tragedies and Their Avoidance—(Same as Feminist Studies 125.) 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 produce a clearer vision of the world faced by men and women.

3-5 units, Aut (Dornbusch) M 2:15-5:05

114. Corporate Competence—Designed for students anticipating professional work in a corporate setting. The dynamics and pitfalls of organizational life can shape career experience more than ones desires or skills. The instructor's experience as a sociologist, organizational consultant, and therapist, presents insights of the social sciences into the tactics of corporate survival. Topics include understanding individual differences (decision-making, time management, creativity), one-on-one encounters (delegation, communication skills), managing groups (team development, effective meetings, R&D management and maneuvering in the corporate culture.) Simulations, exercises, general lectures and discussions are used.

5 units, Spr (Talley) given 1987-88

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 direct experience with group and organizational phenomena through extensive use of simulation games, structures exercises and case studies. Lectures/reading provide tools for analyzing these experiences based on empirical research and theoretical ideas.

5 units, Spr (Cohen) given 1987-88

119. Great Issues in American Society—Issue-centered rather than theory-centered. The most pressing social issues confronting our society and its relation to the rest of the world (population pressures, equality and inequality, women's and minority movements, bureaucratization and constraints on freedom, war and violence in American society) are examined from a sociological perspective. Two faculty members provide continuity, but lectures are given by other faculty and guest lecturers selected for their expertise on each topic. A valuable first course for someone interested in a sociological analysis of critical issues in American society.

5 units, Spr (Staff) MWF 11

one 2-hr discussion by arrangement

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 (1) understanding the basic theories, and (2) drawing out their implications for change in a broad range of situations, families, work groups, and friendship groups. (DR:4)

5 units, Aut (Johnston) MWF 8
121. Introduction to Social Psychology—The objective is to promote understanding of the individual's relationship to social groups, from intimate two-person group to the society at large. Theoretical and experiential perspectives illuminate these relationships. The course will include simulation and observation exercises. Topics include social pressure and conformity, racism, and sexism, self-evaluation, equity and justice, and the social self. (DR:5)

5 units, Win (Staff) 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 include 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

COMPARATIVE SOCIOLOGY: SOCIAL INSTITUTIONS AND SOCIAL CHANGE

130. American Society in Film and Literature — Plays, films, and novels by American social realists are used to 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. Course uses film and literature understand the central features of American society but it does not study film or literature as such. Reading include Ellison, Faulkner, Fitzgerald, James, Miller, Steinbeck, Styron, and Wharton. Films include A Thousand Clowns, Officer and a Gentleman, A Long Day's Journey into Night, One Flew Ocer the Cuckoo's Nest, The Little Foxes, Personal Best, Streetcar Named Desire, and Harlan County, USA. Films are shown Wednesday nights.

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. International Relations Theories — A survey of the literature on international relations with attention to theories of international conflict, including power and conflict, alignment, and decision making.

5 units, Win (Bueno de Mesquita) given 1987-88

137. Status Attainment, Education and Work — (Same as Education 172.) Introduction to sociological research on educational, occupational and economic attainment processes. Focusing on gender differences in work careers over the life cycle and on organizational and institutional structuring of careers. The U.S. status-attainment research tradition is contrasted with alternative theoretical and empirical perspectives on educational and work-career processes.

4 units, Spr (Talbert) T 3:15-6:05

138. Law in Radically Different Cultures— (Same as American Studies 176, Anthropology 157, Political Science 182L, Law 316.) A comparison of legal systems in Western capitalist, secular, industrialized democracies with legal systems in radically different cultures. 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 the Republic of 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 considered are the passing on of status and property rights—especially at death, the punishment of embezzlement, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning.

2 units, Win plus 3 units, Spr (Barton, Gibbs, Merryman) MWTh 2:15

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—A cross-cultural analysis of family organization and processes in different societies, and over time, with emphasis on the urban family of Western society. Divorce, illegitimacy, courtship, changing sex roles, and the relations between family patterns and social class.

5 units, Aut (Staff) MWF 11

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 first part describes concrete structures and processes of stratification in America: Class, status, and power systems at the community and national level and social mobility in America. The second part assesses alternative theoretical explanations of inequality and stratification: How inequalities in status and resources emerge; how they are organized into systems; how stratification (formation of social groups) is based on these inequalities; how it is maintained once it emerges; and dynamics of change (especially revolution). In addition to classical theories (Marx, Weber, various functionalists), attention is given to recent developments (Althusser, Habermas, Wright.) Brief attention to international systems of stratification, including world-systems theories (Wallerstein), dependency theories, and theories of imperialism. (DR:5)

5 units, Win (Herting) MWF 10

145. Race and Ethnic Relations — A systematic study of 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. Specific topics will include race and IQ, interracial dating and marriage, inequalities in employment and income, affirmative action and ethnic political mobilization.

3-5 units, Aut (Walker) MWF 10

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. Emphasis on how these systems and changes in these systems are interrelated with the general social and economic development of these countries.

5 units, Spr (Herting) MWF 9

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, although coming out of similar cultural and political traditions, have diverse status patterns, party systems, union organizations, patterns of social mobility, education systems. Examines the way varying social structures and values emerging out of different histories affect national styles and institutions.

5 units, Aut (Lipset) MWF 9

149. Youth in Modern Society—A study of the ways the lives of adolescents and youth are organized in modern society, how this situation is changing, and how it influences experience in later life. Focus on how institutional arrangements (organizations, legal structures, normative systems) structure the status of "adolescent" and "youth." Of particular interest for students anticipating careers in education, problems of juveniles, social work, or other helping professions. (DR:4)

3-5 units (Meyer) given 1987-88

150. Urban Sociology—Over the last 200 years the scale of the ecological communities in which people are embedded has increased enormously — 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) MWF 1:15

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 treated as participants in one global social system. Competing models of the emerging world order and its dynamics are compared. Emphasis on the question of whether once distinctive societies and cultures are converging on a common standard. Topics include 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. Thursdays 10-11 is discussion only. (DR:5)

5 units, Spr (Inkeles) TTh 10-12


5 units, Win (Arthur) 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. Two units: one focusing on processes of change in a city as a whole; the
other on 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, Spr (Tuma) TTh 1:15-3:05

156. Sociology of Culture—How do art, literature, music and such popular cultural forms as movies and television reflect and shape social experience? Course includes: sociological approaches to the study of culture; cultural markets and culture-producing organizations; popular culture vs. high culture; form and meaning in art; and the sociological study of aesthetic experience.

5 units, Spr (Tuma) TTh 2:15-3:45

157. Sociogeography of Political Behavior—The interplay between ephemeral political events and persistent social and geographic structures. Emphasis on the regional systems, world systems, and French geohistorical approaches. Topics include social movements and revolutions, critical elections, international conflict and cooperation, and formation of new regimes.

5 units, Spr (Hochberg) T 2:15-3:45

158. Social Movements and Social Protest—The underside of electoral politics, "the politics of disorder." Questions considered include: How do new issues get placed on political agendas? What determines whether a given grievance leads to collective protest, and, in particular, 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) MWF 11

159. Revolutionary Processes—A comparative, historical examination of social processes in classical and other types of revolutions.

5 units, Spr (Hochberg) TTh 10-11:30

FORMAL ORGANIZATIONS


5 units, Aut (Scott) MWF 9
one section by arrangement

162. Organizational Cultures—(Same as Graduate School of Business 370.) Organizational cultures include institutional mythology, jargon, rituals, ceremonies, humor. Through these cultural mechanisms, organizational members communicate their philosophies of management, values, and expectations. Recent research on this topic will address: Exactly 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? 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, such as 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, Win (March) TTh 8-10

165. Organizational Leadership—(Same as Political Science 108.) The problems of leadership in complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. Special attention to the role of major executives.

5 units (March) given 1987-88

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, 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: 160 or Industrial Engineering 100.

5 units, Win (Scott) MWF 9 and one section by arrangement

SOCIOLOGICAL THEORY

170. Classics of Modern Social Theory—An in-depth introduction to the works of Marx, Durkheim, Weber, Freud, and Toqueville. 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 11

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 some basic notions and theories used in sociological analysis. Required of all sociology majors. Associated laboratory, see 180B.

3 units, Aut (B. Cohen) MWF 11

180B. Introduction to Sociological Research: Laboratory—Laboratory exercises consider problems of collecting observations, constructing theory, testing hypotheses and generalizing research results. Required of all sociology majors. Students must enroll concurrently in 180A.

4 units, Aut (B. Cohen) by arrangement

181. Research Design and Data Collection—Results of analyses of social scientific data are used increasingly by policy analysts, business executives, lawyers, market researchers and social scientists. Course gives instruction in and intensive experience with basic skills useful in designing social scientific research and in collecting social scientific data. Students will 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) TTh 1:15-3:05

182. Data Analysis—Analyzing social scientific data. Lectures deal with basic statistical techniques used in data analysis. Emphasis on students' own analysis of social scientific data. Follow-up to 181; gives students 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 (Staff) MWF 1:15

INDIVIDUALIZED LEARNING EXPERIENCES, PRIMARILY FOR UNDERGRADUATE MAJORS

190. Undergraduate Directed Research—An opportunity for students to work on a project of their 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 for a student 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). This project will be arranged early in the year of graduation, or before.

3-10 units (Staff) by arrangement

195. Departmental Seminar for Undergraduate Majors—Introduces students to sociology as an academic discipline, acquaints them with career opportunities in the field, and to exposes them to current faculty research interests. Required of all sociology majors.

2 units, Aut (Staff) W 12

FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS

207. Sociology of Mental Health—Same as 107 with special seminar for graduate students.

5 units, Spr (Cronkite) given 1987-88

210. Sociology of Education—(Meets with 310.) (Same as Education 210.) Introduction to sociological approaches to educational phenomena. Topics include school organization and environment, the relationship of education to adult roles, the impact of social class and ethnicity on classroom learning and the social structure of the classroom. Through readings and evaluating social science research. Short written assignments and individual feedback.

4-6 units, Win (Talbert, Staff) 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 one 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 include symbolic interaction, field theory and exchanges and particular problems associated with perspectives, e.g., power and influence, development of the self or attribution. Open to undergraduates with consent of instructor.

5 units, Spr (Walker) MW 2:15-3:45

222. Pathological Interpersonal and Self Process—Seminar on abnormal family and group processes which can result in emotional disturbance and behavioral disorders. Accounts for 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 include the impact of experiences of neglect, abuse, molestation, vio-
lence, marital separation and divorce, war and natural disasters on children and adults. Prerequisites: Graduate standing or consent of instructor.

5 units, Spr (Johnston) T 7-10 p.m.

229. Status, Expectations, And Rewards — The effect of status characteristics, such as 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) Th 2:15-5:05

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 include 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—A broad 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)

239. Seminar: Sociology of Work.
5 units, Spr (Staff) T 2:15-5:05

240. Seminar: Social Stratification.
5 units, Win (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. Covers the principles for design and evaluations of groupwork for students and teamwork for teaching staff. Topics include social processes of influence, role differentiation and evaluation. Methods of systematic evaluation and observation are included; students will receive practical experience in using these methods.

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

247. Democracy and Society in Comparative Perspective—(Same as Political Science 226.) 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, use of case studies in Europe, America and the Third World.

5 units, Spr (Lipset, Diamond) T 2:15-5:05

255. Seminar: Life-Cycle Processes — Intrasocietal and cross-cultural variations in age related patterns or organization of individuals’ lives.

5 units (Tuma) given 1987-88

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.) Interorganizational relations and the external control of organizational behavior. Provides some experience in analyzing and thinking about organization-environment issues. Topics include the dimensions of organizational environments, the theoretical status of environment, and how environments are perceived and enacted by organizations; the implications of the resource dependence perspective for the topics of goals, effectiveness, and efficiency; organizational responses to interdependence including internal structural modifications, avoidance, adaptation, and attempts to manage the environment using strategies such as merger, cooptation, and joint ventures; the analysis of collective structures of interorganizational behavior, and how such structures emerge; and an analysis of 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 (Palmer) given 1987-88

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 are explored. The topics of the relative power of subunits and individuals considered both in terms of vertical power and authority differences and from the perspective of power differences that arise among subunits formally on the same hierarchical level. Topics include the definition of power and politics, and whether power is a measureable and meaningful concept; the sources and determinants of both individual and subunit power; how power is used in organizations, the conditions under which power and politics dominate organiza-
tional 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: Undergraduates or graduate students in sociology sign the class list in the Sociology Department.)

4 units (Pfeffer)

264. Topics in Human Resource Management—(Same as Business 470.) Changes in the labor force, the growth of “high technology” industries, and government’s increased role in dictating employment practices make career management increasingly salient to organizations. Personnel practices affect organizational members. Firms, in turn, are constrained by their workforces. The impact of organizational arrangements on workers’ careers. How personnel practices affect organizational functioning. The impact of unions, technological change, and affirmative action on human resource management. Recent innovations affecting employment relations, such as “comparable worth” and quality of work life programs.

4 units (Baron)

265. Seminar on Organizations: Institutional Environments—How can we usefully conceptualize the normative and cognitive systems that operate to structure (support and constrain) organizational forms and activities? What are their determinants and consequences? Pre-requisite: 160, 260 or equivalent.

5 units, Spr (Scott) M 2:15-5:05

280. Sociology of Religion—(Same as Religious Studies 262.) The central problems in the sociology of religion. Topics include definitions of religion and the domain of religious experience; dynamics of religious change; forms of religious organization; religion and economic life; religion and politics; religiosity and secularism in modern societies.

5 units, Win (Swidler) given 1987-88

282. Seminar: Topics in Comparative and Historical Sociology—The comparative and historical approaches to sociological analysis. Topics vary from year to year.

5 units, Win (Conell) T 2:15-5:05


5 units, Aut (John) W 3:15-6:05

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 especially world effects on the evolution, dominance, and modern forms of states and regimes.

5 units, Win (Krasner, Meyer) T 2:15-5:05

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 more general theories of social change. Emphasis on family and kinship, education, social stratification and mobility. Other institutional complexes of interest are considered.

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

PRIMARILY FOR GRADUATE STUDENTS

300A,B,C. Graduate Proseminar—Limited to first-year graduate students in Sociology.

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

301. Mathematics for Methodology.

5 units, Aut (Staff) TTh 11-12:30

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

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


2 units, Aut, Win, Spr (Staff) M 12:15-1:30

360A,B,C. Trainees Seminar: Organizations, Mental Health and Aging—An ongoing seminar examining the impact of organizations on the mental health of their participants, the relations between organizations and the age structure of their participants, and the organization of services for the mentally ill and the aged. Required of NIMH and NIA trainees, but open to other interested students.

2 units, Aut, Win, Spr (Scott, Staff) T 3:15-5:05

361. Seminar: Social Psychology of Organizations—(Same as Business 671.) The social psy-
4 units, Win (March)

370A,B. Basic Problems in Sociological Theory—A two-quarter course on (1) the logical analysis of theories and (2) basic strategies of sociological analysis. Basic concepts required for the logical analysis of theories are introduced and then used for the analysis of various strategies of sociological analysis in the last six weeks of the Autumn and first six weeks of the Winter Quarter. Each strategy is illustrated by the study of one program of theoretical research starting with its origins in the classical literature and carried to one or more contemporary formulations. The strategies studied vary but 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. Prerequisite: Consent of the instructors.
5 units per quarter, Aut (Zelditch)
TTh 3:15-5:05; Win (Scoville)
MW 2:15-4:05, and one section by arrangement (each quarter)

380A. Introduction to Sociological Research—(Same as 180A but restricted to Ph. D. candidates in Sociology or Sociology of Education.) For associated laboratory see 380B.
3 units, Aut (Cohen) MWF 11

380B. Introduction to Sociological Research—(Laboratory, same as 180B but restricted to Ph.D. candidates in Sociology or Sociology of Education.) Students must enroll concurrently in 380A.
4 units, Aut (Cohen) by arrangement

381. Sociological Methodology: Design and Analysis—The basic principles of experimental and non-experimental design and 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. The second half addresses social dynamics. Prerequisite: 381A or equivalent.
4-6 units, Spr (Herting) TTh 10-11:30

383. Sociological Methodology: Discrete Variables — Rationale for and interpretation of various quantitative methods of analyzing discrete variables, such as tabular analysis, log-linear and logit analysis, probit analysis and event history analysis. Prerequisite: 381A, or equivalent.
4-6 units, Aut (Tuma) MWF 1:15-3:05

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

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

The Center is an interdepartmental organization coordinating teaching and research in space science and astrophysics. Its members are drawn from the Departments of Applied Earth Sciences and Geology in the School of Earth Sciences; the Departments of Aeronautics and Astronautics, Electrical Engineering Department and Mechanical Engineering Department in the School of Engineering; and the Departments of Applied Physics, Chemistry and Physics in the School of Humanities and Sciences.

Research now in progress covers a very wide field and is approached in a variety of ways, including experiments flown on rockets, satellites and space probes; ground-based observations made from the Wilcox Solar Observatory and from national observatories; and theoretical research including computer modeling. Specific topics currently being studied include: technical aspects of space projects such as guidance and control; the application of information sciences to the transfer and analysis of space data; planetary sciences; solar-terrestrial phenomena; solar physics; stellar structure; infrared astronomy; X-ray and extreme ultraviolet astronomy; gamma-ray astronomy; high-energy astrophysics; theoretical astrophysics; gravitation theory and experiments; cosmology; and the study of life in the universe. Many of these projects involve collaboration with scientists at the NASA-Ames Research Center. For administrative purposes, the center comprises a number of smaller units with specialized research activities. It also has a close working relationship with the Center for Aeronautics and Space Information Sciences (Director, Professor Peter M. Banks), which is the primary vehicle within the University for research on information systems in their application to space programs.

Stanford is a member of the Universities Space Research Association, a consortium of universities which operates the Lunar Science Institute in Houston, Texas, and also of the University Corporation for Atmospheric Research, which operates the National Center for Atmospheric Research in Boulder, Colorado. The facilities of the center are available to any interested and qualified student, who must be admitted by and registered in a department. The Departments of Aeronautics and Astronautics, Electrical Engineering, Mechanical Engineering, Applied Physics and Physics offer opportunities leading to an M.S. or Ph.D. degree for work in space science or astrophysics. The center also offers opportunities to undergraduates who may, for instance, participate in research projects in their junior or senior years, either on a part-time basis during the school year or on a full-time basis during the summer. The Astronomy Course Program operates a small student observatory where students may gain practical experience in astronomical observing. The course list at the end of this entry includes courses of interest to undergraduates as well as courses primarily of interest to graduates. For descriptions of these courses, see their listing under Aeronautics and Astronautics, Applied Physics, Electrical Engineering, Geophysics, Mechanical Engineering, Physics, and also under the Astronomy Course Program.

Further information is available from the Director.

COURSES

15A. The Nature of the Universe—(Enroll in Applied Physics 15.)
3 units, Win (Walker)

15B. Cosmic Horizons—(Enroll in Physics 15.)
3 units, Spr (Susskind)

50. Astronomy Laboratory and Observational Astronomy—(Enroll in Astronomy 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, Aut (Petrosian)

111. Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 111.)
   3 units, Win (Petrosian)

129. Life in Space—(Enroll in Aeronautics and Astronautics 129.)
   3 units, Win (Billingham, Chang, Clearwater, Cohen, Daunton, Holton, Johnson, Lawless, McElroy, Sandler, Wydeven)

190A, B, C. Independent Study in Astrophysics and Honors Thesis—(Enroll in Astronomy 190A, B, C.)
   190A. 1-9 units, Aut (Staff)
   190B. 1-9 units, Win (Staff)
   190C. 1-9 units, Spr (Staff)

   3 units, Spr (Sleep)

212. Introductory Hypersonic Aerophysics—(Enroll in Aeronautics and Astronautics 212.)
   3 units, Win (Bershader)

222. Classical Gravitation—(Enroll in Physics 222.)
   3 units, Spr (Bond)
   alternate years, not given 1987-88

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)
   3 units, Spr (Spreiter) alternate years, given 1987-88

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)

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 (Bryson)

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, given 1987-88

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, given 1987-88

350. STAR Laboratory Seminar in Radioscience.
   1 unit, Aut, Win, Spr (Vesecky)

352. Electromagnetic Waves in the Ionosphere and Magnetosphere.
   3 units, Spr (Helliwell)

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
   3 units, Spr (Tyler) alternate years, given 1987-88

356. Introduction to Plasma Physics—(Enroll in Electrical Engineering 356.)
   3 units, Aut (Buneman)

   3 units, Spr (Waterman) alternate years, not given 1987-88

   3 units, Spr (Sturrock) alternate years, given 1987-88

   3 units, Spr (Petrosian) alternate years, given 1987-88

   3 units, Win, Spr (Sturrock)

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)
   3 units, Spr (Petrosian)
368, 369. Gravitation—(Enroll in Physics 368, 369.)
368. 3 units, Aut (Susskind)
369. 3 units, Win (Susskind)

3 units, Aut (Staff) alternate years, given 1987-88

392. Astrophysics Laboratory I—(Enroll in Applied Physics 356.)
3 units, Sum (Walker) alternate years, not given 1987-88

SPANISH AND PORTUGUESE

Emeriti: (Professors) Aurelio M. Espinosa, Jr., Bernard Gicovate, Ronald Hilton, Juan B. Rael, Isabel Magana Schevill; (Assistant Professor); Grace Knopp
Chairman: John Wirth
Professors: Fernando Alegria, Michael Predmore, Jorge Ruffinelli, Sylvia Wynter
Associate Professors: Mary Pratt, Tomás Ybarra-Frausto
Senior Lecturers: María-Paz Haro, Karin Van den Dool
Lecturer: Maña Sandoval
Visiting Professor: Heloisa Buarque de Hollanda (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. Stu-
udents must complete a minimum of 45 units from courses in the department numbered 100 or higher. (Language emphasis path not offered 1986-87.)

Requirements: Spanish 201, 202, Advanced Grammar and Composition; Spanish 140, Introduction to Methods of Literary Analysis; Spanish 180, Undergraduate Winter Colloquium; one course in introductory linguistics (in Linguistics Department); three courses in Spanish linguistics.

Recommended: Spanish 203; two literature courses in one area; Portuguese 109 (Portuguese for Speakers of Spanish).

SUGGESTED SEQUENCE

The department offers a series of core courses designed to fulfill the requirements for all the major paths. All majors are required to take Spanish 140 and 180. Courses numbered 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 sociopolíticas 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, Peru, and one in Sao Paulo, Brazil. Each is a full-year program beginning early in the summer and continuing through the following June. Students enroll in the Pontificia Universidad 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 consult Overseas Studies. For information on the Sao Paulo program consult Professor John Wirth.
INTENSIVE 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, consult 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.

DEPARTMENTAL 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. By University regulation, students desiring the A.M. degree must complete a minimum of 45 units, 36 of which must be completed at Stanford.

Requirements: Spanish 201, 202, Advanced Grammar and Composition; Spanish 306, Introduction to Literary Theory or an equivalent course; four courses in the department numbered 200 or above which form a coherent program (to be worked out with advisor); reading knowledge of one foreign language other than Spanish (this language may be Portuguese).

In addition, students may take further units of graduate courses in Spanish or Portuguese and/or approved courses in related fields such as Linguistics, Comparative Literature, Philosophy, History of Art, 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.

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" of this bulletin.

Students who choose a minor in Comparative Literature or Modern Thought and Literature should consult with the chairs of these programs.

DOCTOR OF PHILOSOPHY

The requirements of the Ph.D. are: (1) a minimum of 36 graduate units during the first year of graduate study and a minimum of 9 units per quarter during six quarters following the first year; (2) completion of the requirements for the A.M. degree; (3) a reading knowledge of Portuguese and one other foreign language; (4) the 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 "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 Literature to 1700, (2) Spanish Literature from 1600, (3) Spanish American Literature, (4) Chicano Literature, (5) Latin American Studies, (6) Luso-Brazilian Studies.

In addition, candidates will select two secondary areas of study outside the major field
from the following: (1) Spanish Medieval Literature, (2) Spanish Literature of the Golden Age, (3) Modern Spanish Literature, (4) Portuguese Literature, (5) Brazilian Literature, (6) Linguistics, (7) Spanish American Literature of the Colonial Period, (8) Spanish American Literature from Independence, (9) Chicano Literature, (10) Literary Theory, (11) Hispanic Civilization, (12) Portuguese and Brazilian Civilization. One secondary area of concentration may be taken outside the department in consultation with the advisor.

In addition to departmental course offerings, students are encouraged, in consultation with their advisor, to take courses in other departments and programs such as the Graduate Program in Humanities, Comparative Literature, Modern Thought and Literature, Feminist Studies or History.

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 completion of course work requirements at the end of the third year of study they will take the comprehensive examination. Before taking the comprehensive examination, and after completion of the course work, students will hand in a long research paper. The comprehensive examination is based on a comprehensive list of readings in the candidate's major field.

Ph.D. candidates must fulfill the requirements for the A.M. before proceeding to the comprehensive examination.

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 filing the application. Candidates taking more than five years will be required to re-instate 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.

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)
   Special Topics (290-298)
   Individual Work (299)
5. Graduate Seminars (300-399)
   Literary Theory and Methodology (300-313)
   Peninsular Literature (314-345)
   Latin American Literature (346-379)
   Chicano Literature (380-389)
   Special Topics (390-398)
   Individual Work (399)
6. Portuguese Program (1-399)
   Language (1-199)
   Portuguese Literature (210-245)
   Brazilian Literature (246-279)
   Graduate Seminars (300-399)

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. For courses 11B, 12B, and 13B see special section for bilingual students. (No auditors permitted in language courses.)
INTRODUCTORY

1. First-Year Spanish (1st quarter)—An introductory course with emphasis on 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 First-Year Spanish—An all in Spanish method, offering preparation in listening, speaking, reading and writing the language with oral presentations and small group conversation sections. Written exercises, short compositions, and daily work in the language laboratory are an integral part of the course. (Classes limited to 15 students. No auditors permitted.)
   9 units, Sum (Staff)

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 equivalent.
   4-5 units, Aut, Win, Spr (Staff) MTWThF

12. Second-Year Spanish (2nd quarter)—Continuation of 11. Prerequisite: 11 or equivalent.
   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 equivalent.
   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 grade of "B."
   3 units, Spr (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. It covers such essential topics as the human body, hospital procedures, diagnostics, food, and essential phrases for on-the-spot reference when dealing with Spanish-speaking patients.
   3 units, Aut (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 specifically recommended for students who plan a career in business. Prerequisite: 11 or equivalent.
   3 units, Aut (Staff)

26. Spanish for Law Students—(Graduates register for 126.) (Same as Law 349.) Provides a solid basis for communication in law-related interactions and develops the ability to read professional texts in Spanish.
   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 15, 25, 35.)

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)

126. Spanish for Law Students—(See 26.)

CULTURAL READINGS

Courses will emphasize composition and structured discussion based on the readings. Especially designed for students who do not anticipate a literature major but want to continue beyond the second year. Prerequisite for each: 13 or equivalent. For courses 130B, 131B, 132B see special section for bilingual students.

135. Introduction to Chicano Life and Culture—(Same as History 64, Anthropology 110, Chicano Studies 110.) Interdisciplinary course focuses 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. Students interact with three different Chicano faculty from three disciplines. Historical texts, novels, poems and ethnographies are the basis for required readings.

3-5 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. Prerequisite: 11B or interview with instructor. (DR:4; entire sequence, 11B, 12B, and 13B must be completed.)

4-5 units, Win (Sandoval) MTWThF

13B. Second-Year Spanish for Bilingual Students—Applied Spanish for functional purposes. Emphasis on vocabulary development. Some grammar review. Prerequisite: 12B or interview with instructor. (DR:4; entire sequence, 11B, 12B, and 13B must be completed.)

4-5 units, Spr (Sandoval) MTWThF

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, Puertorriqueño and Cubano 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. Mexican and Chicano Cultural Readings—Selected grammatical problems and emphasis on oral expression. (DR:2)

3-5 units, Spr (Sandoval)

131B. Latin American Cultural Readings and Composition—Selected grammatical problems and introduction to literary texts. (DR:2)

3-5 units, Aut (Sandoval)

132B. Spanish Cultural Readings and Composition—Selected grammatical problems and emphasis on composition. (DR:2)

3-5 units, Win (Sandoval)

LITERATURE

Courses will 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—Designed for students with little or no background in literary analysis. Introduces basic terminology of literary criticism and examines a variety of critical approaches to literature. Specific literary texts are discussed in light of readings in literary theory and criticism. Emphasis varies with individual instructors,
but the general purpose is to teach students to read, write, and think about literature. Given annually. Prerequisite: 13 or equivalent. (DR:2.)

3-5 units, Aut (Ybarra-Frausto)

141A. (Same as 241.)

145. The Spanish Republic, the Civil War and the Aftermath—Various cultural aspects of the period from the Second Republic to the reign of Juan Carlos I (1932-present) emphasizing writers' responses to the Spanish Civil War. Authors include Hemingway, Hernandez, Lorca, Machado, Neruda, Orwell, Sender, and J. Goytisolo. The International Brigades, the death of Lorca, the construction of the Valley of the Fallen, and Picasso's Guernica are also studied.

3-5 units

151,152. Spanish Literature—The basic introduction to Spanish Peninsular literature. They deal with major works from several periods and genres to prepare the student for more specialized 200 level courses. Designed but need not be taken in sequence. Exact composition of courses varies from year to year. Given annually. Prerequisite: 13 or equivalent.

151. Spanish Literature I—Major works of the Middle Ages and the Renaissance. (DR:2)

3-5 units, Win (Wynter)

152. Spanish Literature II—Major works from 1800 to the present. (DR:2)

3-5 units, Spr (Predmore)

161,162. Spanish American Literature—The basic introductions to Spanish American literature. They deal with major works from several periods and genres and prepare the student for more specialized 200 level courses. Designed but need not be taken in sequence. Exact composition of courses will vary from year to year. Given annually. Prerequisite: 13 or equivalent.

161. Spanish American Literature I—Reading major works of Latin American literature. (DR:2*)

3-5 units, Win (Pratt)

162. Spanish American Literature II—Continuation of 161. (DR:2*)

3-5 units, Spr (Ybarra-Frausto)

180. Undergraduate Winter Colloquium: La Cultura Mexicana del Siglo XX—Through a close reading of texts in various genres (essay, novel, drama and poetry), patterns of culture and artistic production in contemporary Mexico are examined. From the Revolution (1910) through the Student Movement of Tlatelolco (1968) salient literary works are studied in their social context.

3-5 units, Win (Ybarra-Frausto)

199. Individual Work—Open only to majors in Spanish, or with special permission.

1-12 units (Staff) by arrangement

GENERAL

The courses in this section are given in English and do not require a knowledge of Spanish or Portuguese, although in some instances a reading knowledge may be recommended. Majors taking these courses as a part of their requirements must do assigned work in the language. These courses are open to all students.

120A. Don Quixote in Translation.

3-5 units

123A. Spanish-American Literature in Translation—Analysis, discussion of representative works.

3-5 units (Ybarra-Frausto)

145A.—(See 145.)

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)

162B. Chicano Literature: Creative Writing for Bilingual Students—A basic creative writing course in which students are encouraged to draw from their bicultural, bilingual experience. Knowledge of Spanish and familiarity with barrio dialects essential. (Not open to graduate students or freshmen.)

3-5 units (Islas)

FOR ADVANCED UNDERGRADUATES AND GRADUATES

ADVANCED LANGUAGE AND LINGUISTICS

201. Advanced Grammar—Problems of grammar at an advanced level.

3 units, Aut (Haro)


3 units, Win (Sandoval)

203. Problems in Translation—A workshop for advanced language students.

3 units

204. Creative Writing Workshop—Writing in Spanish or English. Admission by consent of instructor.

3-5 units, Spr (Aegria)


3-5 units
211. The Spanish Golden Age—An overview of 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)

213. 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, the critical and social are generated. Knowledge of Spanish and the Golden Age comedia helpful, but not a requirement. The texts used have also been translated into English. Where there are no translations, translated extracts are provided.
3-5 units (Wynter)

214. Studies in Medieval Literature—An introduction to Spanish literature produced between the years 1000 and 1500. Course focuses on the major works and the history of the period. Readings include Poema de Mio Cid, El libro de Buen Amor, and La Celestina.
3-5 units (Sutherland)

215. La Celestina—A careful reading of Fernando de Roja's masterpiece and the major criticism of this important literary text. Other topics include the situation of the conversos in 15th century Spain and the development of the figure of the go-between or alcahueta.
3-5 units

217. Women in Early Spanish Literature—Study works by Spain’s early women writers, among them Leonor López, Teresa de Cartagena, Florencia Pinar, Santa Teresa, and María de Zayas. Treatises directed to women, La formación de la mujer cristiana and La perfecta casada, are also discussed.
3-5 units

220. Introduction to 19th century Spanish literature—Five key authors: Lara, Espronceda, Zorrilla, Bécquer, and Galdós.
3-5 units, Aut (Predmore)

221. Introduction to 20th century Spanish literature—Five key authors: Unamuno, Valle-Inclán, Machado, García-Lorca, and Baroja.
3-5 units, Win (Predmore)

222. Golden Age Drama from Gil Vicente to Calderón.
3-5 units (Staff)

3-5 units (Staff)

226. Don Quijote I—A close study of Don Quijote and selected Novelas ejemplares in relation to the principal literary traditions and cultural forces of the European Renaissance. Graduates enroll in 326.
3-5 units

227. Don Quijote II—Graduates enroll in 327. Continuation of 226.
3-5 units

237. The Generation of '98—Social rebellion and literary traditionalism in the writers of the first part of the 20th century, especially Unamuno, Azorín, Baroja, Pérez de Ayala, Miró, A. Machado.
3-5 units

LATIN AMERICAN LITERATURE

241. Afro-Hispanic Cultural Worlds: An Introduction—(Same as 141A, African and Afro-American Studies 241.) An overview to 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 as yet little known worlds. Reading in Spanish/Portuguese, and in English translations.
3-5 units, Spr (Wynter)

246. La Foesia Vanguardista Hispanoamericana—Main trends and tendencies in the evolution of Vanguard poetry and poetic theory in Latin America.
3-5 units, Spr (Ruffinetti)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought and Cultural Worlds—(Same as African and Afro-American Studies 248, English 162G.) General introduction to 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)

3-5 units (Ybarra-Frausto)

251. Taller de Teatro: Theater Workshop—Investigation of current theater esthetics in the dramatic production of Latin America and of Spanish-speaking groups within the United States. Special focus on both popular theater and vanguard experiments. A group class in which the participants will experience the many aspects of mounting a production.
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, Aut (Ruffinetti)
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, Aut (Pratt)

259. The Modern Spanish American Novel—Close readings and analysis of the works of Roberto Arlt, J.J. Arreola, Juan Carlos Onetti, Mario Benedetti, and Gustavo Sainz.
3-5 units, Win (Ruffinelli)

266. The Culture of Fear in Latin America—(Same as Portuguese 366.) Explores facets of Latin American cultural production under the restrictive conditions imposed by the authoritarian military regimes of the 1970's and '80's, especially in 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; 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, Win (Hollanda, Pratt)

269. Contemporary Women Novelists of Chile—Reading and discussion in Spanish of major works by Brunet, Bombal, Valdivieso and Echeverría. Short and long narrative dealing with women's problems in contemporary Chile.
3-5 units (Alegría)

CHICANO STUDIES

280. Introduction to Chicano Literature—Selected works by major Chicano writers of the 20th century, including poetry, fiction, and drama. General introduction to questions of genre and textual interpretation with an emphasis on the socio-historical and cultural context of Chicano literature.
3-5 units (Ybarra-Frausto)

3-5 units

282. Chicano-Riqueña Literature—Introduction to selected works from Chicano, Nuyorican and Puerto Rican literature. Analysis of texts from a bicultural and bilingual context.
3-5 units (Ybarra-Frausto)

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—Study of the contemporary Chicano theater movement, with an emphasis on 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, both oral and written. Emphasis will be 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—Course situates and analyzes Chicano literature within the context of diverse world literatures.
3-5 units

288. Undergraduate Colloquium: Chicano History—(Same as History 262.)
3-5 units, not given 1986-87

288A. Undergraduate Colloquium: Chicano Literature and Culture—Centered on literature, the course examines diverse aspects of Chicano expressive culture. Shows how a "Chicano Ideological Project" was created uniting artistic forms within a socio-political context.
3-5 units (Ybarra-Frausto)

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—Study of 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 such as Graham Greene, V. Naipaul, S. Naipaul, Paul Theroux, Isak Dinesen and others.
3-5 units (Pratt)

299. Individual Work—May be repeated for credit. Open to undergraduates or graduates
who are 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)

3-5 units (Pratt)

306. Introduction to Literary Theory and Criticism—Initial readings in the major currents of 20th century literary theory and criticism. Course has a roughly chronological organization, 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, Aut (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)

315. La Celestina—A careful reading of Fernando de Rojas's masterpiece and the major criticism of this text. Other topics include the situation of the conversos in fifteenth-century Spain and the development of the figure of the go-between or alcahueta.
3-5 units

316. The Romancero—The romance tradicional, although other ballad genres are also considered. Critical writings of Catalán, Menéndez Pidal, Propp, Greimas, Piaget, and Segre are read in conjunction with the ballad texts.
3-5 units

320. El libro de Buen Amor—(Undergraduates enroll in Spanish 220.) Allegory, autobiog-
PORTUGUESE PROGRAM

INTRODUCTORY

1. First-Year Portuguese (1st quarter)—An introductory course emphasizing speaking and oral comprehension.
   5 units, Aut, Win (Van den Dool) MTWThF, plus additional work in the language laboratory

2. First-Year Portuguese (2nd quarter)—As above, with additional development of reading and writing skill. Prerequisite: 1 or equivalent.
   5 units, Win, Spr (Van den Dool) MTWThF, plus additional work in the 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 additional work in the language laboratory

5. Intensive First-Year Portuguese—Offers preparation in comprehension, speaking, and reading of Brazilian Portuguese and in writing the language. Daily work in the language laboratory is an integral part of the course. A culture component is offered subject to minimum enrollment of six students. (Classes limited to 15 students. No auditors permitted.)
   9 units, Sum (Van den Dool)

10. Elementary Conversation—(Graduates register for 110.) Conversation practice offered 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.)

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, Huysssens, and Hall Foster.
    3-5 units

267. Brazilian Literature I — Survey of literary trends and authors of Brazilian literature.
    3-5 units (Hollanda)

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. Cinema Nova movement and its development in the 70's. The new film of the political opening period.
    3-5 units (Hollanda)

299. Individual Work—May be repeated for credit. Open to graduates or undergraduates who are majoring in Spanish.
    1-12 units (Staff) by arrangement
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 regimes of the 1970's and '80's, especially in 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; recodings of the gender system, symbolizations of the state; how specific characteristics of power structures determine cultures of resistance; the role of the US and the West in producing the discourse and technology of terror. Prerequisite: Reading knowledge of Spanish and Portuguese.
5 units, Win (Hollanda, Pratt)

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

STATISTICS

Emeriti: Quinn McNemar, Rosedith Sitgreaves
Chairman: Herbert Solomon

Professors: Theodore W. Anderson (on leave), Thomas M. Cover (on leave), Persi Diaconis, Bradley Efron, Jerome H. Friedman, M. Vernon Johns (on leave Winter and Spring), T. L. Lai, Gerald J. Lieberman, Lincoln E. Moses (on leave), Ingram Olkin, Lawrence A. Shepp, David Siegmund, Herbert Solomon, Charles Stein, Patrick Suppes, Paul Switzer

Professor of Biostatistics: Byron W. Brown
Associate Professor: Iain M. Johnstone
Assistant Professors: James A. Fill (on leave), Art B. Owen, Joseph P. Romano

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 LCS 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, 217, 218, 200. Courses previously taken may be waived, in which case they must be replaced by other approved courses.
2. Mathematics 113 or 103 and Computer Science 106. Substitutions of other courses in Mathematics and Computer Science may be made with consent of the advisor.
3. Three additional courses from offerings in the Statistics Department. These are normally taken from the group of courses 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 227, 228.
4. Additional units to complete the requirements chosen from offerings in the Statistics Department or from authorized courses in other departments. At least half of the units taken for the M.S. degree must be from offerings in the Statistics Department.

There is sufficient flexibility to accommodate students with interests in applications to operations research, social sciences, engineering, computing, business, economics, and health.

Students with a strong mathematical background who may wish to go on to a Ph.D. in Statistics should consider applying directly to the Ph.D. program.

A 2.75 letter grade indicator will be required for all statistics courses 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 Aptitude Test and the Advanced Test in Mathematics of the Graduate Record Examination. Applicants are urged to take the Graduate Record Examination between July and November in order to afford time for receipt of the scores before January 11. For details concerning this test see the *Information Bulletin*. Overseas applicants, who may not receive the *Information Bulletin* promptly, should write directly to the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540.

The specific course and examination require-
ments 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: (a) two 200-level quarter courses in Mathematics, or (b) two doctoral level quarter courses in Mathematics, Computer Science, or Operations Research together with demonstrated competence in topology and modern algebra as indicated by a grade of "B" or better in graduate or advanced undergraduate courses in these subjects. In general, it is advisable for students to obtain as strong a mathematical background as is feasible.

**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 thesis, but at least eight months before the thesis is finished. At the examination the student will offer a presentation introducing and discussing the thesis project. The student will be examined in depth on the thesis topic and should be able to convince the committee that the thesis 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.

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**Ph.D. MINOR IN STATISTICS**

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 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**—Precalculus course for nonmathematical students in probability theory and game theory. Permutations and combinations, conditional probability, expectation, two-person games, risk and minimax theory, simple gambling and other games. (Graduate students enroll in 140.) (DR:6)

3 units, Aut (Owen) MWF 11

**60. Introduction to Statistical Methods I**—A nonmathematical study of statistical methods. Emphasis on statistical techniques. Organization of data, averages, variability, and association. Statistical inference, tests of hypotheses,
estimation, and confidence intervals. Computer statistical packages are used. (Graduate students enroll in 160.) NOTE: Students cannot receive credit for both Statistics 60 and Psychology 60. (DR:6)

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

61. Introduction to Statistical Methods II—(Graduate students register for 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 (Staff) MTWF 1:15

70. Biostatistics—(Enroll in Family, Community and Preventive Medicine 202.) Statistical reasoning and basic methods. Applications to biology and medicine. Prerequisite: High school algebra.

3 units, Win (Brown)

110. Statistical Methods in Engineering and the Physical Sciences—A first course for engineers and physical scientists. Basic probability theory and statistics: Point and interval estimation, tests of hypotheses, nonparametric methods, curve fitting by least squares, analysis of variance, elementary experimental design. Prerequisite: One year of calculus. (DR:6)

4 units, Aut (Solomon) MTWFTh 11

116. Theory of Probability—Probability spaces as models for phenomena with statistical regularity. Discrete spaces (e.g., binomial, hypergeometric, Poisson). Continuous spaces (e.g., normal, exponential) and densities. Random variables, expectation, independence, conditional probability. Introduction to the Laws of Large Numbers and Central Limit Theorem. Prerequisite: Mathematics 44 or equivalent. (DR:6)

3 or 4 units, Aut (Owen) MTWF 10

Spr (Lai) MTWF 10

Sum (Staff) MTWThF 2:15

140. Chance and Strategy—(See 40. For graduate students.)

3 units, Aut (Owen) 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, capacity expansion, and financial management. Prerequisite: Mathematics 43 or consent of instructor.

4 units, Aut (Hillier)

Win (Veinott)


4 units, Win (Lieberman) MWF 1-2:05

160. Introduction to Statistical Methods I—(See 60. For graduate students.)

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

161. Introduction to Statistical Methods II—(See 61. For graduate students.)

5 units, Win (Staff) MTWF 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 (Staff) MTWF 11

Win (Lai) MTWF 11

CONTINUATION

Courses in this category have been designed for particular use in applications. Generally, they have introductory statistics or probability as prerequisites.

201A. Data Analysis I—Descriptive statistics. Basic ideas of robustness. Assessment of variability: Bootstrap and jackknife. Smoothing procedures. Cross-validation. Data transformations. Nonparametric multiple regression. The linear model: Interpolation, diagnosis, robust fits, variable selection. All topics are illustrated on actual case material. The computer will be used. Prerequisites: 116 and Mathematics 113 or 103, (or equivalent).

5 units, Win (Staff) MTWThF 2:15

201B. Data Analysis II—Classification and discriminant analysis. Dimensionality reduction. Principal components, factor analysis, multidimensional scaling. Cluster Analysis. Treat-
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 include 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, alternate years, given 1987-88

204. Sampling from Human Populations—An introduction to the theory of sampling from finite populations. Simple random sampling, stratified sampling, cluster sampling, efficiency of various designs, nonresponse models; particular emphasis on applications. Prerequisite: A basic course in statistics (61, 110, or 200).

3 units, alternate years, given 1987-88

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, alternate years, given 1987-88

206. Applied Multivariate Analysis—Introduction to statistical analysis of several quantitative measurements on each observational unit. Emphasis on concepts, methods, computation, interpretation. Examples from substantial fields such as economics, education, geology, psychology. Topics include multiple regression, multivariate analysis of variance, principal components, factor analysis, canonical correlations. Prerequisites: 200 or 201A. (Concurrent registration in 200 is permitted.)

3 units, Win (Johnstone) MWF 3:15

207. Introduction to Time Series Analysis—Time series models used extensively in economics, engineering, physics, geology, etc. Trend fitting, autoregressive schemes, moving average models, periodograms, second order stationary processes, spectral analysis. Prerequisites: 116 and a basic course in statistics (200 or 201A).

3 units, Aut (Staff) MWF 2:15

208. Mathematical Models in Behavioral Sciences: Psychometrics—Examination of mathematical models and applications in psychometrics. Illustrative topics are factor analysis, mental testing, clustering and classification, multidimensional contingency tables. Prerequisite: 60, 61.

3 units, alternate years, given 1987-88

209. Quantitative Methods and Their Application to Public Policy—Focusing upon applications of statistical methods, rather than methodology per se. Topics include 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: 60 and 61.

5 units, Spr (Rogosa) MW 3:15-5:15

210. Selecting and Ordering Populations—Normally statistical techniques have been developed to determine whether a number of treatments, differ with respect to some parameter. Ranking and selecting procedures are statistical techniques for comparing these populations where the goal is to select the single best population, or to rank all the populations. Using actual data from a variety of fields, the course concentrates on the ideas underlying the material and not on derivations. Prerequisite: Knowledge of a first course in statistics.

3 units, alternate years, given 1987-88

211. Introduction to Stochastic Processes—Discrete and continuous time Markov chains: communicating classes, irreducibility, periodicity, first-passage times, recurrence and transience, convergence theorems and stationary distributions, sample paths, Q-matrix, birth and death processes. Prerequisite: 116.

3 units, Aut (Meyn) MWF 2:15

212. Introduction to Stochastic Processes—Renewal theory, point processes with emphasis on the Poisson process. Also, Wiener and Gaussian processes, and second order processes. Prerequisite: 211.

3 units, Win (Staff) MWF 10


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


3 units, Win (Staff) MWF 1:15

229. Selected Topics in Data Analysis—Seminar; topics in the area of statistical computing or data analysis. Students will read relevant journal articles and give an expository one hour presentation to the class.

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

251. Stochastic Models in Operations Research—(Enroll in Operations Research 251.) Introduction to stochastic modeling. Orientation is directed to students who anticipate doing project work in government or industry which involves stochastic modeling. Emphasis on stress formulation, solution, and analysis of stochastic models in operations research. Topics include queueing theory, inventory theory, Markov decision processes, dynamic programming, reliability theory. Prerequisite: 217.

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

257. Simulation—(Enroll in Operations Research 257.) Generation of uniform and nonuniform random numbers, discrete event simulations, simulation languages, design of simulations, statistical analysis of the output of simulations, applications to modeling stochastic systems in computer science, engineering, and operations research. Prerequisites: A working knowledge of FORTRAN, BASIC or PASCAL; 217 or the equivalent.

3 units, Spr (Staff) 2:40-3:55

299. Literature of Statistics—Intensive study of literature of any special topic, usually culminating in the preparation and presentation of reports upon topics studied.

(Staff) by arrangement
theory. Prerequisite: Operations Research 240.
3 units, Win (Eaves) TTh 4:15-5:30

260A,B,C. Workshop in Biostatistics—Applications of statistical techniques to current problems in medical science. Intended primarily for doctoral students in statistics. Enrollment for more than two units of credit involves extra reading or consulting and requires permission of the instructor.

260A. 1-5 units, Aut (Brown, Efron, Moses) Th 1:15-3:05
260B. 1-5 units, Win (Brown, Efron, Moses) Th 1:15-3:05
260C. 1-5 units, Spr (Brown, Efron, Moses) Th 1:15-3:05

266A,B,C. Workshop in Statistical Consulting—Purpose is to provide Statistics Ph.D. students with a broad base of skills that are required of practicing statistical consultants, as well as exposure to a wide range of statistical applications. Students participate as consultants in the drop-in consulting service operated by the department. Seminar will provide students with supervised experience in short term consulting. Prerequisites: Course work in applied statistics or data analysis and permission of the instructor. No previous consulting experience is necessary.

266A. 1-3 units, Aut (Friedman) by arrangement
266B. 1-3 units, Win (Friedman) by arrangement
266C. 1-3 units, Spr (Friedman) by arrangement

314. Inequalities: Theory and Applications—Presentation of underlying themes to the development of a theory of inequalities with particular emphasis on applications in reliability, probability, and statistics (as well as economics, matrix theory, combinatorics). (1) Totally positive functions. These arise in a variety of contexts; they possess reproductive and smoothing properties that make them exceedingly useful. (2) Schur functions and majorization. Majorization is a partial ordering that is extremely rich. Applications from a broad class of fields are discussed. (3) Convexity in stochastic orderings. Some of the types of inequalities discussed are matrix inequalities, moment inequalities, stochastic inequalities, norm inequalities, extremal inequalities.

3 units, alternate years, given 1987-88


317. 3 units, alternate years, given 1987-88
318. 3 units, alternate years, given 1987-88

324A. Multivariate Analysis—General theory of multivariate distributions; multivariate normal distribution and related distributions such as the Wishart distribution and Hotelling's $T^2$. Tests for means, variances and covariances, multivariate analysis of variance, multiple regression, principal components, canonical correlations. General problems of classification and clustering of high dimensional data.

3 units, alternate years, given 1987-88

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, Win (Lai) MWF 3:15

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, given 1987-88

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, alternate years, given 1987-88

333. Robust Estimation—Procedures which continue to be effective when the usual parametric assumptions are violated. The estimation of location for symmetric distributions: $M$, $L$, and $R$ estimators, asymptotics, the influence curve. Robustness in hypothesis testing. Survey of recent literature. Prerequisite: 236A,B,C.

3 units, alternate years, given 1987-88

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, Spr (Johnstone) MWF 1:15

to ranked data and data on circles and spheres. The group theory and representation theory are developed from first principles. In particular, the theory of Gelfand pairs, and the representation theory of the symmetric group.

3 units, Aut (Diaconis) MWF 1:15


3 units, given 1987-88

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, alternate years, given 1987-88


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


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


3 units, given 1987-88


3 units, given 1987-88


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

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

Director and Professor: Lawrence Ryan (English and Humanities Special Programs)
Emeritus: (Professor) John Goheen (Philosophy)
Professors: N. Gregson Davis (Classics), Mark Mancall (on leave)
Lecturers: George Cattermole, Steven Fuller, Suzanne Greenberg (History), Leigh Sealy, Amy Sims
Coordinator: Steven Fuller (German Studies)

STATEMENT OF PURPOSE

The Program in Structured Liberal Education (SLE) is designed specifically for freshmen interested in an integrated and interdisciplinary approach to the liberal arts and sciences. 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 toler-
ance 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 AND ADMISSION**

Interested freshmen should apply for SLE during the summer preceding the academic year in which they will enroll.

SLE is designed as a three-quarter sequence, and all students applying should be willing to make a commitment for the entire program, although a student can withdraw from the program at any time.

Correspondence regarding the program should be addressed to Program in Structured Liberal Education, P. O. Box L, Stanford University, Stanford, California 94305.

**OFFERINGS**

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) TTh 3:15-5 and TTh 7-9 p.m.
92. 9 units, Win (Staff) TTh 3:15-5 and TTh 7-9 p.m.
93. 9 units, Spr (Staff) TTh 3:15-5 and TTh 7-9 p.m.

**PROGRAM IN SYMBOLIC SYSTEMS**

Chairman: Jon Barwise (Philosophy)
Program Committee: John Etchemendy (Philosophy), Helen Nissenbaum (Program Coordinator), P. Stanley Peters (Linguistics), Stuart T. Reges (Computer Science), Paul Rosenbloom (Computer Science and Psychology), Thomas Wasow (Linguistics and Philosophy), Terry Winograd (Computer Science and Linguistics)
Affiliated Faculty: Herbert H. Clark (Psychology), John McCarthy (Computer Science), Nils J. Nilsson (Computer Science), John Perry (Philosophy), Ivan A. Sag (Linguistics), Solomon Feferman (Mathematics)

**STATEMENT OF PURPOSE**

This program is designed for students interested in the study of information, its representation in natural and computer languages, and how it is processed by minds and computers. It approaches these issues from a variety of traditional perspectives: artificial intelligence, computer science, linguistics, logic, philosophy, and psychology. The Symbolic Systems curriculum is aimed at students who wish to combine the traditional humanistic approaches to language and meaning with exciting contemporary developments in science and technology.

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 nine or ten 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
- Cognitive Science
- 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.

Affiliated Consulting Faculty: Phil Cohen (Linguistics), David Israel (Philosophy), Ron Kaplan (Linguistics), Ray Perraull (Philosophy), Stan Rosenschein (Computer Science), Brian Smith (Philosophy)
COURSES

CORE

The core consists of nine or ten courses.

Introduction to Software Engineering—(Enroll in Computer Science 106B or 106X.) (DR:8) 5 units, Aut, Win, Spr (Staff)

Fundamentals of Computer Science—(Enroll in Computer Science 108A,B,C.)
108A. 5 units, Aut, Win, Spr (Staff)
108B. 5 units, Aut, Win, Spr (Staff)
108C. 5 units, Aut, Win, Spr (Staff)

Mind, Matter and Meaning—(Enroll in Philosophy 80.) A writing intensive course. 5 units, Win (Bratman)

First Order Logic—(Enroll in Philosophy 160A.) 4 units, Win (Etchemendy)

Introduction to Cognitive Psychology—(Enroll in Psychology 106.) 4 units, Win (B. Tversky)

Computability and Logic—(Enroll in Philosophy 160B.) 4 units, Spr (Skowcroft)
or
Automata Languages, and Computability—(Enroll in Computer Science 254.) 3 units, Win (Staff)
Spr (Floyd)

Philosophy of Mind—(Enroll in Philosophy 180.) 4 units, Win (Denyer)
or
Philosophy of Language—(Enroll in Philosophy 180.) 4 units, Spr (Perry, Etchemendy)
either the following two courses

Introduction to Syntax—(Enroll in Linguistics 120L.) 4 units, Spr (Wasow)

Introduction to Semantics and Pragmatics—(Enroll in Linguistics 130L.) 4 units, Spr (Staff)
or the following three courses

Syntactic Theory I—(Enroll in Linguistics 220L.) 4 units, Aut (Bresnan)

Syntactic Theory II—(Enroll in Linguistics 221L.) 4 units, Win (Sag, Pollard)

Semantics and Pragmatics—(Enroll in Linguistics 230L.) 4 units, Spr (Peters)

PROGRAM ON URBAN STUDIES

Director: Leonard Ortolano (Professor of Civil Engineering)
The Committee on Urban Studies: Nancy Tuma (Professor of Sociology), Clay Carson (Associate Professor of History), Paul Turner (Associate Professor of Art), Lyna Wiggins (Assistant Professor of Civil Engineering), Sylvia Yanagisako (Associate Professor of Anthropology)

Lecturers for Adjunct Courses: Timothy Duane, Gerry Cast, Susan Goltsman, Daniel Iacofano, Randall Rossi, George Sipel, Frederick Stout

Urban Studies brings together students, faculty and outside specialists who are concerned with the people and problems of cities. The major 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.

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 average in their major, and who have successfully completed all the course requirements for their major. Details as to admission,
application and procedures can be obtained from the Office of the Director of the Program on Urban Studies, 126 Encina Commons.

REQUIRED COURSES

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 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 majors should take Urban Studies 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; History 255, The Politics of U.S. Urban Development; and Urban Studies 131, Managing Local Government.

URBAN STUDIES CORE (33-37 units)

110. Introduction to Urban Studies.
120. Utopia and Reality in Modern Urban Planning.
130. The Politics of U.S. Urban Development or
140. U.S. Urban Life and Culture or
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 OPTION

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 in urban economics, which requires introductory economics and microeconomics as prerequisites, provides a key element to this option. In addition, students are required to study the methods of land use planning and techniques to control the use of land. Because urban planners rely heavily on statistics and computers in doing their analyses, the major requires an introduction to each of these subjects.

See departmental listings for course information.

PREREQUISITE COURSES (10 units)

Course No. and Subject Units
Economics 1. Elementary Economics 5
Economics 51. Economic Analysis I 5

MAJOR REQUIREMENTS (25-27 units)

Course No. and Subject Units
Applied Earth Science 130.
Environmental Earth Sciences 6
Civil Engineering 234. Land Use Planning and Control 3
Computer Sciences 105A. Introduction to Computers 4
Applied Microeconomics—select one of the following: Economics 148, 150, 155; Civil Engineering 221.
Statistics—select one of the following: Statistics 60, 110; Sociology 182; Psychology 60 or 153.

RESTRICTED ELECTIVES

Courses selected from the Urban Studies Core, from any offered by the Program on Urban Studies or from those listed below to bring the total to 60 units (not including Economics 1 and Economics 51).

Course No. and Subject Units
Applied Earth Science 131.
Environmental Earth Sciences II 5
Applied Earth Science 132.
Environmental Earth Sciences III 5
Sociology 181. Research Design and Data Collection 5
Urban Studies 183. Transportation Policy 3

ARCHITECTURE AND URBAN DESIGN OPTION

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>
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</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 130. 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>
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</tbody>
</table>

AT LEAST TWO OF THE FOLLOWING COURSES

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Art 107. Medieval Architecture</td>
<td>5</td>
</tr>
<tr>
<td>Art 174. Baroque Architecture</td>
<td>4</td>
</tr>
<tr>
<td>Art 175A. Modern Architecture I</td>
<td>4</td>
</tr>
<tr>
<td>Art 175B. Modern Architecture II</td>
<td>4</td>
</tr>
<tr>
<td>Art 176. American Architecture and Urbanism</td>
<td>4</td>
</tr>
<tr>
<td>Art 278. Seminar on American Architecture: The Design of the American College Campus</td>
<td>4</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, 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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</thead>
<tbody>
<tr>
<td>Civil Engineering 180. Elementary School 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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<tbody>
<tr>
<td>Engineering 10N. Applied 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.

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—A generalized introduction to the study of cities and the process of urbanization. Reviews the various disciplinary approaches to urban studies, history, geography, sociology, economics, and politics, and the interdisciplinary perspectives that are inherent in the practice of urban planning, urban design, urban public administration and urban public policy formation.

4 units, Aut (Stout) MW 3-4

115. Seminar on 20th Century Urbanism—(Enroll in Art 280.) The origins of the contemporary urban situation with emphasis on the city as a cultural phenomenon. Interdisciplinary methodology focuses on key interrelationships: between the city as an economic machine and the city as a human community; between the city's architectural form and its social and political functions; between the perceptions/descriptions of the city characteristic of statistical analysis and those common to literature, art, and film; between the short term projections of policy analysis and the visions of urban futurists. Prerequisite: 110 (for Urban Studies majors only).

4 units, Win (Turner, Stout) W 3-5

120. Economics of Urban Problems—(Enroll in Economics 148.) Application of elementary tools of economic analysis to public policy issues in areas such as poverty, employment, education, housing, urban transportation, and the local public sector. Prerequisite: 51.

5 units, Spr (Staff) MTWThF

131. Managing Local Government—Urban administration using the urban executive as a focal point. Topics include 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" discussed vis-a-vis contemporary urban problems such as productivity, declining resources, housing and transportation. Prominent elected and appointed officials from the area will guest lecture. Prerequisite: 110 (for Urban Studies majors only).

4 units, Spr (Sipel) T 3-5 plus periodic W 3-4 alternate years, given 1987-88

132. Urban Politics—The political process in urban areas. Topics include historical development, environment and structure of politics, the policy-making process, the interface between politics and administration, politics as craft, citizens and the political process, and politics at the intergovernmental level. Emphasis on practical application using the expertise of former and current elected/appointed public officials.

4 units, Spr (Sipel, Gregorio) T 3-5 and periodic Th 3-4

134. Managing Urban and Environmental Conflicts — Workshop teaching a variety of 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. Course topics include 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)

Th 2:15-5:05

141. Race and Ethnicity in American Urban Society: 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 include 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 (Cammarillo) MTWThF 10

142. Technology and the Modern City—(Enroll in VTSS 140.) Impact of technology on the development of the modern city from the mid-19th century to the present. New York, London, Paris, and other European and American cities are used to examine the role of technological change in the creation of urban form and image, in the pattern of urban growth and suburbanization, and in the evolution of urban economic and social structure. Topics include the impact of the Industrial Revolution on urban society; the boulevard builders and the age of city planning; the great expositions and the glorification of technology; the revolution in public transportation and services; skyscrapers and the loss of human scale; the impact of the automobile; the urban region and the crisis of the central city. Open to undergraduates and graduates in all fields.

4 units, Win (Wakeman) W 1:15-5:05

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 enormously, 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

151. Urban Growth and Change—(Enroll in Sociology 154.) Cities and towns continually change in size, density, composition and internal organization. Course examines causes and consequences changes. Divided into two units: one focuses on processes of change in a city as a whole; the other on processes of change in a subarea 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, Spr (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 include the social consequences of crowding, rural-urban migration, pre-industrial urbanism, changing family and kinship patterns, urban ethnic communities and inter-ethnic relations, urban poverty and stratification, and crime.

5 units, Win (Yanagisako)

161. Women in Cities: A Cross-cultural Perspective—(Enroll in Anthropology 145, Feminist Studies 142.) The range of 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 critically evaluated in light of research on women in Latin America, Asian, and African cities. Topics include women and urban migration, changing forms of the sexual division of labor, changing family and kinship structures, prostitution, and the political activism.

5 units (Yanagisako) MWF 11
alternate years, given 1987-88

165. Inter- and Intra-Ethnic Variation in Urban Vernacular English—A critical review of 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. The practical implications of findings for research in linguistics, the social sciences and for urban policy makers, administrators and educators.

4 units, (Rickford) given 1987-1988

170. Introduction to Urban Design—(Undergraduates enroll in Art 168A; graduates enroll in Urban Studies 270.) Urban design in theory and practice. Course overviews important theoretical ideas of city form and image, from historical principles inherited from the cities of Western Europe to late 20th Century models exemplified by Los Angeles and the sunbelt cities. Case studies examine urban design examples, projects and controversies in North America. Workshops analyze the image and physical characteristics of San Francisco neighborhoods. A 5-week term urban design problem summarizes principles in the readings, seminars and workshops.

5 units, Win (Gast) T 10-12 and 7-9 p.m., plus two Sat. workshops by arrangement

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. Course develops a step-by-step understanding of the urban design process and problem-solving methods. Graphic, diagrammatic and other visual tools of analysis and communication are introduced and used in the study project. Recommended: 170. Enrollment limited to 14 students.

5 units, Spr (Gast) M 7-10 p.m. and W 9-12, plus two Sat. workshops by arrangement

172. Environmental Psychology in Urban Design—A seminar emphasizing critical reading and discussion of environment/behavior literature; and a workshop training students in environmental research procedures. Examines the major theories and methods of environmental psychology and their application to the fields of architecture, urban planning and design. Topics include 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, alternate years, given 1987-88

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 use; 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.

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

182. Land Use Planning and Control—(Graduate students enroll in Civil Engineering 234.) Theory and practice of contemporary and newly emerging methods in the planning and control of development, and the protection of the environment. A survey of current practices, their origin and evolution, and the relation between land use planning and environmental protection. Emphasis is placed on the regulatory and permitting process with examples of actual projects in both 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) by arrangement

183. Transportation Policy—(Enroll in Civil Engineering 135.) Social and economic roles of
transportation. Traffic flow in an economic context. Transportation supply and demand. Introduction to transportation systems' analysis. Modeling the performance of existing and hypothetical transportation systems. Approaches to transportation planning.

3 units, Aut (Staff)

185. Microcomputers in Urban and Environmental Planning—(Same as 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 studies include word processing, spreadsheets, Land Management Systems (LMS), and statistical mapping as they pertain to architecture, construction, urban design, environmental planning and city planning. Considers 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 (Wiggins)

186. Microcomputers in Resources Planning —(Enroll in Civil Engineering 224.) The use of spreadsheets in urban and regional planning. Emphasis also given to communications between microcomputers and main frames.

1 unit, Aut (Duane) T 10-12

187. Microcomputers in the Third World—(Enroll in Civil Engineering 232.) Planning and policy for computer use in the Third World: a research seminar with lectures, discussions, and student project reports. Topics include: computer applications; the "appropriateness" of the technology; dependency; economics advantages and disadvantages; cultural, institutional and technical problems.

3 units, Win (Harris) MTh 3:15-4:20

190. Seminar on Planning and Design Professions—Informal luncheon seminar. Explores 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 will be devoted to graduate school admissions and the degree relevant to these fields.

1 unit, Win (Staff) W 12-2

270. Introduction to Urban Design—(See 170. For graduate students.)

271. Urban Design Studio—(See 171. For graduate students.)
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 (seventeen 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 forty 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 plus 2-hour hour discussion seminar
   Win (Ryan, Staff) lecture MTW 11 plus 2-hour discussion seminar
   Spr (Lindenberger, 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 courses are titled “The Birth of Western Philosophy,” “Faith, Reason, and Evil” and “Ideas of Human Liberation.” They deal with the emergence of ethical systems, conceptions of the self, and the development of rational ways of interpreting reality. (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 seminar discussion section. (DR:1; three-quarter sequence)

**CONFLICT AND CHANGE IN WESTERN CULTURES**

*Track Chairman: Ann Swidler (Assistant Professor of Sociology)*

10, 11, 12. **Western Culture**—This sequence challenges some of the reverential notions of a noble, mythical entity whose revealed name is Western Culture. The canon of so-called ‘great works’ is in reality a recently invented fiction whose purpose, in part, is to justify the current relations of power between nations (East vs. West), classes, races and persons (male and female) by projecting them into the past. Conflict and Change is taught collaboratively by faculty from literature, sociology, anthropology and history in 2½ hours of lecture and 2 hours of discussion per week. (DR:1; three-quarter sequence)

**LITERATURE AND THE ARTS IN WESTERN CULTURE**

*Track Chairman: 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 request this Western Culture track for 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 concurrently 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). 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 such writers as Homer, Sophocles, Plato, the Beowulf poet, Dante, Boccaccio, and Chaucer.

8 units, Aut (Howard, Staff) MTW 10 lectures plus sections


8 units, Win (Rebholz, Staff) MTW 10 lectures plus sections


5 units, Spr (Friedlander, Staff) MTW 10 lectures plus section

This program is intended for undergraduates who are interested in pursuing an area of scholarly inquiry which falls outside the purview of an established academic department or program of the University. It permits intellectually coherent majors designed by the students themselves with the assistance of faculty members of their choice. The Program for Individually Designed Majors is not an honors program. Any student in good academic standing is free to participate. Information about proposal procedures is available at the Undergraduate Advising Center.

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.
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, (Old Union 306, 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 these specific requirements:

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. Students proposing an Individually Designed Major must submit the completed proposal no later than May 1 of their Junior year. Students must have at least three quarters undergraduate work remaining at Stanford after the date on which the proposal is to be discussed by the committee.

These specific requirements are in addition to the general guidelines discussed in “The Major” in the “Degrees” section of this bulletin. Since each proposal is considered individually, the student and the faculty advisory group may request exception to the specific requirements. Such a request must be included in the statement which justifies the major.

Several extradepartmental programs have administrative offices that provide advising services to students interested in individually designed majors of an interdisciplinary nature. Examples of such programs are Acoustics and Noise, 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. Additional information about the Program for Individually Designed Majors may be obtained at the Undergraduate Advising Center.
INNOVATIVE ACADEMIC COURSES

Innovative Academic Courses offer a variety of special studies not covered in the University’s departmental curricula. They encourage 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 Specials.

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 1986-87; each seminar will have eight to twelve students.

ADMISSION PROCEDURES

Enrollment is limited to freshmen and sophomores. Seminar offerings are announced each autumn in Approaching Stanford II and in Approaching the Sophomore Year. Students sign up for Seminars at Registration.

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 program initiated by students in 1969 to harness the research capabilities of Stanford in searching for solutions to urgent social and political problems.

SWOPSI workshops are led by community members and Stanford students, faculty, and staff; each course is sponsored by a faculty member. The program offers credit for approximately 15 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 high student involvement.

Workshops combine academic analysis with direct exposure to the issue. Some workshops conduct community-based research and publish the research findings and policy recommendations. 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. One goal of the program is to introduce alternative topics and methods into the standard university curriculum. 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 sponsorship of a public event should contact the SWOPSI office at (415) 723-4305. Workshops for Autumn Quarter are listed in a catalog distributed in the reg packets. Winter and Spring Quarter catalogs are available during advance registration through the residences or the SWOPSI office, Sweet Hall.

UNDERGRADUATE SPECIAL COURSES

Undergraduate Special courses widen the range of options open to undergraduate students by encouraging innovation and introducing experimental and interdisciplinary courses, and other types of offerings which for various reasons might not appear under the auspices of a particular department or school.

Grades in these courses are given in the normal manner, with the Pass/No Credit option available upon the instructor’s approval.

The list of all Undergraduate Special courses
to be offered in any given quarter is available to students in advance of registration in the separately published program catalog. Enrollment of individual students in all courses is determined by the Registrar's class lists. (Sign-ups 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.)

A proposal for an Undergraduate Special course may be initiated by a student, staff member, faculty member, or other member of the academic community. The proposed instructor—the person doing the actual teaching or presentation of course materials—should file 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 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.

The Program Catalog is available each quarter at the Registrar's Office, at the Undergraduate Advising Center, and in Sweet Hall.

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 of the Action Research and Internship Program 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, and the Stanford International Development Organization, student organizations designed to interest and 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. 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 Fisher

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 assistants and faculty in the areas of teaching evaluation and improvement.

SERVICES TO UNDERGRADUATES AND GRADUATES

At some point in their studies here, many students find that they need to sharpen their study skills. CTL can help through programs and coursework designed to improve students' ability to read with speed and comprehension, study efficiently, and learn material more effectively. Free tutoring is also available to undergraduates in most subjects; to arrange it, undergraduate students should drop by CTL and request a trained tutor. Students interested in and qualified for tutoring others can also take
courses in tutoring techniques from CTL. The 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, identification of implicit and explicit assumptions in an argument as well as logical and statistical fallacies, 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, library research, and the theory and usefulness of speed reading.

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 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)

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; and a short paper drawn from actual tutoring experiences. New tutors may begin work after 2-3 weeks in the class.

1 unit, Aut, Win, Spr (Staff)

121. Peer Tutoring: The Humanities—Format same as 120, but content designed for tutors in the humanities.

1 unit, Aut, Win, Spr (Staff)

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 undergraduate 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 ten 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: Firestone Major Grants for Extended Research, Robert M. Golden Major Grants for Humanities Scholarship and Artistic Creation, and Small Grants for Research Expenses.

Golden and Firestone Grants differ from Small Grants in the scope of the project proposed rather than the level of reimbursement requested. Firestone and Small Grants are restricted to supplies and expenses associated with research. Golden Grants may include a stipend to replace summer earnings.

Firestone and Golden Grants (up to $2,500) are awarded once a year, to as many as thirty-five 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 $1,000. The application deadline for 1986-87 is April 3. Small Grants (up to $500) are awarded in the fall and spring of each year. The deadlines for 1986-87 are November 3 and April 3. 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.

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**PROGRAM IN VALUES, TECHNOLOGY, SCIENCE, AND SOCIETY**

 Emeriti: (Professors) Eric Hutchinson (Chemistry), Walter G. Vincenti (Aeronautics and Astronautics)
Chairman: James L. Adams
Associate Chairman: Robert E. McGinn
Director, Western Culture Sequence: Paul S. Seaver
Professors: Herbert Abrams (Radiology), James L. Adams (Industrial Engineering and Engineering Management), Clifford Barnett (Anthropology), Barton J. Bernstein (History), Robert A. Chase (Surgery, on leave 1986-87), Raymond B. Clayton (Psychiatry, on leave 1986-87), Alexander L. Fetter (Physics), Alexander L. George (Political Science), Edwin M. Good (Religious Studies), Alex Inkeles (Sociology), Stephen J. Kline (Mechanical Engineering), John W. Lewis (Political Science), John McCarthy (Computer Science), Leonard Ortolano (Civil Engineering), Robert Osserman (Mathematics), Nathan Rosenberg (Economics), Paul S. Seaver (History), Bernard Siegel (Anthropology), Robert Teotor (Anthropology)
Associate Professors: Peter Galison (Philosophy and Physics, on leave Autumn, Winter), Wilbur R. Knorr (Classics and Philosophy, on leave 1986-87), Paul Turner (Art), Terry A. Winograd (Computer Science)
Assistant Professors: Paul Adler (Industrial Engineering and Engineering Management), C. Jeff Martoff (Physics), Lyna Wiggins (Civil Engineering)
Professors (Teaching): Gilbert Masters (Civil Engineering), Robert E. McGinn (Industrial Engineering and Engineering Management, and VTS)
Lecturers: Iaih Boal (VTSS), Brigitte Comparini
STATEMENT OF PURPOSE

Technology and science are activities of pivotal importance in modern life, intimately bound up with industrial society's evolving character, problems, and potentials. If the pursuit of technology and science is 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. 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. For information on which Distribution Requirement Area(s) a given VTSS course satisfies, inquire at the VTSS office, Building 370, Room 372, (415) 723-3069.
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 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.

MAJOR PROGRAMS

Major programs in VTSS are interdisciplinary curricula devoted to understanding critically the nature and significance of technology and science in modern society. Majors will analyze technology and science from philosophical, ethical, historical, social, economic, and aesthetic perspectives. Those students pursuing an 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. Economic Perspectives (VTSS 107)
   c. Philosophical and Ethical Perspectives (VTSS 110)
   d. Aesthetic Perspectives (VTSS 115)
   e. Historical Perspectives (one of VTSS 150, 153, 155, 159, or 161)
   f. 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 grade 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” 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. Themantic Concentration (at least 6 courses, 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). Examples of themes around which concentrations may be built are the interactions of technology and science with public policy, medicine, history, the arts, development, environment, energy, and innovation.

BACHELOR OF SCIENCE

The student pursuing the B.S. degree shall complete a coherent package of approximately 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 connected with a particular area of engineering or science, all courses in it are technical as follows:
1. VTSS Core (7 courses; see above)
2. Technical Depth (about 15 to 17 courses).

Students are expected to fulfill any prerequisites which may exist for courses required for the above curricula. 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 a set of 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 Perspectives: One of VTSS 150, 151, 153, 155, 159, or 161
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, junior year; 5 units Autumn and 5 units Winter, 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.

Both the honors project and each of the VTSS courses taken for the Honors Program must be completed with a grade of at least “B”. Students who fulfill these requirements will have the designation “Honors Program in Values, Technology, Science, and Society” affixed to their permanent academic records.

COURSES

WESTERN CULTURE SEQUENCE

1,2,3. Western Culture and Technology—The development of Western culture from the ancient world to the 20th century through exploration of the interconnections among the three major realms of culture: intellectual, material, and social. The course 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, Runnels, 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, Vincenti, 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 (McGinn, 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 that enhances 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 include sources of problems, nature of invention and discovery, experiment vs. theory, societal concerns. (DR:6, 7 and 8 when all three courses taken.)
   3 units each quarter, Aut, Win, Spr (Adams, Fetter, Osserman) MWF 1:15

CORE
101. Technology and Science in Contemporary Society—Interdisciplinary survey of social, cultural, and values issues associated with technological and scientific developments in contemporary life, with special reference to the U.S.A. in the 1980’s. Topics: technology and the transformation of cultures; frameworks for assessing changes arising from technological innovations; science, technology and modern consciousness; technology and the fine arts; technology and the changing character of everyday experience; and selected case studies in science, technology, and public policy (e.g., robotization and work, computers in education, limits to urban growth, artificial human reproduction, and technology in war). (DR:5)
   4 units, Win (McGinn) TTh 2:15-4:05

107. Technology and Modern Industrial Society—(Same as Economics 113.) The interrelationships between technology and the nature and form of industrial societies over the past 200 years. Technological change as a socio-economic process illuminating the history of industrial societies. Factors influencing the rate and direction of technological change and diffusion. Implications for economic structure and the growth of large-scale organizations. The impact of these changes on modern industrial man as producer and consumer. (DR:5)
   4 units, Win (Rosenberg)

110. Philosophical and Ethical Issues in Public Policy—Philosophical and ethical aspects of public policy, with special attention to issues raised by developments in technology and science. Analysis of ethical and value conflicts in policymaking and use of case studies to explore their complexity and role in the design of socially responsible public policy. Topics: “freedom”, “justice”, “rights”, and other key ethical terms in policy discourse. Applications to cases from biomedical policy (euthanasia, reproductive technologies), environmental policy (wilderness, urban amenity rights), and public policies with international dimensions (food aid, immigration). (DR:3)
   5 units, Aut (McGinn) MTW 2:15 plus two-hour section by arrangement

115. Technology and Aesthetics—Consideration of the more subjective aspects of technology and science. The role of emotion, both 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. Special attention to improving the student’s ability to analyze and appraise the “fit” of the products and practices of technology and science with human beings. Case studies of items such as personal computers, buildings, machines, offices, and scientific models and theories.
   4 units, Win (Adams, Katz) MW 2:15-4:05

121. History of Technology in Western Society, 1500-1918—Examination of the interplay of technological change and social and cultural developments from the late Middle Ages to the First World War. Topics include mechanization and the labor process, the changing relation of science to technology, cultural implications of changing communications technologies, government and technology, and technical change and the art of war. (DR:5)
   4 units, Aut (J. Corn) TTh 10-11
   Section W 9-10:50 or 2:15-4:05 or Th 2:15-4:05

200. Core Seminar—Weekly seminar for senior-year VTSS majors and Honors Program students led by VTSS faculty members.
   2 units, Spr (Staff)

Note—See Major Programs for courses which satisfy the Social Perspectives requirement.
106. The Nature of Technology in Modern Society—Development of unified consideration of technology, science, society, and human values to assist technical and non-technical students in understanding each other's views. 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. (DR:5)

4 units, Spr (Kline) TTh 10 plus section T or Th 2:15-4:05


4 units, Spr (Meehan) TTh 9-10:50

116. Technology and Aggression—Critical inquiry into the role of technology in organized warfare; readings on the psychological and sociological roots of aggressive behavior; developments in such fields as metallurgy, navigation, communications, and power technology in conjunction with specific weapons technology in history: iron and bronze armaments, the stirrup, the crossbow, fortifications, gunpowder, the "science" of strategy, nuclear weaponry.

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

132. The Scientific Revolution—(Same as Philosophy 145, History 139, History of Science 145.) Social, intellectual and institutional background of the period that established modern science, the 17th century. Stress on theories of matter and motion, especially Descartes, Galileo, Bacon, Boyle and Newton. Historical controversies: Yates’ thesis on hermeticism and magic; Merton on Protestantism and science; Hessen on the economic basis of scientific change. Readings from 17th century texts and modern historical studies. Considers various interpretations of the revolution and what is meant by science and revolution.

4 units, Win (Maienschein) MWF 2:15

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 do we mean by "unified" field theories in contemporary physics? Readings: scientific, historical, and philosophical texts.

4 units, Win (Wise) TTh 11-12:15

136. Food, Technology, and Third World Development—The role of food and food production technologies in international development policy. Topics: technology in national and international food aid programs; the technocratic approach to development; national and international strategies for development; and the importance of international relations, political, social, economic, and other non-technical concerns in food technology-development contexts.

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

137. Prehistoric Technology and Culture—(Same as Anthropology 183.) The related development of technology and culture over the first million years of human existence. Illustrated lectures, demonstrations, and student projects on the development of technology from early flaked stone tools of hunter-gatherers to the "high technology" of agriculture and metallurgy of complex Bronze Age societies. Special attention to the manufacture and use of stone tools; to ceramics, glass, metallurgy, and other fire-using technologies; to quarrying, transport, and construction technologies; and to the construction of monumental architectural works such as Inca fortresses, Stonehenge, the megaliths, and Aztec and Egyptian pyramids.

3 or 5 units, Win (Runnels, Rick)

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 and secondary sources.

4 units, Spr (Comparini) TTh 3:15-4:45

140. Technology and the Modern City—The impact of technology on the development of the modern city from the mid-19th century to the present. New York, London, Paris, and other European and American cities are used to examine the role of technological change in the creation of urban form and image, in the pattern of urban growth and suburbanization, and in the evolution of urban economic and social structure. Topics include: the impact of the Industrial Revolution on urban society; the boulevard builders and the age of city planning; the great expositions and the glorification of technology; the revolution in public transportation and services; skyscrapers and the loss of human scale; the impact of the automobile; the urban region and the crisis of the central city. Open to undergraduates and graduates in all fields.

4 units, Win (Wakeman) W 1:15-3:05

142. Information Systems and Society—Information systems and their social impact. Analysis of 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 computer, and rock video.

4 units, Spr (House)

143. Physics of Nuclear Weapons—(Enroll in Physics 145.) Introduction to nuclear weapons, nuclear warfare, and their effects. The goal is to evaluate critically the technical premises underlying national security policies and various political efforts to control nuclear arms and secondarily to involve students in calculations and problem-solving related to nuclear weapons so as to increase their grasp of the capabilities of nuclear weapons, and to permit responsible discussions of policy. Topics: the basic nuclear physics of fission and fusion weapons; technical issues in nuclear proliferation, arms control treaties, and advanced weapons systems; the deployment of nuclear weapons and factors governing their use in warfare. Prerequisites: Completion or in the process of completing the Physics 50 or Physics 20 series. Some familiarity with both differential and integral calculus is assumed.

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

145. Chemistry and the Life Sciences in Historical and Philosophical Perspective—Development of chemical and biological ideas in the context of Western social, philosophical and religious thought, emphasizing the impact of these ideas on the concept of man in the 20th century. Topics include: the enduring human drive to understand and control nature, including the life process; the 17th century religious roots of the scientific establishment; 18th century context of the chemical and physiological revolutions; 19th-century Romanticism’s impact on science; scientific creativity; tension between vitalistic, and mechanistic, interpretations of life; challenges to traditional values posed by recent biomedical science and technology. Open to juniors and above. Prerequisite: At least one course in chemistry or biology (or consent of instructor). Limited enrollment.

(DR:3)

4 units (Clayton) given 1987-88

146. Topics in Medicine—(Same as Human Biology 26.) Weekly lecture and discussion in which Medical School faculty deal with their own areas of expertise in the broader context of medicine. Provides an overview of major fields of clinical practice and research within the framework of social, economic and ethical aspects of medicine. Useful for students contemplating careers in medicine or health policy. Open to sophomores and above.

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

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 are discussed. Example case studies for discussion.

3 units (Chase) given 1987-88

150. Legal and Political Perspectives on Technology and Biology—(Same as Human Biology 125.) Critical examination of how legislatures, courts, and regulatory agencies deal with contemporary issues involving technology and biology. Issues include: 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. Following an introduction to the workings of law, politics, and regulation, the emphasis is on student research and developing skills of written and oral presentation to educate and persuade. Limited to 30 students.

4 units, Aut (McBride) TTh 3:15-4:45

151. Technology in American Society—(Same as History 270.) Undergraduate colloquium focusing on five related areas: the impact of
152. The Atomic Bomb in History—(Same as History 75S.) Analysis of the use of the A-bombs, the roles of scientists, problems of post-war international control of atomic energy, the quest for the H-bomb, the rise of nuclear strategy, and the issues of "atomic spies.

5 units (Bernstein) given 1987-88

153. Applied Anthropology—(Same as Anthropology 137.) Application of anthropological knowledge and skills to a variety of practical problems: developing and evaluating medical care delivery systems and educational programs, both 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. Course addresses 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) not given 1986-87

154A,B,D. Arms Control and Disarmament—(Same as Political Science 138A,B,D.) Introductory course, 154A surveys international security relations since 1945, revolutionary development of nuclear weapons, arms competition, and efforts at arms control and disarmament in post-World War II period. Political, technological, and conceptual problems of national security policies and arms control are stressed. Analyses of strategic military doctrines and negotiations on strategic and regional military forces, including SALT, START, INF, and space-based weapons. 154A is a prerequisite to 154B. 154B is seminar with limited enrollment, focusing on substantive and procedural aspects of arms control negotiations. Core faculty are assisted by guest speakers with negotiating experience. 154A and B are prerequisites for 154D. 154D is research and tutorial, supervised by members of arms control faculty.

154A. Arms Control.
5 units, Win (Lewis, Blacker)

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 will be reviewed and compared. Topics include: 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, Spr (Inkeles) TTh 10-12

156. Accidental or Unintentional Nuclear War—(Same as Political Science 138E.) Seminar examines the likelihood of nuclear war occurring through accident, miscalculation, misunderstanding, or inadvertence. Analysis of past accidents in world’s nuclear weapons systems, the impact of false alerts, human fallibility, systems fallibility reflecting command and control, and component failure, the security of nuclear fuel and weapons, terrorism and potential theft by non-state actors, the nature of decision making in crises, and the synergy between accidents and crisis. Mechanisms of risk reduction, anticipatory planning, crisis prevention and management, and the means of translating such measures from theory to practice. Limited enrollment. Prerequisite: 154A.

5 units, Aut (Abrams, George) Th 2:15-4:05

157. The Machine in American Culture—(Same as American Studies 221.) The impact of technology upon American culture and society from the latter 19th century; theoretical and historical sources on specific fields of technology including civil engineering, architecture, industrial design, the computer, atomic weaponry; guided field trips keyed to specific themes and readings: Lawrence Livermore, Golden Gate Bridge District, Lockheed, SLAC, and Skidmore, Owings, and Merrill.

5 units, Aut (Katz) MW 2:15-4:05

158. Material Culture—(Enroll in American Studies 217.) Introduction to material aspects of American culture. Three-dimensional and two-dimensional objects, including structures and buildings, arts and crafts, machines and machine-made artifacts. American attitudes, values, and beliefs embodied in and reflected by the production, use, collection, and preservation of artifacts.

5 units (J. Corn) given 1987-88
159. Sociocultural Implications of High Technology—(Same as Anthropology 138/238.) Seminar on the development, diffusion, and utilization of high technology as a cultural process. Emphasis on high technology of the type developed in and around Stanford, telemicroelectronics, biogenetics, and materials science. Occasional in-class presentations by local technologists and venture capitalists. Ways in which such technology can drive profound change in other parts of a sociocultural system (e.g., its symbolic, value, and belief systems, and its social and economic organization). Possible unintended or undesired human impacts of technological innovations. Implications for appropriate technological design and for public and educational policy. Open to all graduate students and undergraduates contemplating Honors theses.

5 units, Aut (Textor)

160. Technological Opportunities for Humanity—Opportunities for new technologies for 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) given 1987-88

161. Anthropology of Development—(Same as Anthropology 149.) Begins with a history of anthropology in development projects from the Colonial Period through World War II. Continues with 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, Spr (Siegel) MWF 11

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 (Good) given 1987-88

166. Innovation—(Same as Mechanical Engineering 293.) 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. Modes of institutionalizing R & D. Barriers to innovation, and countervailing forces. Revolutionary and evolutionary innovation in small and large companies. Effects of management style. Effects of industry and of product life cycle. Government role in innovation.

3 units, Win (Kline) T or W 1:15-3:05

170. Work and Society — Historical and contemporary perspectives on work, particularly as conditioned by technology and transformed by technological change. Topics: work in the pre-industrial world; the impact of the industrial revolution on work, leisure, and community; philosophies of work and work-society relations; the Labor Movement in Europe and America; key 20th-century work legislation and court cases in America; recent innovations in work theory and practice in Japan, Italy, Sweden, and the U.S.; the productivity and job satisfaction controversy; and work and technology in the future. Enrollment limited to 25. (DR:5)

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

172. Automation and Work—(Same as Industrial Engineering and Engineering Management 272.) Reciprocal effects of advanced technologies and changes in work. Topics include: human resource management in technology-intensive environments, implementing advanced technologies (numerical control, word processing, CAD), new versus old skills, technology and industrial relations, Taylorism, knowledge in production, learning and productivity, technology and employment. Emphasis is placed on current issues, but students are encouraged to explore historical background. Enrollment limited and at discretion of instructor. Open to seniors and graduate students only.

4 units, Win (Adler) MW 11-12:15

175A,B. Modern Architecture I, II—(Enroll in Art 175A,B.) A two-quarter course tracing developments, largely in Europe, which led to the present state of architecture and urbanism. Emphasis on the designer’s responses to new materials, technology, and environmental conditions.

4 units, Win, Spr (Turner)

3 units, Aut (Winograd) MWF 10

181. Problem Solving—(Same as Industrial Engineering and Engineering Management 201, Engineering 190.) An investigation of problem solving with emphasis on 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, Spr (Adams) given 1987-88

182. Environmental Science and Technology—(Same as Civil Engineering 170.) An introduction to the causes, effects and methods of controlling environmental degradation. Emphasis is on problems associated with water resource development and water pollution; air pollution; population; and environmental effects of energy consumption. (Intended for both 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.

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

185. Facility Siting—(Same as Civil Engineering 239.) Emphasis on 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. A review of 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) TTh 11-12:30

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
Dean: John Hart Ely
Associate Deans: Jack H. Friedenthal, Thomas McBride, John Gilliland
Assistant Dean: Margo D. Smith
Emeriti: John H. Merryman, Howard Williams
Associate Professors: Ellen Borgersen, Thomas J. Campbell, Henry T. Greely, Barton H. Thompson, Robert Weisberg
Lecturers: Leonard Edwards, Robert T. Fries, Christopher C. Murray, Lisa M. Pearson, Stephen Scharf, Dean Schlobohm
Visiting Professors: Michael T. Andrew, Patricia L. Bryan, John C. Coffee, Samuel R. Gross, Leon Higginbotham, Bill Ong Hing, Stephanie Wildman

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.)

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—An examination of the range of problems that arise at the intersection of law and the visual arts (painting, sculpture, and graphic art) including: the protection of works of art in time of war, occupation and civil strife; the international traffic in stolen and smuggled cultural treasures; censorship, criticism, selection, and artistic freedom; copyright, moral right, and the proceeds right; art forgery, fakes, and consumer protection in the visual arts; legal relations between artists, dealers, museums, collectors, and auction houses; tax and estate problems of artists and collectors; legal services for artists; artnapping and insurance; legal problems of art museums, etc. Merryman and Elsen, Law, Ethics and the Visual Arts (1979).

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 will 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, Aut (Wald, Maccoby)

307. Law and Behavioral Science—The implications of psychological research and theory for law and legal processes. Issues include 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 1986-87

316. Law in Radically Different Cultures—(Same as American Studies 176L, Anthropology 157, Political Science 182L, Sociology 138; 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 the Republic of Botswana (traditional law) to identify the historical, philosophical, social, and cultural factors which con-
tribute to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights—especially at death, the punishment of embezzlement, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. (Open to graduate students and to juniors and seniors. 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 26.)

3 term units or 5 quarter units, Spr (Barton, Gibbs, Merryman)

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. Brooks, Law, Psychiatry and the Mental Health System (1974) and Supplement (1980).

3 term units, Spr (Rosenhan)

337. Public Policy Towards Abused and Neglected Children—The standards that are, and should be, used in defining child abuse and neglect and evaluate various means of state intervention to protect such children. The role of various professionals, doctors, lawyers, mental health experts, police, social workers and 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)

345. Psychology and Law Proseminar—(Same as Psychology 225.) A survey of current Stanford research on psychosocial 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 identifica-
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 Medical School. 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 Professor: Suzanne R. Pfeffer

OFFERINGS AND FACILITIES

The Department of Biochemistry is part of the Graduate Division of the University and a department of the Medical School. Departmental offices and laboratories are located in the Stanford Medical Center. Courses offered by the department may be taken by undergraduate, graduate, and medical school students. Postdoctoral fellows as well as house staff members are also welcome to attend. A basic series in biochemistry (200, 201) is taught by the entire staff as well as by a number of guest lecturers from the campus and from other institutions. Students who elect to enroll in either of the above courses should have a good background in general and organic chemistry, as well as in cell biology, equivalent to the core series offered by the Department of Biological Sciences.

Advanced courses in more specialized areas are offered as well, and they emphasize the most recent developments in biochemistry, cell biology, and molecular biology. These courses include the physical chemistry of proteins and nucleic acids, membrane biology and biochemistry, mechanisms and regulation of nucleic acid replication and recombination, the biochemistry of bacterial and animal viruses, the molecular basis of morphogenesis, and the structure and function of both eukaryotic and prokaryotic
chromosomes. The Department of 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, as well as with 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 regional and national meetings in biochemistry and molecular biology. Teaching experience is an integral part of the Ph.D. curriculum and is required for the degree. During each year of study, every student assists in teaching sections in the basic or advanced courses, and such activities involve at least one afternoon per week during each quarter, with assignments scheduled by both the appropriate course director and the students.

General University regulations concerning the Ph.D. degree are summarized in the "Degrees" section in this bulletin. The department offers neither master's nor undergraduate degrees.

Men and women interested in pursuing a career in biochemical research and teaching are invited to apply directly to the Department of Biochemistry for admission to the Ph.D. program. Those applying should have at least a baccalaureate degree, and should have completed work in cell and developmental biology, basic biochemistry and molecular biology, and genetics. Also required are at least one year of university physics, differential and integral calculus, as well as analytical, organic, inorganic, and physical chemistry. The department is especially interested in those applicants who have research experience in biology or chemistry. Students must submit an application, including transcripts and letters of recommendation, by December 15. 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 biochemistry of bacterial and animal virus infection; structure and function of chromosomes; control and regulation of gene expression; the biochemistry and control of developmental processes; and the structure, function, and biosynthesis of cellular membranes and organelles.

COURSES

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, Kaiser, Kornberg, Lehman, Pfeffer, Rothman) MTWThF 11

201. Molecular Biology—Lectures providing the most recent information about rapidly developing frontiers in polynucleotide metabolism and its control, chromosome structure and function, transcription and translation, hormone action, and virus biochemistry. Prerequisite: 200 and an understanding of basic molecular biology.

5 units, Win (Berg, Brutlag, Davis, Hogness, Kornberg) MTWThF 11

211. Development in Microorganisms—Microorganisms exhibit cell differentiation and multicellular development. They are attractive subjects for molecular studies of the regulation of development because (1) the facility with which they can be manipulated by both genetic and biochemical techniques, (2) they can be handled in large numbers, and (3) their genomes are relatively small. Topics include morphogenesis of virus particles, asymmetric cell division in Caulobacter, spore formation in Bacillus, heterocyst differentiation in Anabaena, cell-cell communication in Vibrio and Saccharomyces, multicellular development in Myxococcus and Dictyostelium. Lectures, discussions and reading in the current literature.

3 units, Win (Kaiser)

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—The advent of recombinant DNA and rapid DNA sequencing methods has led to a dramatic increase in genetic information best handled by symbolic computation. Course reviews and describes computer methods used at all steps during a cloning/sequencing project including the planning stages, sequencing and analysis of biological sequence information. Direct 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 of the methods including microcomputer methods, timesharing methods, communications between microcomputer and mainframes. Homework assignments are required in addition to completion of a research project. Registration limited to 40 students with consent of the instructor.

3 units, Spr (Brutlag)

221. The Teaching of Biochemistry—To be taken by all students as teaching assistants in 200, 201, or 217. Emphasizes practical experience in teaching on a one-to-one basis, as well as in problem set design and analysis. Familiarization with current lecture and text material is expected, along with evaluations of class papers and examinations. Prerequisites: enrollment in the 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 at present to students in the Biochemistry Ph.D. program and to those in the Stanford Medical Scientist Training Program.

5 units, Aut (Davis) by arrangement

299. Research.

1-15 units, any quarter (Staff) by arrangement

399. Research and Special Advanced Work—Prerequisites: Consent of instructor. Must register by section numbers by arrangement with faculty.

1-18 units, any quarter

CELL BIOLOGY

Chairman: Roger D. Kornberg
Professors: Roger D. Kornberg, James A. Spudich, Lubert Stryer, Nigel Unwin
Assistant Professors: Robert O. Fox, Peter Parham
Lecturer: Patricia Cross

OFFERINGS AND FACILITIES

The department offers opportunities for course work and research in cell biology. Courses fall in three categories: 1) Molecular Biology of the Cell, an intensive, one-quarter course that treats the emerging discipline of cell biology from a molecular standpoint and that is intended for advanced undergraduates, graduate students, and medical students; 2) a series of one-quarter courses that treat special topics of great current interest in cell biology at an advanced level; and 3) Structure of Cells and
Tissues, a one-quarter course tailored to the needs of medical students that includes both lectures on structure-function relationships of mammalian cells and tissues and a laboratory on medical histology.

The emphasis of research in the department is on understanding fundamental cellular processes in terms of the structure and function of organelles and molecular assemblies. Techniques used include standard methods of biochemistry, genetic engineering, and cell culture, as well as image processing and three-dimensional reconstruction from electron micrographs, X-ray and electron diffraction, fluorescence microscopy, nanosecond fluorescence spectroscopy, and microinjection of cells and nuclei. The department owns and operates a computing center equipped with the most advanced time-sharing and color graphics systems for data analysis and molecular modeling.

The graduate program in Cell Biology leads to the Ph.D. degree. The department also participates in the Medical Scientists Training Program in which individuals are candidates for both the Ph.D. and M.D. degrees.

The graduate program is intended to prepare students for careers as independent investigators in cell and molecular biology. The principal requirement of a Ph.D. degree is the completion of research constituting an original and significant contribution to the advancement of knowledge. In addition, students are required to enroll in the series of special topics courses taught by the faculty of the department. Finally, students gain teaching experience by assisting in the one-quarter course, Molecular Biology of the Cell.

Applicants to the program should have a bachelor's degree and should have completed at least a year 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. Major themes are storage and expression of genetic information, protein targeting, exocytosis and endocytosis, cell surface interactions, cell motility and the cytoskeleton, and signal transduction. The three-dimensional architecture and dynamics of biological macromolecules and supramolecular assemblies in relation to their biological function. Experimental techniques discussed include electron microscopy, X-ray diffraction, site-directed mutagenesis, immunocytochemistry, and reconstitution of functional assemblies. Four lectures and one discussion section per week. Prerequisite: Knowledge of introductory biochemistry.

3 units, Win (Stryer, Staff) given 1987-88

211. Structure of Cells and Tissues—The structural organization of tissues in relation to their function. Topics include light and electron microscopy, epithelia, muscle, connective tissue, bone and cartilage, blood, cardiovascular system, lymphoid tissue, nervous tissue, skin, endocrine, exocrine, gastrointestinal, respiratory, urinary, female and male genital systems, and the ear and eye. Three lectures, two laboratories, and one review session per week.

7 units, Aut (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 include 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 (Unwin) given 1987-88

225. Cell Motility—The molecular basis of cell movements and change of cell shape. The central theme is 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 used to elucidate the molecular basis of cell motility will be considered: 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 can be analyzed and understood at the molecular level by the use of a wide range of biochemical, biophysical, and molecular
226. Molecular Immunology—Surveys current understanding of the molecules involved in immune phenomena and their mechanisms of action. Major themes are: 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 (Spudich) given 1987-88

227. Membrane Channels—Ion transport through membrane channels is critical in sensory transduction, synaptic transmission, and nerve impulse conduction. The central theme is the molecular 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. A variety of experimental approaches used to study membrane channels are considered: 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 has allowed a detailed molecular interpretation of many biological processes. Focuses on the results of protein crystallography after a survey of the methods and their limitations. Major themes include 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 several simple enzyme systems will be considered in detail. Prerequisites: Knowledge of basic biochemistry and cell biology.

3 units, Aut (Fox)

229. The Eukaryote Chromosome—Principles of chromosome structure and function. Topics include 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 particular 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, Spr (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: Stanley N. Cohen
Assistant Professors: Michele P. Calos, Laurence J. Korn

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 need 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 thesis 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 Institutes 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 Department 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**

- **201.** 3 units, Win (Calos, Cavalli-Sforza, Cohen, Ganesan, Herzenberg, Korn) MWF 9
- **202.** 3 units, Spr (Calos, Cavalli-Sforza, Cohen, Ganesan, Herzenberg, Korn) TTh 10


3 units, Win (Cavalli-Sforza) TTh 4:15-5:45 alternate years, not given 1987-88

**206. Gene Expression During Development**
Topics in developmental biology, especially molecular aspects of embryogenesis and eukaryotic gene expression. Emphasis on experimental approaches and on critically evaluating the scientific literature. Prerequisites: A course in molecular biology.

3 units, Win (Korn) alternate years, given 1987-88

**207. Oncogenes: The Control of Cell Proliferation**
Oncogenes are considered as the set of genes involved in triggering proliferation of normal and malignant cells. The detection, characterization, and control of expression of the oncogenes, including their mutation and rearrangement. The function of these gene products in the cell cycle. Focus is primarily on eukaryotic, especially mammalian, cells. Lectures and discussion of literature. Prerequisites: Background in biochemistry, molecular biology and genetics.

3 units, Spr (Calos) TTh 4:15-5:45 alternate years, given 1987-88

**249. Cytogenetics—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. Plant genetics and applications of biotechnology in improving important crop plants. Intended for graduate students, medical students and advanced undergraduates with good knowledge of biochemistry, biology and basic genetics.

3 units, Aut (Ganesan) alternate years, given 1986-87

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
By Courtesy: Alain C. Enthoven, Richard W. Scott
Clinical Associate Professor: Sheldon S. King
Clinical Assistant Professor: Roland S. Merchant, Sr.

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 select-
ed 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 the 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 Registrar's Office or 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 Health Services Research, Department of Family, Community and Preventive Medicine, School of Medicine, Stanford University, Stanford, California 94305.

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 are to understand the role and limits of health care and prevention in achieving and maintaining health; to develop a working knowledge of the organization, financing, and regulation of health care in the United States; to learn to plan and carry out analyses of problems in health policy, and to be able to 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.) Description of problems and institutions, review of analytical studies, and discussion of policy issues. Topics include mortality and morbidity, physicians and other personnel, hospitals, the drug industry, national health insurance and health maintenance organizations. Open to graduate students, undergraduate economic majors (seniors and juniors), or by permission of instructor. (Graduate Students enroll in 256.) Prerequisite: Preparation in micro theory and some statistics desirable, 51 plus some background in math or statistics.

5 units, Spr (Fuchs)

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 (both 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) W 4:15-5:15

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 391.) The financial and public policy context in which the health care system operates, and the issues in public policy controlling one of the largest and fastest growing items of public expenditure. The main 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.

4 units, Aut (Enthoven) MF 8-10

394. Cost-Benefit Analysis in Health Care— (Same as Business 392.) How do you do cost-benefit analysis when the "output" is difficult or impossible to measure? Study and discussion of the main literature on the principles of cost-benefit analysis applied to health care. Then a critical review of a number of actual studies. Emphasis on insights into the art of practical application. Recommended: Business 309. Prerequisite: Business 200.

4 units, Spr (Enthoven) MF 8-10

PROGRAM IN HEARING AND SPEECH SCIENCES

Emeriti: (Professors) Virgil A. Anderson, Jon Eisenson

Director: Earl D. Schubert
Professor: Earl D. Schubert
Affiliated Faculty: Dorothy A. Huntington

OFFERINGS AND FACILITIES

The aims of the program are two-fold: (1) to make available to doctoral and postdoctoral students the material essential to a complete understanding of behavioral and physiological aspects of normal and defective processes of human communication; and (2) to provide, at the undergraduate level, a systematic understanding of these processes as a complement to formal study in such disciplines as psychology, biology, linguistics, music, etc. Students may be preparing for careers in university teaching or research, or they may have primary interest in another discipline, e.g., medicine, with a desire for specialized study in some area of human communication.

The available facilities include laboratories for basic and applied research into every major aspect of the hearing and speech sciences. A direct relation with the Division of Otolaryngology of the Stanford Medical School makes it possible to offer excellent opportunities for training and research in selected clinical aspects of communication disorders. Strong working relationships with other departments of the University, both within the School of Medicine
and elsewhere, provide further for a well-balanced undergraduate and postgraduate academic environment.

GRADUATE PROGRAMS

Each student's doctoral program is planned individually with the needs and interests of the candidate in mind. Candidates may include a formal minor as part of their program. The minor is chosen in consultation with the candidate's major advisor, but the content and details of the minor program are specified and administered by the department in which the minor is taken. The student will take a qualifying examination prior to admission to the University oral examination. The University oral examination will be focused on the dissertation. The general University requirements for the doctorate are followed as they apply to residence, application for candidacy, etc. (See the "Degrees" section in this bulletin.)

For further information write to the Director.

COURSES

200. Individual Study—Study under direction in fields or subjects of special interest. Prerequisite: Consent of instructor.

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

230. Physiology of Speech Production—(Same as Linguistics 116.) Study of the structure of the speech mechanism and its function. Includes laryngeal control in the production of segmental and prosodic features of speech as well as articulatory coordinations and control. Prerequisite: Course in phonetics or consent of instructor.

4 units, Spr (Huntington)

231. Speech Perception—(Same as Linguistics 115.) Perceptual and physiological correlates of the acoustic constituents of speech. Prerequisite: Course in phonetics, 230 or consent of instructor.

3 units, Win (Huntington)


2-3 units, any quarter (Schubert) by arrangement

292. The Auditory Process—(Same as Psychology 231.) A systematic survey of our current knowledge of the operation of the auditory system. Emphasis on acquiring a knowledge of the acoustic signal, and on an understanding of the methods of measuring a sensory process.

3 units, Aut (Schubert) by arrangement

300. Independent Study—Advanced individual study under direction in fields or subjects of special interest. Maximum 12 units in any one quarter.

any quarter (Staff) by arrangement

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 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 C. Buchanan (Professor), William J. Clancey (Senior Research Associate), Edward A. Feigenbaum (Professor), Michael L. Genesereth (Associate Professor), Edward H. Shortliffe (Associate Professor), Gio Wiederhold (Associate Professor)

Economics: Victor R. Fuchs (Professor)

Electrical Engineering: Albert Macovski (Professor), Gio Wiederhold (Associate Professor)

Engineering-Economic Systems: Samuel Holtzman (Consulting Assistant Professor), Ronald A. Howard (Professor), Ross D. Shachter (Assistant Professor), Edison Tse (Associate Professor)

Family, Community, and Preventive Medicine: Byron W. Brown, Jr. (Professor), John P. Bunker (Professor)

Genetics: Stanley N. Cohen (Professor)

Medicine: Terrance Blaschke (Associate Professor), Robert W. Carlson (Assistant Professor), Lawrence M. Fagan (Senior Research Associate), James F. Fries (Associate Professor), Charlotte Jacobs (Assistant Professor), Laurence Kedes (Professor), Richard L. Popp (Professor), Edward H. Shortliffe (Associate Professor), Harold C. Sox, Jr. (Professor)

Obstetrics and Gynecology: Emmet J. Lamb (Professor)

Pathology: Howard H. Sussman (Associate Professor)

Psychology: Amos N. Tversky (Professor)

Radiology: Leslie M. Zatz (Professor), Dieter Enzmann (Associate Professor)

Statistics and Biostatistics: Byron W. Brown Jr. (Professor)

Surgery: Michael Eliastam (Associate Professor)

Graduate School of Business: Alain C. Entchoven (Professor)

Graduate School of Education: Richard E. Snow (Professor), Lee S. Shulman (Professor)

This interdisciplinary program was created in response to a recognized need for well-trained researchers and academic leaders in the expanding field of medical information sciences.

FACILITIES

Stanford University’s extensive computing facilities are described under the Computer Science Department section in this bulletin. In addition, the Medical Information Sciences Program has a network of Hewlett-Packard 9836 and Xerox 1100 series professional workstations. These high performance machines are available for coursework and research projects by trainees in the program.

GRADUATE PROGRAMS

The Medical Information Sciences program is an interdepartmental program that offers instruction and research opportunities leading to graduate degrees in Medical Information Sciences with subspecialization in Medical Computer Science or Medical Decision Making.

MASTER OF SCIENCE

The University’s basic requirements for the master’s degree are discussed in the section “Degrees” in this bulletin. The Medical Information Sciences Program offers both masters and doctoral degrees with students selecting to subspecialize in either medical computing or medical decision making. In all degree programs the candidate must attain a 3.0 average. Students who fail to maintain a 3.0 average 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. Program on Engineering in Biology and Medicine, 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 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 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 IN MEDICAL INFORMATION SCIENCES-COMPUTING (MIS/CS)

This degree is designed for individuals who wish to undertake in-depth study of computer applications in medicine. 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 computer science.

**PROGRAM REQUIREMENTS**

Programs of at least 54 units that meet the guidelines in the following categories will normally be approved:

1. Same as core curriculum, but students are encouraged to take the advanced physiology course(s) that deal(s) with the domain of their research project.
2. Core curriculum requirements plus three of the following for a total of at least 15 units: CS 135, 223A,B, 245, 323.
3. Same as core curriculum.
4. Same as core curriculum.
5. Same as core curriculum.
6. Electives: Additional courses as desired by candidate to bring total to 54 or more units.

### MASTER OF SCIENCE IN MEDICAL INFORMATION SCIENCES-DECISION MAKING (MIS/DM)

This degree is designed for individuals who wish to study decision theory applied to medicine in depth. Normally a student will spend two years in the program and will undertake 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 decision sciences.
PROGRAM REQUIREMENTS

Programs of at least 54 units that meet the guidelines in the following categories will normally be approved:

1. Same as core curriculum, but students are encouraged to take the advanced physiology course(s) that deal(s) with the domain of their research project.
2. Same as core curriculum, but additional courses strongly encouraged.
3. Same as core curriculum, with a minimum of 16 units of formal coursework in this category including Psychology 256.
4. Same as core curriculum.
5. Same as core curriculum.
6. Electives: Additional courses as desired by candidate to bring total to 54 or more units.

MASTER OF SCIENCE IN MEDICAL INFORMATION SCIENCES (MIS)

This special program is designed as post-doctoral training for individuals with established research credentials who may wish to acquaint themselves broadly with the field of Medical Information Sciences, emphasizing formal coursework. Candidates will be required to complete the core curriculum and to supplement coursework with approved electives to obtain a total of 42 units. A research project is encouraged but not required. Candidates will be permitted to complete the program in no less than four quarters. Students in this program will be drawn from applicants with doctoral degrees in medicine, computer science, decision theory, or related fields; for example, an academic physician on sabbatical might wish to undertake this program of study. The degree is designed to allow its graduates to complement their area of primary academic or research activity by providing them with a heightened ability to work effectively in collaborative research projects.

DOCTOR OF PHILOSOPHY

Individuals wishing to prepare themselves for careers as independent researchers in medical computer science or medical decision science should apply for admission to the doctoral program in Medical Information Science. The university's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the "Degrees" section in this bulletin. The following are additional requirements imposed by the MIS Interdisciplinary Committee:

1. A student should plan and successfully complete a coherent program of study including the core curriculum, oral examination, and additional requirements for the masters program corresponding to his or her area of primary interest (Medical Computing or Medical Decision Making). In addition, doctoral candidates will be expected to complete at least 6 additional units of advanced coursework in the category of their specialization. For computer science specialization, this will require 6 additional units in CS courses numbered 135 or higher. For decision making specialization, the courses will be chosen with the student's MIS advisor, but will generally include Statistics 228 and 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 full-time 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. Each student, to remain in the Ph.D program must attain a grade average as outlined for the masters 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 a 3.0 average. The student must fulfill these requirements and apply for admission to candidacy for the Ph.D. by the end of six quarters of full-time study (excluding summers).

3. By the end of nine quarters (excluding summers) each student must orally present a thesis proposal to members of the Graduate Study Committee of the MIS Program. The committee will determine whether the student's general knowledge of the field (Medical Computing or Medical Decision Making), 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 thesis 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 thesis 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.

10. Upon successful completion of the dissertation and other degree requirements, the candidate will be granted the degree “Doctorate in Medical Information Sciences - Computing” or “Doctorate in Medical Information Sciences - Decision Making” depending upon the field of subspecialty that he or she has pursued.

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. The students will be assigned to selected faculty members who introduce students to the medical wards, outpatient clinics, emergency room, operating room, intensive care unit, psychiatry ward, and rehabilitation ward. Meeting time is adjusted to suit the student’s class schedule. Available only to students in 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.) One quarter lecture series provides an overview of medical computer science activities in both research and applied environments. Topics include office systems, hospital information systems, medical databases, laboratory systems, image analysis, EKG analysis, history taking, library systems, multiphasic health testing, medical computer-aided instruction.

3 units, Aut (Fagan, Cooper, Wiederhold) TTh 12:15

211A. Computer-Assisted Medical Decision Making—(Same as Computer Science 271A). An introduction to medical decision making techniques and to methods for their implementation in decision support systems. Emphasis on Bayesian statistics, decision analysis, and artificial intelligence (expert systems).

3 units, Win (Cooper) TTh 12:15

211B. Computer-Assisted Medical Decision Making—(Same as Computer Science 271B). Continuation of 211A 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 (Fagen, 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 ten year's research on rule-based expert
systems in the Knowledge Systems Laboratory,
and its relationship to similar research direc-
tions for the 1980's. Emphasis is on an analysis
of the research lessons of MYCIN and related
projects in the KSL, the strengths and limita-
tions of the rule-based approach to knowledge
representation, and the way in which AI re-
search evolves as new ideas and concepts are
discovered. Prerequisites: At least one course
in artificial intelligence and familiarity with
LISP.
2 units (Buchanan, Shortliffe) not given
1986-87

235. Medical Decision Analysis—(Same as
Engineering-Economics Systems 235, Com-
puter Science 371.) Introduction to the use of
decision analysis in medical practice. Student
teams will analyze specific clinical decision
problems as a term project. Individual analyses
is generalized by outlining a computer-based
clinical decision tool for cases similar to the one
analyzed. Also covers advanced topics in deci-
sion analysis of particular relevance to medical
decisions, including influence diagram formula-
tion, probability encoding, risk attitude assess-
ment, value model development, and com-
puter-based decision system design. Prerequi-
site: Engineering-Economic Systems 231, or
equivalent. No formal medical background is
required.
3 units, Spr (Holtzman) MF 3:15-4:30

299. Directed Reading and Research—Stu-
dents wishing to receive credit for research time
should register for this course.
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. Mc-
Devitt, Leon T. Rosenberg, Bruce A. D.
Stocker
Associate Professor: Harry B. Greenberg,
Abdul Matin, Robert J. Roantree
Assistant Professors: John C. Boothroyd, Mark
M. Davis, Edward S. Mocarski, Peter O'Han-
ley, Gary K. Schoolnik, Lucy S. Tompkins

Professor (Teaching): John P. Steward
Associate Professor (Research), Thomas E.
Hamm

OFFERINGS AND
FACILITIES

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 be-
low). In addition, research experience is offered
to medical students in the course of an M.D.
program and to postdoctoral trainees. The cur-
rent research interests of the department in-
clude 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 para-
sites.

UNDERGRADUATE
PROGRAM

BACHELOR OF SCIENCE

Requirements include: Mathematics, includ-
ing 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 fol-
lowing: 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 Re-
search). 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 degree will be expected to have
completed the preliminary requirements listed
above for the B.S. degree, or their equivalent.
In addition, the candidate is expected to com-
plete 45 quarter units of work related to micro-
biology; 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 depart-
ment faculty. There will also be an oral examina-
tion, 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 aptitude tests and the advanced test (normally in biology, but where appropriate in some other subject, e.g., chemistry) of the Graduate Record Examination. It is strongly recommended that the GRE be taken in October so that scores will be available when applications are evaluated.

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

101. General Microbiology—A lecture and laboratory introduction to the biology of bacteria, bacteriophages, and animal viruses. Coverage will include bacterial anatomy, genetics, and physiology, as well as antibiotic action, immunology, and host-parasite relationships. Prerequisites: Chemistry 31, 33, and 35; Biological Sciences 31 recommended.

5 units, Aut (Roantree) MWF 1:15
lab MWF 2:15-4:05

102. Principles of Immunology—An introduction of basic facts of immune responses in vertebrates. Immune-like reactions in nonvertebrate animals, as well as in plants and bacteria, are briefly covered.

3 units, Win (Rosenberg) TTh 1:15
given 1987-88

103. Undergraduate Medical Microbiology—Lecture covering the principles of pathogenic microbiology in more breadth and depth than 101. Topics include 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

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 include: 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. Designed principally for medical, graduate, and advanced undergraduate students.

Basic principles of genetics and introductory courses in biochemistry and histology essential.

3 units, Spr (Rosenberg, McDevitt, Weissman) MWF 10
200A. Problem Solving in Immunology—
(Same as Pathology 220A.) Designed to provide
direct experience in understanding immunol-
ogy using problems. Each week 3-5 problems
are to be corrected and discussed. Prerequisite:
Simultaneous enrollment in 200.
1 unit, Spr (Rosenberg, McDevitt,
Weissman) by arrangement

201. Advanced Immunology—A reading/dis-
cussion course on major ongoing areas of immu-
nology primarily for graduate students and post-
doctoral fellows. Topics include genetics and
structure function relationships of antibody/T
cell receptors, MHC Class I and Class II mole-
cules; accessory molecules such as T3, LFA1,
T4 and T8; the phenomena of tolerance, sup-
pression and autoimmunity and the response to
viral and protozoan challenges. Recommended:
Introductory course in immunology. No final
exam.
2 units, Win (Falkow) T 2:15-4:05

202. Medical Microbiology—Lectures and lab-
oratory demonstrations covering the funda-
mentals of pathogenic microbiology, with par-
ticular reference to bacteria, and animal vir-
uses. Includes a discussion of some aspects of
immunology, laboratory diagnosis, and pre-
ventive measures. Limited to medical students
and those graduate students who have the con-
sent 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 stu-
dents. Bacterial nutrition and growth kinetics;
bacterial phenotype during nutrient-limited
growth; structure and function; terminal
energy-yielding pathways (aerobic and anaero-
bic respiratory chains, proton translocation,
oxidative phosphorylation, nutrient transport);
and special bacterial groups or processes. Pre-
requisites: 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 Sci-
cences 31 or equivalents. Consent of instructor
for minilab.
3-4 units, Win (Stockert) MWF 9
lab MWF 2:15, or by arrangement

206. Animal Viruses—For graduate and ad-
vanced undergraduate students. Lectures cov-
er the molecular biology of virus replication
with emphasis on the host-virus interaction.
Prerequisites: 101 or 202, Biochemistry 200, or
consent of instructor. Recommended: Biolog-
ical Sciences 213 and Biochemistry 201.
3 units, Spr (Mocarski) MWF 9

207. Pathogenesis of Infectious Diseases—
Emphasis: provide a better understanding of
the molecular mechanisms employed by micro-
organisms to bring about the infection of animal
and human hosts. Formal instruction plus class
discussion of recent literature pertaining to
microbial pathogenicity, as well as normal and
acquired host surface mechanisms. Prerequi-
tive: Consent of instructor. Sign-up list re-
quested.
2 units, Win (Falkow) alternate years,
given 1987-88

208. Topics in Virology—In depth discussion
of current literature in a topical area of the
molecular biology of viruses. Student participa-
tion in presentations required. Prerequisite:
206. May be taken repeatedly.
1 unit, Win (Mocarski) M 10

209. Molecular Parasitology—An advanced
seminar dealing with the molecular biology of
parasites, especially protozoa. Topics include
antigenic variation, molecular cloning of protective
antigens, gene amplification, kinetoplast DNA and host-
parasite interactions. Recom-
mended: A background in parasitology, e.g.,
Family, Community and Preventive Medicine
204. Prerequisite: Biochemistry 201 or consent
of instructor.
2 units, Spr (Boothroyd) Th 3:15-5:05

210. Advanced Bacteriology—Inte-
grates the clinical features of selected infectious
diseases, laboratory procedures used to identify
the responsible pathogen, and the molecular
basis of pathogenicity. Minimum enrollment of
six students. Prerequisite: Consent of instruct-
ors. Sign-up list requested.
2 units, Win (Schoolnik, Uyeda, Falkow)
Th 1:15-3:05

270. Seminar—Reports, discussions on select-
ed topics by departmental speakers.
1 unit, Aut, Win, Spr (Staff) W 12

299. Directed Reading—Prerequisites: Con-
sent 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: Eric M. Shooter
Professors: Denis A. Baylor, Uel J. McMahan, Eric M. Shooter
Associate Professors: Carla J. Shatz, Eric I. Knudsen
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—An introduction to structure and function of the nervous system, including neurophysiology, neurochemistry and neuroanatomy. Topics range from the properties of neurons to the mechanisms and organization underlying higher functions. Designed to present a coherent framework as a preparation for neurology, neuropathology and clinical medicine in general, and advanced work in neurobiology. Lectures and neuroanatomy laboratories, frequent, informal seminars with students in small groups, and demonstrations. This is an integrated course, neuroanatomy and neurobiology components must be taken together. Final exam. No limitation.

212. Neurochemistry—An advanced seminar and reading course dealing in detail with the biochemistry and molecular biology of neural development, regeneration and synaptic modulation. Topics include neurohormones and peptides, receptor-coupled enzymes nerve growth factor, and molecular mechanisms regulating axon growth. Emphasis on the study of original papers and on student presentation.
   3 units, Spr (Shooter, Skene)

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, Leland J. Rather
Chairman: Klaus G. Bensch
Associate Professors: Margaret E.Billingham, Gerald R. Crabtree, Edgar G. Engleman, F. Carl Grumet, Roger A. Warnke
Assistant Professors: Eugene C. Butcher, Michael L. Cleary, Steven K.H. Foug, Brian J. Nickoloff, 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

PATHOLOGY
Associate Professor (Clinical): Michael R. Hendrickson
Lecturer: Glen B. Haydon
Acting Assistant Professors: William C. Pitts, Donald P. Regula
Clinical Professor Emeritus: Donald L. Alcott
Clinical Associate Professors: Robert W. R. Archibald, Stephen S. Chen, John T. Differding, Seth L. Haber, A. Paul Miller, Mahendra Ranchod
Physician Specialist and Clinical Professor: P. Joanne Cornbleet
Clinical Assistant Professors: Robert M. Cardelli, Barbara M. Egbert, Meredith Halks-Miller, Maie K. Herrick, Paul L. Herrmann, Jon C. Ross, Charles T. Uyeda, Peter Windhorst
Physician Specialist and Clinical Instructor: Charles M. Lombard, Robert Shiurba
Senior Research Associate: Dolly B. Ness
Research Associates: Nahid Moheghpour, Roger Schultz, Barry S. Stein, Charles van Bohemen, 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, developmental and cellular immunology, tumor immunology, viral leukemogenesis, and a variety of clinical-pathological studies with particular emphasis on disease of the cardiovascular and lymphoreticular systems. Research training in all of these areas is available at the present time for qualified medical and graduate students by individual arrangement with the appropriate faculty member.

COURSES

205. Clinical-Pathological Correlations—Correlation of clinical histories with surgical and autopsy material, including microscopy. Maximum 12, minimum 5 students.
1 unit, 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 fixed dissected organs from current autopsies and correlate an autopsy finding with a clinical history. Students participate in one postmortem examination with the assistance of residents and staff and present the case to the class. Relevant microscopic sections are demonstrated. Prerequisite: Currently taking or previously completed 230B or C.
1 unit, Aut, Win (Bensch, Staff) T 12:30-2

220. Immunology—(Same as Medical Microbiology 200.) Immunology as related to medicine is emphasized. Designed 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.) Designed
to provide direct experience in understanding
immunology using problems. Each week 3-5
problems 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 dis-
ordered 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, Hourpian, 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 Micro-
scopic Techniques—Laboratory course provid-
ing basic familiarity with the major technical
problems encountered in the preparation of
biological material for electron microscopy
through tutorial direction in the completion of
two projects. Prerequisite: A basic understand-
ing of electron microscopy.
1-4 units, Aut, Win, Spr (Haydon)
by arrangement

290. Research in Experimental Neuropathol-
ogy — Introduction to research methods in
experimental neuropathology for students in-
terested in a long-term project in this area.
Work consists of participation in neuropathol-
ogy research under the close supervision of a
staff member in neuropathology. Facilities
available include electron microscopy, tissue
culture, neurochemistry and immunocyto-
chemistry with antibody and molecular probes.
Prerequisite: Consent of the instructor.
1-15 units, any quarter (Staff)
by arrangement

299. Directed Reading — Prerequisite: Con-
sent of faculty member
1-15 units, any quarter (Staff)
by arrangement

399. Research—The faculty of the Pathology
Department are involved in active research
programs, both at the Stanford Medical Center
and at the Palo Alto V.A. Medical Center.
Students interested in research at the molec-
ular, 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. Pre-
requisites: Consent of instructor.
1-15 units, any quarter (Staff)
by arrangement

PHARMACOLOGY

Emeritus: (Professor) Robert H. Dreisbach
Chairman: Tag E. Mansour
Professors: Avram Goldstein, Dora B. Gold-
stein, Sumner M. Kalman, Tag E. Mansour
Associate Professors: Terrence Blaschke (Joint-
ly with Medicine) Gordon Ringold, Howard
Schulman, James P. Whitlock, Jr.
Assistant Professors: Helen M. Blau, Richard
A. Roth
Professors (by courtesy): Leo Hollister, Ken-
neth Melmon, Ferid Murad
Assistant Professors (by courtesy): Phyllis Gar-
der, Brian Hoffman, Richard D. Mamlok,
Stephen Peroutka
Consulting Professor: Alejandro Zaffaroni

PROGRAMS OF STUDY

The department presents two basic courses in
contemporary pharmacology (201 and 202) and
advanced courses open to qualified medical and
other graduate students.

A program of study and research training is
offered leading to the Ph.D. degree. Postdoc-
toral 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, phys-
ics, or mathematics who wish to pursue a career
of research in a field that lies between biology

Prerequisites: Biological Sciences 21 and/or cur-
cent consent of instructor.
3 units, Spr (Hanawalt, Friedberg, K. Smith)
alternate years, given 1987-88
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, Pharmacology 202, will provide the medical and graduate student with a broad exposure to the principles of pharmacology and the properties of the major drug groups relevant to the proper use of drugs in man.

201. Pharmacology—A lecture on the principles of pharmacology and the major drug groups used in medicine. Topics include 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) MTWThF 8

202. Pharmacology—Continuation of 201. Major drug groups include the drugs affecting the central nervous system, and drugs affecting the peripheral nervous system, the cardiovascular system, and the kidney. Emphasis is on pharmacological principles in relation to the use of drugs in man; centrally acting drugs discussed include convulsants, anticonvulsants, anesthetics, sedatives, analgesics, tranquilizers, and other psychoactive drugs. Problems of drug abuse are also considered. 5 units, Win (Staff) MTWThF 8

**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.

207. Signal Transduction and Hormone Action—Molecular mechanisms for transduction and transmission of biological signals. Topics include molecular basis for the action of polypeptide and steroid hormones, neurotransmitters, and growth factors on neurotransmission, metabolism, gene regulation and cell growth. Lectures and discussions. 5 units, Spr (Ringold, Roth, Schulman) by arrangement

231. Regulation of Gene Expression in Differentiation and Development—Model biological systems for the study of differentiation and development analyzed at a cellular and molecular level. A lecture and student discussion course of recent research developments. 2 units, Win (Blau) by arrangement

270. Research Seminar—Weekly seminars by outside speakers on current research in pharmacology. Seminars are reviewed and discussed in a separate conference with a member of the faculty. 2 units, Aut, Win, Spr (Staff) Th 4:15-6:05 F 12-1

250. 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

**REGULARLY OFFERED, BUT NOT DURING 1986-87**

204. Effects of Drugs on Membrane Bilayers—Lectures and discussion about drug effects on membrane lipids and on the physical properties of biomembranes. No limitation. Prerequisite: Biochemistry 201 or equivalent. 2 units (D. B. Goldstein) by arrangement
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 combating pollution.

2 units (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 (A. Goldstein) by arrangement

221. Molecular and Biochemical Aspects of Chemical Carcinogenesis—Topics include causes of cancer, initiation and promotion, carcinogen metabolism, oncogenes, growth factors, tumor cell heterogeneity, cellular responses to DNA damage, carcinogen detection, and quantitative risk assessment.

2 units (Whitlock) by arrangement

223. Topics in Therapeutics—A series of lectures and small group discussions demonstrating how principles of pharmacology may be applied to therapeutic decision making. Students participate in problem-solving exercises by analyzing appropriate literature.

2 units (Blaschke) by arrangement

225. Frontiers of Pharmacology: Biogenic Amine Receptors—Lectures and discussions on the localization, characterization and control of different biogenic amine receptors. Emphasis on biochemical and molecular aspects of these receptors in vertebrate and invertebrate animals. Weekly lecture and weekly group analysis of assigned papers. Prerequisite: Biochemistry 200 or equivalent.

2 units (Mansour) by arrangement

**PHYSIOLOGY**

*Emeriti: (Professors)* Frederick A. Fuhrman, Ronald Grant

*Chairman:* Roy H. Maffly

*Professors:* Julian M. Davidson, Rex L. Jamison (jointly with Medicine), Eugene D. Robin

*Consulting Associate Professor:* Noel Thompson

**PROGRAMS OF STUDY**

The Department of Physiology offers required and elective courses for students in the School of Medicine, open also to other qualified students with the consent of the instructor. The main emphasis is on training of medical and postdoctoral students. For a very limited number of highly qualified students, the department offers the Ph.D. degree, but not the master's or bachelor's degrees.

**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 (aptitude and advanced 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, Statistics 160 and 161, and Physiology courses 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 the University.

**COURSES**

200. Clinical 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 9-10:50, TTh 11-11:50


6 units (201, 4 units; 202, 2 units), Win (Endocrinology: Hoffman; Gastrointestinal: Cooper, Gray) MW 9-10:50 TTh 11-11:50

203-204. Clinical 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: Jamison, Maffly, Meyer) MTF 8-9:50

205. Introduction to Mathematical Methods in Physiology and Chemistry — The solution of several differential equations using methods useful in physiology and chemistry. Standard methods, Laplace Transforms, analog computer and digital computer methods will be considered. Prerequisite: One year of college calculus.

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

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 1986-87

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 5:15-7:05

213. Special Topics in Physiology — A seminar of guided reading and discussion in both introductory and advanced physiological topics. Topics are agreed upon by an individual instructor and interested students. Prerequisite: Consent of instructor.

(Staff) by arrangement

215. Tutorial in Clinical Physiology — Guided study, with readings and discussions in both introductory and advanced physiological topics, to supplement 200, 201, 202.

1-2 units, any quarter (Robin, Staff) by arrangement

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) W 3:15

299. Directed Reading — Prerequisite: Consent of instructor.

any quarter (Staff) by arrangement

399. Advanced Research — Investigation sponsored by individual faculty members may be undertaken by interested, qualified medical or graduate students. The hours and units may be arranged by the student. The fields of research open to students include endocrinology, neuroendocrinology, central nervous system function, reproductive physiology, chemistry and mechanism of action of toxins in marine biology, cybernetics (systems analysis and instrumental techniques).

any quarter (Staff) by arrangement

RADIOLOGY

Emeriti: David Click, Henry H. Jones, Frederick N. Silverman
Chairman: Malcolm A. Bagshaw
animal and human tumors; studies in developing contrast agents to improve diagnosis in conventional radiography, computed tomography and ultrasound; analysis of tissue signature characterization by ultrasound for diagnostic use; studies in advanced diagnostic imaging systems in computed tomography, digital radiography, digital fluoroscopy, and magnetic resonance imaging (MRI), both imaging techniques and in vivo spectroscopy of normal and abnormal physiology, and vascular and CNS applications of MRI, studies on pulmonary oxygen toxicity and development factors in immature/growing lung; studies on the microvasculature; 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 Radiology Research. Aut, Win, Spr (Staff) by arrangement

154. Biosocial Aspects of Cancer—(Same as Human Biology 154.) Aspects of cancer as a biological phenomenon and as a clinical, emotional and societal problem. Diagnosis and treatment of human neoplasms, their psychosocial and economic impact, organization of cancer care and research. Detailed considerations of the specific control mechanisms operative in vitro and/or in vivo and delineation of their influence in an attempt to characterize the differences between normal and malignant growth.

3 units, Spr (Brown, Staff)
W 7:30-9:30, T 7:30-9

201. Biological Effects of Radiation—Basic physical and chemical events, relevant biochemical pathways and molecular targets, repair of molecular lesions, cellular and tissue radio-biological determinants, radiation dose modifier effects on tumors and specific tissues and organs, whole body effects, carcinogenesis, hazards, and permissible dose standards. Prerequisite: Biochemistry 200, or consent of instructor.

2 units, Win (Smith, Staff) by arrangement

202. The Radiobiology of Radiotherapy—Intended primarily for residents or fellows in the Radiotherapy Division training program; open to medical or postgraduate students interested in radiotherapy. Focus is on the basic radiobiological processes underlying the treatment of malignant disease by radiation. Carcinogenesis and mutagenesis by radiation also covered. 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 21 and/or consent of instructor.

3 units, Spr (Hanawalt, Friedberg, Smith) alternate years, given 1987-88

208. Experimental Nuclear Medicine—Familiarize the student with computer applications in medicine, particularly in the use of radioisotopes as tracers. Recommended: Some knowledge of physiology and calculus.

Spr (Goris) by arrangement

241,242,243. Molecular and Cellular Aspects of Cancer Biology—3 quarters covering three subject areas: cancer cell biology, carcinogenesis, and fundamental principles of therapy, with one subject each quarter. Not intended to replace other specialized courses offered under departmental headings, but gives a comprehensive view of the major, relevant scientific bases and advances in areas relating to understanding and control of neoplastic growth. Organized and coordinated by E.C. Friedberg (Dept. Pathology), with faculty drawn almost exclusively from Stanford faculty participating in Cancer Biology Program.

242. 3 units, Win (Staff) dhr
243. 3 units, Spr

299. Research.

any quarter (Staff) by arrangement
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 assistantships 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: Graduate Division Special Program, Committee on Biophysics, Cancer Biology Program, and Neurosciences Program. The Dean also has responsibility for the Bechtel International Center.

INTERDISCIPLINARY PROGRAMS AND COMMITTEES

GRADUATE DIVISION SPECIAL PROGRAM

The Graduate Division Special Program is designed for students seeking a Ph.D. degree 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, 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 at Stanford and not later than the end of the third year of graduate study at Stanford. Students must have been admitted to a Stanford doctoral 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 reexamination 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
BIOPHYSICS PROGRAM

Committee on Biophysics: Robert D. Simoni, Chairman, (Professor of Biological Sciences), David A. Clayton (Professor of Pathology); Oleg Jardetzky (Professor of Pharmacology); Harden M. McConnell (Professor of Chemistry); Lubert Stryer (Professor of Structural Biology); Philip C. Hanawalt (Professor of Biological Sciences)

The Biophysics Program offers instruction and research opportunities leading to the Ph. D. in biophysics. Students admitted to the program may perform their graduate research in any appropriate department.

GRADUATE PROGRAM

A small number of highly qualified applicants will be admitted to the program each year. Applicants should present strong undergraduate backgrounds in the physical sciences and mathematics. The graduate course program, beyond the stated requirements, will be worked out for each student individually with the help of appropriate advisors from the Committee on Biophysics.

The requirements for the Ph.D. degree include the following:

1. Training in physics or chemistry equivalent to that of an undergraduate physics or chemistry major at Stanford.
2. A graduate minor in physics, chemistry, or biology (or in a related field). Consult appropriate departmental announcements for minor requirements.
3. Completion of the following courses (or their equivalents):
   a) Biophysics 250.
   b) Biochemistry 200, 201.
   c) Chemistry 131, 171, 173 and 175.
   d) Additional courses as required for the individually tailored program.
4. Proficiency in one or more foreign language 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 advising committee.
6. Successful passing of a comprehensive qualifying examination in biophysics is required for admission to Ph.D. candidacy. This examination is normally taken early in the second year of study and it emphasizes the area of specialization in biophysics.
7. Preparation of a Dissertation Proposal defining the research to be undertaken, including methods of procedure. This proposal should be submitted by Spring Quarter of the second year and it must be approved by a committee of at least three members including the principal research advisor and at least one member from the Committee on Biophysics. The candidate will be called upon to defend the dissertation proposal in an oral examination. The dissertation reading committee will normally evolve from the dissertation proposal review committee.
8. The presentation of a Ph.D. thesis as the result of independent investigation and expressing a contribution to knowledge in the field of biophysics.
9. The successful passing of the University oral examination which is to be taken only after the student has substantially completed the research. The examination will be preceded by a public seminar in which the research will be presented by the candidate.

COURSES

250. Molecular Biophysics—Physical biochemistry and physical approaches to biological problems at the molecular level. Lectures include discussion of macromolecular structure and intermolecular interactions, physical methods for characterizing proteins and nucleic acids, the interaction of electromagnetic radiation with biological molecules, isotopic tracer techniques, and classical physics of cellular processes. Open to qualified advanced students upon consent of instructor.
4 units, Aut (Hanawalt, Jardetzky, Staff) TTh 10 and Th 1:15-3:05

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

Other recommended courses:
Chemistry 287, 289, 291; Biological Sciences 205, 211, 252; Cell Biology 211, 224; Radiology 201; Applied Physics 130, 232A, Physics 170, 171, 172, 230, 234.
The Cancer Biology Program is designed to provide a framework for students with an interest in the understanding and control of neoplastic growth to build a curriculum in varied biomedical areas relevant to that subject. Students in this program are based in departments appropriate to their specialty and are subject to the core requirements specified below. The degree offered is the Ph.D. in Cancer Biology. Basic University requirements for the Ph.D. are described under the “Degrees” section at the beginning of this bulletin.

GRADUATE PROGRAM
DOCTOR OF PHILOSOPHY

A limited number of well qualified applicants will be admitted to the program each year. It is preferable that applicants will have completed an undergraduate major in the biological sciences; applicants with undergraduate majors in physics, chemistry, or mathematics may be admitted under the condition that they will complete background training in biology during the first two years of study. During the first year in the program each student is required to constitute a three person Advising Committee which will assist him/her with the development of an appropriate program of courses and provide advice and consultation on thesis-related research. The appointment of this committee is normally carried out in consultation with the student’s research preceptor, who will chair the Advising Committee.

The requirements for the Ph. D. degree are as follows:

1. Training in biology equivalent to that of an undergraduate biology major at Stanford.
2. Completion of the following courses (or their equivalents, except for the Cancer Biology course):
   a) Biochemistry 200, 201. General Biochemistry and Advanced Molecular Biology.
   b) Pathology 230A. General Pathology.
3. Each student must take at least 12 units of additional courses that are offered by 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. thesis 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 primarily three subject areas: 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, given 1987-88
242. 3 units, Win (Staff) TTh 4:15-5:35 alternate years, given 1987-88
243. 3 units, Spr (Staff) TTh 4:15-5:35 alternate years, given 1987-88

251,252,253. Special Topics in Cancer Biology—Full quarter courses or half-quarter mini-courses given by different lecturers and 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.

NEUROSCIENCES PROGRAM

Chairman: U. Jackson McMahan (Professor of Neurobiology)

Committee: Jack D. Barchas (Professor of Psychiatry and Behavioral Sciences), Barry W. Connors (Assistant Professor of Neurology), Corey Goodman (Associate Professor of Biological Sciences), Eric I. Knudsen (Associate Professor of Neurobiology), David A. Prince (Professor of Neurology), Richard H. Scheller (Assistant Professor of Biological Sciences), Richard Thompson (Professor of Psychology), Stuart Thompson (Associate Professor of Biology); Student Members: Sascha du Lac, Chuck Solc

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), Corey S. Goodman (Associate Professor), H. Craig Heller (Associate Professor), Richard H. Scheller (Assistant 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: Barry W. Connors (Assistant Professor), Dennis Choi (Assistant Professor), Jeffery Kocsis (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 (Assistant Professor), Michael Weinrich (Assistant Professor)

Pathology: Lawrence F. Eng (Professor, Research)

Pharmacology: Avram Goldstein (Professor), Dora Goldstein (Professor), Howard Schuman (Associate Professor)

Physiology: Julian M. Davidson (Professor)

Psychiatry and Behavioral Science: Patricia R. Barchas (Assistant Professor), Jack D. Barchas (Nancy Friend Fritzheimer Professor), Phillip A. Berger (Professor), Roland D. Ciaranello (Professor), William C. Dement (Professor), Seymour Levine (Professor), John Madden (Assistant Professor), Dona Wong (Assistant Professor)

Psychology: Richard Thompson (Professor), Jeffrey J. Wine (Associate Professor)

Surgery: David M. Maurice (Professor, Research), Michael F. Marmor (Associate Professor)

GRADUATE PROGRAM

DOCTOR OF PHILOSOPHY

The Neurosciences Program is an interdisciplinary 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. Deadline for receipt of applications with all supporting material in the University's Graduate Admissions Office is January 15. A supplemental application (which can be obtained from the Neurosciences Program Office, Fairchild D 201A, Stanford University) 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 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. thesis which is the result of independent investigation and which contributes to knowledge in an area of neuroscience and to defend his or her thesis in a University oral examination, including a public seminar.

Medical students may also participate in this program provided they meet the prerequisites and satisfy all the requirements of the graduate program as listed above. The timing of the program may be adjusted to fit in with their special circumstances.

**COURSES**

The course selections of individual departments participating in the Neurosciences Program should also be consulted for complete offerings.

**Biological Sciences 153. Introduction to the Nervous System**—(Same as Psychology 107). A survey of neural mechanisms and interactions underlying behavior. Prerequisites: 42 and 43, or Psychology 1, or consent of instructor.

*4 units, Aut (Donegan) not given 1987-88*

**Biological Sciences 154. Cellular and Molecular Neurobiology**—A study of the function of the nervous system at the cellular and molecular level. Discussion of membrane biophysics, synaptic transmission, biochemistry and molecular genetics of neuronal function, and their relationship to behavior and learning. Prerequisites: 42 and 153, or consent of instructor.

*4 units, Win (Scheller) not given 1986-87*

**Biological Sciences 155. Developmental Neurobiology**—(Formerly 109.) A study of the development of the nervous system at the cellular and molecular level. Discussion of axon guidance and cell migration, neuronal determination and lineage, and synaptogenesis and selective pruning. Prerequisites: 42 and 153, or consent of instructor.

*4 units, Win (Goodman) not given 1986-87*

**Biological Sciences 155H. Experimental Methods in Neurobiology**—An intensive laboratory and lecture course with projects emphasizing microelectrode techniques, extracellular recording, intracellular microinjection, and morphological methods for the study of single neurons. Lectures on membrane biophysics, neuromodulation, synaptic mechanisms and experimental techniques. Prerequisites: 153 and either 154 or 155, or consent of instructor. Course taught at Hopkins Marine Station. Apply to Hopkins.

*15 units, Spr (S. Thompson)*

**Biological Sciences 164. Neurobiological Aspects**—(Same as Psychology 147.) Ethological studies of behavior with an emphasis on understanding physiological substrates of simple behavior. Prerequisites: 43 or Human Biology 033A or Psychiatry 107 or consent of instructor.

*4 units, Aut (Wine) TTh 1:15-2:30 not given 1986-87*

**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)*

**Human Biology 167. Neurochemical Aspects of Behavioral Disorders in Children**—A series of lectures covering principles of neurotransmitter dynamics as they relate to our understanding of behavioral disorders in children. Current hypotheses concerning the neurochemical and neurobiological basis of behavior disorders in children. Clinical syndromes including infantile autism, childhood schizophrenia, and hyperkinetic syndromes and childhood depression in terms of disturbed neurochemical of neurophysiological functioning. Limited to junior and/or senior students. Prerequisites: Human Biology or Biology Core or permission of the instructor. Recommended: Human Biology 111, Human Biology 163 and organic chemistry.

*4 units, Win (Ciaranello) not given 1986-87*

**Human Biology 196. Advanced Neurochemistry Seminar**—Seminar intended 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 is the course will be at the cutting edge of neuroscience and
offer students 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) not given 1986-87

Mechanical Engineering 282. Neuromuscular Biomechanics—Neuromuscular biomechanics and control, with emphasis on current experimental, analytical, modeling, and computer simulation methods. Within a framework of sports biomechanics and rehabilitation, topics will include posture, locomotion, manual control of external devices, and intermuscular control of limb movement. Prerequisites: 200A, 231A and 231B or equivalent

3 units, Spr (Zajac)

Neurobiology 200. The Nervous System—An introduction to structure and function of the nervous system, including neurophysiology, neurochemistry and neuroanatomy. Topics range from the properties of neurons to the mechanisms and organization underlying higher functions. 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. An integrated course in which 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—An advanced seminar and reading course dealing in detail with the biochemistry of neurons and synaptic transmission. Topics include neurotransmitter metabolism, neurohormones and peptides, nerve growth factor and regeneration. Emphasis placed on the study of original papers and on student presentations. Prerequisites: Neurobiology 200 or equivalent

3 units, Spr (Shooter, Skene)

Neurobiology 213. Functional Organization and Development of the Central Nervous System—An advanced seminar and reading course examining the way in which the vertebrate brain processes and codes information, and the role of experience in establishing neural connections. Emphasis on the visual, auditory and somatosensory systems and on the study of original papers and on student presentations.

Prerequisites: Neurobiology 200 or the equivalent.

3 units, Win (Knudsen, Shatz) not given 1986-87

Neurobiology 215. Neurobiology Techniques—For medical students and graduate students in the Neurosciences Program. Use of microscope techniques that enable study of synaptic components including, light and electron microscopy, histochemistry, immunocytochemistry, autoradiography, freeze-fracture and photography.

3 units, Aut, Win, Spr (McMahan) not given 1986-87

Neurobiology 216. Membrane Biophysics Seminar—For students who have some background in neurobiology (Neurobiology 200) and are curious about the basic mechanisms of signaling in nerve cells. Selected topics are covered in depth by reading and discussion of original research papers. Emphasis on concepts, quantitative analysis of experimental results, and critical evaluation of evidence. Topics include gating mechanisms in voltage-sensitive and chemosensitive ion channels and ionic mechanisms in sensory transduction. Student presentations and small group discussions.

3 units, Spr (Aldrich, Baylor) not given 1986-87

Neurobiology 217. Extracellular Matrix—Current views on the structure, function and regulation of extracellular matrix in a variety of tissues with emphasis on the nervous system. Prerequisites: Introductory courses in cell biology and biochemistry.

3 units, Win (McMahan) not given 1986-87

Neurology 204. Physiology of Mammalian Central Nervous System—Laboratory course for advanced students interested in neurological sciences. Introduction to a variety of techniques used in current research in physiology of mammalian central nervous system. No final exam. Limited to 8 students. Prerequisites: consent of instructors.

4 units, Spr (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)

Pharmacology 204. Effect of Drugs on Membrane Bilayers—Lectures and discussion about drug effects on membrane lipids and on the physical properties of biomembranes.

2 units (D.B. Goldstein) by arrangement not given 1986-87
Physiology 210. Neuroendocrine Physiology of Sex—A lecture and discussion on selected topics of current interest in the general area of nervous and endocrine system interrelationships. Emphasis on the mechanisms for control of pituitary function and behavioral aspects of neuroendocrinology. Prerequisites: Basic knowledge of Neurophysiology, Neuroanatomy and Endocrinology; consent of instructor.
2 units, Spr (Davidson) not given 1986-87

Psychology 107. Introduction to the Nervous System—(Same as Biological Sciences 153.) A survey of neural interactions underlying behavior. Prerequisite: 1 or equivalent and elementary biology.
4 units, Aut (Donegan) not given 1986-87

Psychology 147. Animal Behavior: Neurobiological Aspects—(Same as Biological Sciences 164.) Ethological studies of behavior with an emphasis on understanding the physiological substrates. Prerequisites: 107, 108, or 109, or Biological Sciences 22 or Human Biology 3A.
4 units, Aut (Wine) not given 1986-87

Psychology 206. Behavioral Neuroscience — The neurobiological substrates of behavior. Topic areas organized in terms of categories of behavior and includes the neuroanatomical, neurophysiological, neurochemical, hormonal and pharmacological aspects of these behavioral phenomena.
3 units, Spr (R. Thompson)

Psychology 227. Seminar: Cellular Neurophysiological Approaches to Behavior— A detailed consideration of selected examples of current research that have solved or are close to solving persistent problems. Identifies problems and preparations which might profitably be explored. Sample topics: the Mauthner cell system; the function of muscle spindles; efferent control of sensory input.
3 units, Spr (Wine) by arrangement
not given 1986-87

Psychology 228. Mechanisms of Fluid and Macromolecular Secretion—The cellular mechanisms of secretion. Glands controlled by neurons and ionic movements are the key mechanism for secretion. However, in contrast to neurons, glandular secretion is usually not controlled by transmembrane voltages, but regulated by intracellular messengers controlled by neurotransmitters and hormones.
2 units, Spr (Wine)

Psychology 306. Seminar in Brain Substrates of Learning and Memory.
1-3 units, Aut (Thompson)

1-3 units, Spr (Wine)
INDEPENDENT RESEARCH LABORATORIES, CENTERS, AND INSTITUTES

Vice Provost and Dean of Research and Academic Information Systems: Robert L. Street
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 and Academic Information Systems are: Center for Economic Policy Research, Center for Materials Research, Center for Research in International Studies, Hansen Laboratory of Physics (including Ginzton Lab, High Energy Physics Lab, and the 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.

Three additional independent centers report to Elizabeth Traugott, Vice Provost and Dean of Graduate Studies. They are Stanford Center for Chicano Research, Institute for Research on Women and Gender, and the Stanford Humanities Center.

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 Institutes of Health.

Following is a description of the activities of each of these organizations including the research activities and, where applicable, courses offered.

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.

CENTER FOR ECONOMIC POLICY RESEARCH

Director: James L. Sweeney (Professor of Engineering-Economic Systems)
Chairman of the Steering Committee: Michael J. Boskin (Professor of Economics)

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: Technological Innovation Program (TIP), chaired by Paul David and Nathan Rosenberg of Economics; Tax Policy Studies 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.

W. W. HANSEN LABORATORIES OF PHYSICS

Director (HEPL): Mason Yearian
Director (Ginzton Lab): Stephen Harris
Associate Director: Marshall O'Neill
Assistant Director: Robert Strena

The Hansen Laboratories consist of two distinct programs: the High Energy Physics Laboratory (HEPL), and the Edward L. Ginzton Laboratory. HEPL is engaged in basic research in high energy, intermediate energy, and low temperature physics, which currently includes experiments involving superconducting accelerators, particle detection at SLAC and other National Laboratories, gravity waves, gamma 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.

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 five to seven Stanford Faculty Fellows (internal fellows), about eight Faculty Fellows from other universities (external fellows), and about ten 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. The center also designates one of its internal Stanford Faculty Fellows to serve as a humanities advisor to undergraduates and as a coordinator of undergraduate activities at the center. For information, please call (415) 723-3052.

In 1986-87, the Center will co-sponsor, with the School of Engineering, a Stanford Centennial Conference on "Humans, Animals, Machines: Boundaries and Projections" (April 9-11).

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 1986-87 follows:

COURSES

Anthropology 204. Andean Oral History—
(Same as Latin American Studies 204.)
5 units, Win (Millones)

4 units, Aut (Lubin) T 3:15-5:05

English 265. Figures of Imagination and Desire in Film and Literature.
5 units, Aut (Carney) T 3:15-5:05, film MW 7-9 p.m.

French 269. Memory and Modernity: Representing the Past and Theorizing Culture Since the French Revolution.
4 units, Spr (Terdiman)
History 234C/334C. The Idea of Europe.  
Spr (Judt) T 3:15-5:05

History 293/393. The Modern Philippines.  
Aut (Rafael) T 3:15-4:05

Italian 229/329. Rhetoric, Semiotics, and Contemporary Italian Literature.  
4 units, Spr (Allen)

Italian 335. Dante's Divine Comedy: Inferno.  
Aut (Jacoff) TTh 4:15-6:05

Slavic 300A. Literature as Institutions.  
4 units, Spr (Todd)

INTERNATIONAL STRATEGIC INSTITUTE AT STANFORD (ISIS)

Chairman: John W. Lewis  
Associate Chairman: Nancy Okimoto

The Northeast Asia-United States Forum on International Policy and the Center for International Security and Arms Control together constitute the International Strategic Institute at Stanford and share offices located at 320 Galvez Street.

The Northeast Asia-United States Forum on International Policy is co-directed by John Lewis, William Haas Professor of Chinese Politics, and Daniel Okimoto, Associate Professor, Political Science. The Forum serves as a focal point at Stanford for research, training, and exchange activities related to international policy issues involving the United States, China, and Japan. Some 60 faculty members throughout the University are Forum members. The Forum's programs have in residence each year a group of visiting fellows and graduate student research assistants. Current areas of research include projects on high-technology industries in Japan and the United States, science-and-technology policy and management in the People's Republic of China, 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 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 in-service 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 four interdisciplinary language and area programs: African Studies, East Asian Studies, Latin American 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 four centers. The great majority of area-related courses and seminars are offered by the school or department concerned, not directly by the centers. Undergraduate degree programs are coordinated by staff associated with each of the area programs. Special graduate programs leading to the A.M. in Latin American Studies, East Asian Studies and Russian and East European Studies are available and are described separately in this bulletin. The area studies programs do not offer the Ph.D. but qualified doctoral candidates may develop an area specialization within their discipline. Students may also design a cross-disciplinary specialization which emphasizes the area interest within an individually organized program of interdisciplinary preparation.

Note: For course information see listings under the School of Humanities and Sciences.

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 under the rubric “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 for Chinese Language Studies in Taipei, Taiwan, was established in September 1963. It is sponsored by ten American universities, with Stanford University as the administrative agency. The program is a cooperative effort drawing upon the accumulated experience of the profession in providing advanced language training offerings at American institutions.

The purpose of the program is to provide graduate and undergraduate students with intensive audio-lingual language instruction (usually 20 hours a week), as well as to further the students’ familiarity with Chinese texts and materials preparatory or leading to research in given disciplinary or professional fields. The program, however, is not a research institution but a language-training facility.

Undergraduate, graduate, or postdoctoral candidates are eligible to apply to the program if they have successfully completed a minimum of two academic years, or the equivalent, of Chinese language study at the college level. Applicants must also pass a short written screening examination in the Chinese language.

Stanford students attending the Inter-University Program for credit should enroll in Asian Languages C400, Advanced Language Training (15 units per quarter). This course will be graded on a Pass/No Credit basis.

For further information please write to the attention of IUP at:
Center for Research in International Studies Room 200, Lou Henry Hoover Building Stanford University Stanford, California 94305
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
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 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 law, medicine, the humanities, education, employment, 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 40 faculty members have been associated with the Institute.

2. **Graduate Students**—Stanford graduate students working on their own research or in conjunction with Institute-affiliated faculty meet with their peers and with other scholars at the Institute. Through the Institute they can obtain exposure to the most advanced thinking in gender-related scholarship. A few small grants are available each year to facilitate 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 URO. 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 “Feminist Studies” and other departments.

4. **Visiting Scholars**—From 6 to 8 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 in return take back to their own institutions the latest methods and research trends.

5. **Affiliated Scholars**—Approximately 20 scholars are selected among promising independent scholars in the Bay Area for two-year 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**—Numbering nearly 200, the Institute Associates are members of the broader Stanford community who provide financial support to the Institute and perform many services in extending the Institute’s educational mission to the broader public. The Associates attend Institute lectures and help to organize invitational seminars designed to transmit the new scholarship on women and gender to the public. The collaborative activities undertaken at the Institute have brought it national prominence for its contributions to education and scholarly excellence.

**STANFORD LINEAR ACCELERATOR CENTER**

**Director:** Burton Richter  
**Deputy Director:** Sidney D. Drell  
**Executive Officer of the Faculty:** David W. G. S. Leith  
**Associate Directors:** Richard E. Taylor (Research Division), John Rees (SLC Project), Eugene B. Rickansrud (Business Services Division), Kaye D. Lathrop (Technical Division)  
**Emeriti (Professors):** Jean V. Lebacqz, Richard B. Neal  
**Associate Professors:** Jonathan Dorfan, John Jaros, Michael Peskin
The Stanford Linear Accelerator Center (SLAC) is devoted to experimental and theoretical research in elementary particle physics and the development of new techniques in high energy accelerators and elementary particle detectors. The center is located on 480 acres of Stanford property west of the main campus, parallel to and south of Sand Hill Road, and is operated under a contract with the Department of Energy.

The two-mile long linear accelerator, which began operations for physics research during 1966, can provide an electron beam at energies up to 29 GeV and at beam intensities up to 30 microamperes average current. Positrons can also be accelerated to a maximum energy of about 19 GeV, at average beam currents up to about one microampere. Polarized electron beams can be produced with polarization 40% at full beam intensity and energy, and up to 85% at lower intensities. In 1978 one of the experiments performed using this beam established the existence of clear connections between the weak and electromagnetic interactions.

A "switchyard" of magnetic elements at the end of the accelerator can direct the beams to any of several experimental areas. A large number of secondary beams of special character, including pion, kaon, muon, and photon beams, is available. A complement of large research instruments available for use with the accelerator includes three magnetic spectrometers capable of analyzing momenta up to 1.6, 8, and 20 GeV/c. 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.

The other 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. The only other comparable ring is operating in Hamburg, Germany. PEP is the third storage ring to be constructed at Stanford. The first physics results obtained by the high energy colliding-beam technique were obtained in experiments performed on the 500-MeV Princeton-Stanford electron-electron rings in 1965 at the Hanssen Laboratory. PEP offers six interaction regions, five of which can house major particle experiments, and one of which is reserved primarily for experiments associated with the performance of the machine, although it will accommodate small particle physics experiments. The interaction rate or luminosity of PEP is obviously of critical importance, and there are several continuing accelerator research programs to study methods for further increases in the luminosity.

Another colliding beam facility began construction at SLAC in October 1983. 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°, 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 June 1985, physicists from 80 other institutions have had research programs accepted for execution at the center. The faculty of the Center leads a group of some 150 physicists in research programs on theoretical and experimental particle physics. In addition, the faculty offers lecture series on various aspects of high energy physics, and conducts seminars on topics of current interest. The SLAC Summer Institute on Particle Physics is an annual meeting which combines pedagogic lectures with a critical review of recent progress in high energy physics.

The experimental research program at SLAC 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.

SYNCHROTRON RADIATION LABORATORY

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 19 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, Medicine, Electrical Engineering, Geology, Materials Science and Physics.

Students interested in working at the facility should contact a member of the affiliated faculty or one of the Associate Directors.
Since its founding by Herbert Hoover in 1919 as a special collection dealing with the causes and consequences of World War I, the Hoover Institution on War, Revolution and Peace has become an international center for documentation, research, and publication on political, economic, social, and educational change in the 20th century.

The library includes one of the largest private archives in the United States, and has outstanding area collections on Africa, East Asia, Eastern Europe, Russia and the Soviet Union, Latin America, the Middle East, North America, and Western Europe.

Holdings include government documents, files of newspapers and serials, manuscripts, memoirs, diaries and personal papers of men
and women who have played significant roles in the events of this century, the publications of ephemeral societies and of resistance and underground movements, and the publications and records of national and international bodies, both official and unofficial, as well as books and pamphlets, many of them rare and irreplaceable. The materials are open to all Stanford students, faculty, and staff, and to scholars from outside the University.

The Institution has a resident research staff of historians, economists, educators, political scientists, and sociologists. The International Studies Program and the Domestic Studies 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, national security, 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.

Within the International Studies Program, the Institution has initiated a project involving research in national security affairs. The project’s approach is multi-disciplinary, and utilizes the core of distinguished scholars in the international studies area as well as the unique resource base of the Institution’s library and archives. The project is coordinated by Dennis L. Bark.

The Institution has expanded its Domestic Studies Program, which is now comparable in size and quality to International Studies. Research currently underway is concerned with income redistribution, and welfare programs, regulation and deregulation, government taxing and spending, the federal deficit, and related subjects. John F. Cogan is coordinator of Domestic Studies.

In addition to its own research staff, the Institution has been visited over the years by tens of thousands of American and foreign scholars. In recent years, increased use of the Institution’s resources has been encouraged by providing more funds for postdoctoral fellowships. The National, Peace and Public Affairs Program, for example, provides about 14 scholars annually the opportunity to pursue advanced postdoctoral research. Thomas H. Henriksen coordinates the National Fellows Program.

The Institution also maintains a publications program. In addition to books published by the Hoover Institution Press, research results are disseminated through seminars, conferences, journal articles, lectures, testimony, and the news media.

The many interrelationships with Stanford University include library cooperation, joint appointments, co-sponsorship of seminars and lectures, and courses offered by Hoover Institution scholars. Examples include senior fellow Robert E. Hall and senior research fellow Thomas E. MacCurdy on joint appointments with the Economics Department; senior research fellow Bruno Bettelheim on joint appointment with the School of Education; senior fellow Seymour Martin Lipset on joint appointment as the Caroline S. G. Munro Professor of Political Science and with the Sociology Department; senior fellow James G. March on joint appointment as the Fred H. Merrill Professor of Management with the Graduate School of Business and with the Departments of Political Science and Sociology and, by courtesy, Education; senior fellow Alex Inkeles on joint appointment with the Sociology Department and, by courtesy, Education; senior research fellow John A. Ferejohn on joint appointment with the Political Science Department; senior research fellow Henry S. Rowen on joint appointment with the Graduate School of Business; senior research fellow Kenneth E. Scott on joint appointment as Ralph M. Parsons Professor of Law and Business in the Law School; senior research fellow Mauro Capelletti on joint appointment with the Law School; Professors Kenneth J. Arrow and Michael Boskin in Economics; Peter Duus in History; Heinz Eulau and Robert E. Ward in Political Science; Joseph Berger, Nancy B. Tuma, and William J. Goode in Sociology are senior fellows (by courtesy). East Asian curator Ramon H. Myers is adjunct professor at the Food Research Institute and acting professor in the History Department; senior research fellow Larry Diamond is assistant professor (by courtesy) in the Sociology Department; and deputy archivist Robert Hessen teaches in the Graduate School of Business.

In addition, Peter J. Duignan, who is the Institution’s curator on Africa, serves as curator for the African program of the University as a whole. Curatorial functions on a university-wide basis for materials in Arabic, Turkish, and Persian are also performed at the Hoover Institution. The East Asian library 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 five Nobel laureates, 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, eight members of the National Academy of Sciences, five members of the National Academy of Education, and six 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. Hitchcock (Chief Catalog Librarian); Elmer R. Grieder (Associate Director of Libraries); Jennette E. Hitchcock (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); Emily Olson (Education Librarian); Jack Plotkin (Chief Circulation Librarian); Ruth Pressman (Assistant Director, Lane Medical Library); Ruth Scibird (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:* Joan K. Krasner (Acting)  
*Director for Technical Services:* Cynthia I. Gozzi  
*Deputy Director:* Paul H. Mosher  
*Collection Development Officer:* Michael T. Ryan  
*Library Development Officer:* Brigitte Carnochan  
*Department Chiefs:* Darla Crockett (Access Services, Acting); Charlotte R. Derksen (Science, Acting); Carol Fleishauer (Acquisition, Acting); Tamara Frost (Catalog); Carolyn Henderson (Personnel); James Knox (General Reference, Acting); Susan Perry (Meyer); Jerry C. Persons (Systems Office); Michael T. Ryan (Special Collections); David Thompson (Serials, Acting); Roberto Trujillo (Foreign Languages and Area Collections); Carol A. Turner (Government Documents)  
*Branch Librarians:* Alan Baldridge (Hopkins Marine Station); Barbara Celone (Cubberley Education); Henry Lowood (Physics, Engineering, Acting); Harry P. Lilii (Mathematical and Computer Sciences); Charles C. Milford (Food Research Institute); Beth Rebman (Music, Acting); Alexander Ross (Art and Architecture); Lisa C. Brainard (Swain Chemistry and Chemical Engineering, Falcorer Biology, Acting)  
*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 Farrine (Romance Language and Humanities Collections); Alexander Ross (Art and Architecture Collections); Michael T. Ryan (Special Collections); Roberto Trujillo (Chicano Collections); Barbara Van Deventer (Social Science Collections); Wojciech Zalewski (Russian and East European Collections)  
*Curators—Honorary:* William R. Moran (Archive of Recorded Sound); Samuel I. Barchas (History of Science); Margaret V. Sowers (Map Collections); Charles J. Tanenbaum (Exhibits); W. Conyers Herring (Physics Collection); Samuel Stark (Theatre Collection)

**Hoover Institution**

See "Hoover Institution" listing in this catalog.  
*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. Ross  

**Lane Medical Library**  
*Director:* Peter Stangl  
*Head of Public Services:* Valerie Su  
*Head of Technical Services:* Dick Miller

**Robert Crown Law Library**  
*Law Librarian:* J. Myron Jacobstein  
*Associate Law Librarian:* Rosalee M. Long  
*Public Service Librarian:* J. Paul Lomio  
*Senior Reference and Special Projects Librarian:* Iris J. Wildman; *Reference Librarian:* David L. Bridgman; *Head Catalog Librarian:* Eliska Ryznar; *Catalog Librarian:* Harriet Wu

**Linear Accelerator Center Library**  
*Head Librarian:* Robert Gex  
*Associate Head Librarian:* Louise Addis
The Libraries of Stanford University sponsor a variety of instructional activities to promote awareness of the library resources and services that are available to the campus community and to expedite their effective use.

The reference librarians in all major library units provide professional advice and consultation in locating and utilizing published information. Curators and branch librarians offer similar bibliographic help within their subject specialities. Other types of instructional aid include tours, audio-visual presentations, and lectures to classes at the instructor's request.

Numerous library publications are prepared to inform and instruct library users. The most general and basic of these are the guide series entitled "Guides to the Stanford University Libraries," which include information on orientation to physical facilities, scope of collections, and services offered. A general description of the libraries, their collections and services is included in the Information Bulletin.

The formal courses listed below are intended to serve those students for whom a more extended study of bibliographic organization is useful.

**COURSES**

**Library 100. Library Resources and Research Methods**—Designed for students at all levels who wish to improve their ability to use libraries in general and the Libraries of Stanford University in particular. Provides practical experience in using major types of reference sources (e.g., catalogs, indexes, abstracts) in both online and printed forms. Includes hands-on computer labs and visits to unique campus resources such as the Hoover Archives. Students may tailor many of the assignments to their own subject interests.

3 units, Aut, Spr (Staff)

**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, given 1987-88

**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 Chicano/Mexicano population in the United States. Includes the study and use of both standard library resources and subject specialized information sources.

Class design is to help students develop search strategies for locating information and resources related to their specific interests.

3 units, Aut (Trujillo)

**English 313. Modern Literary Research, 1750 to the Present**—Examination of 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. Close study of several short works representative of major period and national circumstances focuses discussion of different models of contextual criticism. Topics include: 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) W 3:15-6:05

**French and Italian 397. Colloquium on Research Methods in French and Italian Studies**—An introduction to library resources in French and Italian studies, designed to help graduate students do research more effectively and to impart that knowledge to their own students. Seminar format allows participants to benefit from shared observations on research methods. Includes broad coverage of basic reference works and bibliographies emphasizing students' particular fields of interest. Designed for graduate students. Undergraduates may enroll with instructor's permission.

3 units, Aut (Parrine) not given 1986-87

**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 vast 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)

**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 in the Stanford University Libraries.

3 units, Aut (Breedlove)

**Music 200. Music Bibliography**—Survey of essential tools and methods of information re-
trieval for music. Introduction to the use of local, institutional, and network resources. Practical experience in evaluation and use of handbooks, compendia, bibliographies, discographies, indexes, and catalogs. Guest presentations related to resources and programs of the Music Department. Three exams and final bibliographic project.

3 units, Aut (Staff)

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. Knowledge of Russian and/or another Slavic language helpful.

3 units, Win (Zalewski)
INFORMATION SERVICES

ACADEMIC COMPUTING AND INFORMATION SYSTEMS (ACIS)

Vice Provost and Dean of Research and Academic Information Systems: Robert L. Street

In addition to his responsibilities for several Independent Research Labs and Centers at Stanford, the Vice Provost and Dean of Research and Academic Information Systems is responsible for planning and overseeing all aspects of academic computing, both instruction and research.

The goal of Academic Computing and Information Systems (ACIS) is to work with and for Stanford's academic community to acquire new technology and to foster the opportunities to use it in the exploration of creative new approaches to instruction and research. Specifically, the organization seeks to increase access to and availability of computing power, data storage capabilities, and communications, including local area network and video capabilities.

The ACIS divisions are: Instruction and Research Information Systems (IRIS), the Low Overhead Time Sharing (LOTS) Computer Facility, and Networking Systems.

INSTRUCTION AND RESEARCH INFORMATION SYSTEMS (IRIS)

Instruction and Research Information systems (IRIS), directed by Michael P. Carter, provides technical advice and counsel to students, faculty, and academic staff on their information needs. IRIS manages a range of special projects, including a laboratory for the evaluation and demonstration of microcomputers, a program to promote the development of software by Stanford faculty, and an interactive classroom for the introduction of instructional computer applications. IRIS cooperates in Stanford's effort to encourage the acquisition and use of personal computers on campus and helps administer clusters of microcomputers located in Stanford libraries and a few of its residences. IRIS offers courses on the use of microcomputers as well as some campus mainframes. Information on these courses can be obtained by calling the IRIS office, (415) 723-1055.

LOW OVERHEAD TIME SHARING (LOTS) COMPUTER FACILITY

Stanford's Low Overhead Time Sharing (LOTS) Computer Facility, directed by Ralph E. Gorin, is the academic computer center. LOTS provides interactive computing to Stanford students and faculty in support of instruction and unsponsored research. The LOTS computers are located in the Center for Educational Research at Stanford (CERAS) building. The LOTS offices are located in the recently completed Sweet Hall. Terminal clusters that provide access to LOTS are located in CERAS, Sweet Hall, and Meyer Library. Additional terminals and a cluster of personal computers are also located at LOTS Two in Tresidder Union. Various campus locations have terminals attached to SUNet that can access the LOTS computers. In addition, several projects sponsored jointly by Residential Education, the Computer Science Department, and LOTS have provided terminals and personal computers in particular student residences.

Use of the three LOTS DECsystem-20 computers is available without charge to students and faculty. Instructions on how to obtain an account are available from the LOTS office in Sweet Hall. Interactive services available include a text editor and many programming languages such as Pascal, FORTRAN, Basic and LISP, and statistical packages such as SPSS, BMDP, Minitab, NAG, and IMSL.

LOTS Two operates personal computers that are suitable for word-processing and other purposes; information is available at the recreation center desk at Tresidder Union. (LOTS Two also houses other LOTS activities such as the Waterloo Microcomputer Cluster.)

LOTS operates an IBM 4381, two DEC VAX-11/780, and several workstations, a DEC VAX 8650, and an SC30M computer from Systems Concepts for various objectives in specific disciplines. The LOTS office has information defining eligibility to use these systems.

The LOTS staff provide limited advice on program development and system features for users of the computers; extensive advice is not available. Users are expected to do all of their own programming and do necessary adaptations of available programs for their specific application. (Faculty who contemplate the development of course related software are encouraged to consult the staff of LOTS and IRIS.)
COURSES

Short orientation classes on the use of major utilities and applications are offered at the beginning of each quarter. Requests for course schedules and information should be directed to the LOTS office, (415) 723-3214. No registration required.

Other non-credit classes in computing are offered by Information Technology Services (ITS). For-credit classes in programming are offered by the Computer Science Department.

1.2. Introduction to LOTS I and II—Two one-hour orientation sessions designed for users who are familiar with computing concepts but who need a guide to the use of the LOTS facility. Includes information about obtaining accounts, an introduction to the file system, and a demonstration of the use of the editor to create and run a program.

0 units, Aut, Win, Spr, Sum

10. Introduction to FORTRAN—For students who know FORTRAN. The particular features of FORTRAN available at LOTS are discussed. Persons not familiar with FORTRAN should consider Computer Science 103.

0 units, by arrangement

11. Introduction to PASCAL—A one-hour session dealing with the characteristics of PASCAL at LOTS. PASCAL is an ALGOL-like language gaining in popularity due to its clarity, simplicity and powerful data-structure manipulation and type definition facilities. Familiarity with some programming language is assumed.

0 units, by arrangement

12. STAT Packages—One-hour orientation sessions to introduce the computer statistical packages, i.e. SPSS, Minitab and BMDP. It is assumed that the user is familiar with these packages. Previous attendance in Introduction to LOTS I and II helpful.

0 units, by arrangement

NETWORKING SYSTEMS

Networking Systems, directed by William H. Yundt, provides technical advice and counsel to faculty, students, and academic staff on their networking needs. Networking Systems is completing the installation and activation of a University-wide computer network, SUNet, which will connect all major academic buildings and student dormitories. This division is identifying network standards, evaluating products, and providing the hardware and software that allow departmental networks to access SUNet services, including electronic mail, file transfer, and the sharing of expensive resources. SUNet will also offer video transmission for instructional television and image retrieval. The Networking Systems division is also developing the means to access outside supercomputing facilities. Additionally, the division offers courses on local and cross-campus networks. For more information about these courses, other seminars, and consulting services, contact Networking Services, (415) 723-3909.

INFORMATION TECHNOLOGY SERVICES (ITS)

Director: Edward E. Shaw
Deputy Director: Michael M. Roberts

Stanford's Information Technology Services supports the institutional processes of the University and the Hospital by providing them with highly reliable data processing, graphics and printing, and telecommunications technologies, both centralized and decentralized. ITS supports local systems, offering consultation services where desired, and services based on the Data Center's mainframe computers. It has implemented a fully digital communications system with integrated voice and data; and it handles mail, photocopy, and a full range of graphics and printing services. More specifically, ITS helps administrative departments and programs to effectively acquire, develop, and use these technologies for managing information.

At the Data Center in Forsythe Hall, ITS operates an IBM 3084, and provides many machine and staff services to the Stanford community. Public terminals at Forsythe and other easily accessible campus locations are available. ITS also maintains connections for Stanford to national networks such as Tymnet and Telenet. Computer based services include: Screen text editing (WYLBUR)® and formatting (SCRIPT) programs for preparing reports, letters, data, and theses; batch processing; interactive use of the computer through the ORVYL® timesharing system; on-line information collection and retrieval with the SPIRES® data base management program; and on-line library catalog searching via Socrates. ITS 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,
FORTAN, 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.

ITS can also produce a wide range of graphic products via services in board design, comprehensive computer graphics, photography, typesetting, writing, and printing, including a full-spectrum printing plant. The telecommunications system allows such options as call forwarding, speed dialing, and call conferences.

While ITS staff provides extensive consultation on program development and problem solving to the present or potential administrative community, the documentation and educational services can also help clients learn to use ITS systems and facilities efficiently.

The courses and seminars described below are offered to help new ITS clients learn to use the facilities and services independently. The courses are non-credit but do require registration through ITS. Currently courses are free, but this status may change. 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. For detailed descriptions of course offerings, see the annual Information Technology Computing Education Course Catalog. For current information on places and times, see the quarterly Class Schedule. Both are available at the ITS Information Desk in Forsythe Hall, (415) 723-4391. The catalog is also available online (DOC#COURSES PUBLIC), as is the Class Schedule (DOC#SCHEDULE PUBLIC). A related educational program is offered by IRIS, a division of Academic Computing and Information Systems (call (415) 723-1055 for information).

Part-time work is sometimes available for undergraduates. Inquiries should be addressed to the Human Resources Office, (415) 723-9656.

COURSES

ORIENTATION SEMINARS

26. Orientation to ITS Computing—Overview of ITS Data Center services for all clients, both new to and experienced in information systems. Outlines ITS organization, physical locations, and services in these areas: data and information, access and security, computing, communication, input and output, consulting, documentation, administrative systems planning, and cost control.

0 units, Aut, Win, Spr, Sum

32. Fundamental Computer Concepts and the Microcomputer—(Videotaped) An introduction to the fundamental concepts needed in understanding computing usage today; for people who need a basic understanding of computers. The history of computer development, from ancient counting devices, to mechanical calculating machines, to modern electronic technology is presented in the videotape "Computers: from Pebbles to Programs." The microcomputers in wide use today and the more popular applications of their use: word processing, spread sheets, and data bases, are explained in the videotape "Learning Concept: Introduction to Personal Computers." Computer terminology is defined throughout these tapes. Opportunity for questions and discussions.

0 units, Aut, Spr, Sum

35. Computing Fundamentals: Bits, Bytes, and Buzzwords—A videotaped introduction to computer fundamentals, using microcomputers as an example. Topics include word processing, data base management, spread sheets, graphics, games, and a demonstration of LOGO, a programming language.

0 units, Win, Spr, Sum

40. Introduction to the IBM PC/XT, PC/AT, and DOS—The IBM hard disk personal computers XT and AT, and their disk operating system, DOS. Includes a brief introduction to PC hardware components, and discusses features distinguishing hard disk systems from dual-floppy disk PCs. Describes fundamental features of the disk operating system, basic DOS commands, and elements of DOS particular to hard disk machines. Optional, 2-hour hands-on session explores more advanced DOS features.

0 units, Aut, Win, Spr, Sum

48. Introduction to the IBM Personal Computer—For persons with little or no experience with microcomputers. Part One is a two-hour lecture introducing IBM PC hardware and software concepts. Emphasis is on "survival skills" — information all PC users should know, with brief demonstrations of popular IBM PC software programs. Part Two is an optional hands-on laboratory familiarizing students with the operation of the IBM PC. Part Two or equivalent experience is a prerequisite for the introductory courses on software programs.

0 units, Aut, Win, Spr, Sum

50. BBC Computer Programme—(Videotape.) BBC-produced introduction to the world of computers. Covers binary system, computer languages, programming, data bases, telecommunications, computer graphics and sound, and computer modeling.

0 units, Aut, Win, Spr, Sum
TEXT EDITING AND FORMATTING

MAINFRAME

1. Introduction to WYLBUR—Introduces WYLBUR, the text editor on the Data Center mainframe computer. Emphasizes Page WYLBUR, an extension to WYLBUR that allows users to edit a full screen of text by moving around the screen, inserting, deleting, and changing text, using a terminal to edit, print, and store information. Prerequisite: Orientation to ITS computing class.

0 units, Aut, Win, Spr, Sum

2. Accelerated Introduction to WYLBUR—Covers the same material as the Introduction to WYLBUR class, but in half the time. For those familiar with a text editor on another system (LOTS, for example), or for those familiar with WYLBUR who want to learn Page WYLBUR. Prerequisites: Orientation to ITS computing class and previous text editing skills.

0 units, Aut, Win, Spr, Sum

3. Text Formatting with SCRIPT—Introduction to SCRIPT, a program used for producing a report, a thesis, or other documentation. SCRIPT and its SYSPUB extensions provide control over page layout, footnote placement, divisions of a document, table of contents, lists of tables and figures, and indexes. Prerequisite: Basic WYLBUR knowledge.

0 units, Aut, Win, Spr, Sum

4. Printing and Publishing Services at Stanford—For people interested in the publishing process and in the tools and services available to support it. Reviews steps from creator to reader and surveys the tools and services, self-serve through full-service, available at Stanford. The range from flyer through magnum opus is considered.

0 units, Aut, Spr

MICROCOMPUTER

5. Typography for Microcomputers—The possibilities and problems associated with computers offering several type styles in a range of styles. Considers typographic terminology, type styles and sizes, legibility, and the problems of low resolution.

0 units, Win, Spr

DATA BASE MANAGEMENT

6. SPIRES Concepts and Facilities—Overview of basic SPIRES facilities, including file definition, data entry, indexed and sequential searching, protocol definitions, and simple output formats. Emphasis on the basic ideas behind SPIRES. Simple applications are developed. Useful for anyone interested in developing a data base application. Prerequisites: Basic WYLBUR knowledge and programming concepts; knowledge of SPIRES search and updating.

0 units, Aut, Win, Spr, Sum

7. Introduction to SPIRES—The search capabilities of SPIRES, a unified approach to storing, retrieving, and processing information. Demonstrates how to add, update, remove records, and create simple reports for anyone using or planning to use data base systems developed in SPIRES. Prerequisite: Basic WYLBUR knowledge.

0 units, Aut, Win, Spr, Sum

30. SPIRES for Programmers—Comprehensive introduction to SPIRES. Provides complete, high-level overview of application development concepts and facilities of SPIRES in order to integrate the components of SPIRES. Homework includes reading over 700 pages of SPIRES documentation, problems on the class and reading material, and designing, implementing, and packaging a small data base application. Prerequisites: Introduction to SPIRES, SPIRES Concepts and Facilities, and some programming experience.

0 units, Aut, Spr

46. Reporting in SPIRES—Primarily for administrative users who need to create reports using the data stored in SPIRES data bases. Covers SPIRES facilities useful for ad hoc report writing, with emphasis on the $REPORT format and the REPORT DEFINER. Topics include selecting and sequencing records, displaying values, using element or structure filters, and enhancing efficiency and convenience. Advanced report writing techniques include page formatting, group summaries, and SPISORT. Prerequisite: SPIRES introduction and knowledge of $REPORT format.

0 units, Aut, Win, Spr

61. Developing Applications in Prism®—Prism, a new tool for SPIRES end-users and application developers, provides easier methods for searching, entering, reporting, and exporting data in SPIRES files. Directed to SPIRES application developers who need to put up their applications in the new Prism environment. Preparation time for each class: 5 hours. Topics include application design for the Prism environment; understanding the Prism meta-data file; formats coding for Prism full-screen applications; and user exits. A full Prism application will be installed. Prerequisites: 77 and SPIRES programming equivalent to the concepts in the SPIRES manual "A Guide to Output Formats"; some familiarity with the SPIRES Protocols language.

0 units, Win, Sum
77. Introduction to Prism—Prism provides SPIRES users with a consistent and easy-to-use framework for searching, entering, reporting, and exporting data in SPIRES files. Covers the basics of Prism: structure, searching for information, entering new data in a prism file, generating printed reports. A brief demonstration of some applications in Prism; the online Faculty/Staff Directory, the Meeting Scheduling System, and Stores Ordering.

0 units, Aut, Win, Spr, Sum

JOB CONTROL LANGUAGE

70. JCL for Statistical Packages on the IBM 3084—The details of using statistical packages on the ITS Data Center mainframe computer. A rudimentary introduction to the batch job system focusing on basic Job Control Language necessary for reading and writing files using SAS and SPSSx, and BMDP. Topics include using disk and tape storage, coding JOB, EXEC, DD, JOBPARM, and SETUP statements, and using WYLBUR commands to submit and control batch jobs. Prerequisite: Knowledge of WYLBUR.

0 units, Aut, Win, Spr, Sum

78. Importing and Exporting Tapes—Data formats, labeled and unlabeled tapes, utility programs for reading and writing tapes, and problems of converting to or from other systems' formats. Useful if you are sending data to, or receiving data from, other computer installations, especially non-IBM installations. Prerequisite: Knowledge of WYLBUR, experience running simple batch jobs.

0 units, Aut, Spr

STATISTICAL APPLICATIONS PACKAGES

The following three courses are offered by ACIS (Academic Computing and Information Systems), in cooperation with ITS.

14. SPSS-X Overview—SPSS-X, the extended version of the Statistical Package for the Social Sciences, is an integrated system of computer routines used for analysis and management of data. This is a brief introduction to general formats and conventions of SPSS-X control statements necessary for running SPSS-X programs. Prerequisites: For users of the Data Center mainframe computer, knowledge of WYLBUR and TCL; for users of other machines, knowledge of the system's text editor and how to read, write and save files.

0 units, Aut, Win, Spr

15. SAS Overview—The Statistical Analysis System (SAS), a package of computer programs used for data analysis, contains sophisticated data management capabilities and routines for handling complex statistical procedures. Topics include how to run SAS on the Data Center mainframe computer and the general structure and capabilities of the SAS language. Prerequisites: For users of the IBM 3084 only; JCL for statistical packages on the IBM 3084 class; knowledge of WYLBUR.

0 units, Aut, Win, Spr, Sum

47. SAS/GRAPH®—SAS/GRAPH, a sophisticated graphics system, can produce full color graphs, charts, and maps. Topics include general bivariate plotting, mapping, contour plots, and three-dimensional plotting. Prerequisites: For users of the IBM 3084 only; JCL for statistical packages on the IBM 3084 class; knowledge of WYLBUR.

0 units, Aut, Spr

APPLICATION PACKAGES

37A. ADMIN: Administrative Applications for the Office—The administrative applications available on the Data Center mainframe computer through the ADMIN command. Building a mailing list that can be merged with a standard letter, a memo-writing package, a financial calculator system, a vacation/sick leave accrual system, and public informational data bases. Prerequisite: Basic WYLBUR knowledge.

0 units, Aut, Spr

56. Introduction to Socrates—Overview of Socrates, the on-line library catalog, including content, indexes, commands, and display formats. Emphasis on developing efficient search techniques using both the look-up and command modes. Participants encouraged to bring sample searches to the session. For information, contact the General Reference Department, Green Library, (415) 723-1811.

0 units, Aut, Spr

COMMUNICATIONS/NETWORKS

20. CONTACT/EMS—Introduces basic concepts of electronic mail, with focus on CONTACT/EMS, the system based on the Data Center mainframe computer. Topics include sending, receiving, filing, retrieving, and "ticking" mail. Special topics include addressing messages by personal name, distribution lists, and an automatic answering feature. Other mail systems are discussed. Prerequisite: Basic WYLBUR knowledge.

0 units, Aut, Win, Spr

24. Data Communications—Overview of general and ITS data communications. Topics include equipment selection, short and long haul transmission basics, the data switch, multiplexing, networks, transmission media, and deregulation benefits and hazards.

0 units, Aut, Spr
45. Micro/Mainframe Communications Using Samson—The use of Samson for terminal emulation, local logging and printing of mainframe terminal sessions, and file transfer between an IBM PC, HP 160 micro, or Macintosh, and the Data Center mainframe computer on campus. Topics include special considerations when uploading and downloading Wordstar, Multimate, and Lotus 1-2-3 files, and demonstrations of mainframe programs that facilitate micro/mainframe file transfers. SAMSON, a computer program developed at ITS, makes a microcomputer work like a terminal connected to the mainframe. Prerequisites: Basic WYLBUR knowledge and knowledge of basic microcomputer concepts, including DOS commands.

0 units, Aut, Win, Spr, Sum
STATEMENT OF PURPOSE

Acoustics is the science of generation, transmission, and reception of sound and of the application of the principles underlying these to various technological problems. The aims of this program are two-fold: to provide a means for students to acquire an awareness and understanding of an interdisciplinary field that holds scientific challenge together with high relevance for societal concerns; and to make available to students the programs of study essential to acquire some special training in one of the other fields of acoustics while majoring in their own chosen disciplines. As acoustics is a field encompassing a variety of disciplines, the program will serve as an umbrella for those which cross both departmental and school lines at Stanford. As such, it will hold interest and provide opportunities for interaction among students and faculty in science and engineering, humanities, medicine, law and business.

GENERAL INFORMATION

Although Stanford University presently does not offer a formal degree program in Acoustics and Noise, teaching and research in that area has been an ongoing activity in several departments. These include Aeronautics and Astronautics, Electrical Engineering, Mechanical Engineering, Applied Physics, Mathematics, Communications, Hearing and Speech Sciences, Neurobiology, Music, Physics, and Psychology. The program relates as well to the interdisciplinary program on Values, Technology, Science and Society.

Students desiring to acquire special training in the field of Acoustics and Noise are encouraged to undertake a regular departmental major of their choice such as Physics, Electrical Engineering, Mechanical Engineering, or Music. The course requirements and descriptions for the basic major studies are stated under appropriate department sections. Students desiring guidance in developing a course of study with Acoustics and Noise, forming a minor complementing a regular departmental major, should contact the Chairman of the Program in Acoustics and Noise.

Graduate programs in Acoustics and Noise are carried out in the departments of Aeronautics and Astronautics, Applied Physics, Electrical Engineering, Hearing and Speech Sciences, Music, and Psychology. Opportunities for graduate research are also available at the Center for Computer Research in Music and Acoustics and the (Stanford — NASA) Joint Institute for Aeronautics and Acoustics. Students interested in graduate studies relating to Acoustics and Noise should contact the chairman of this program.

COURSES

UNDERGRADUATE

AERONAUTICS AND ASTRONAUTICS

135. Introductory Acoustics
136. Noise Pollution

PHYSICS

14. Physics of Music

PSYCHOLOGY

102A. Perception

VALUES, TECHNOLOGY, SCIENCE AND SOCIETY

165. Technology and Musical Expression

GRADUATE AND UNDERGRADUATE

AERONAUTICS AND ASTRONAUTICS

201A. Fundamentals of Acoustics
201B. Fundamentals of Acoustics
202. Acoustics Measurements Lab
203. Aerodynamic and Hydrodynamic Noise

APPLIED PHYSICS

252. Acoustic Waves in Solids I
MUSIC
220A. Fundamentals of Computer Generated Sound
220B. Compositional Algorithms, Psychoacoustics and Spatial Processing

HEARING AND SPEECH SCIENCES
265. Assessment of Auditory Function
292. The Auditory Process

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 Aids Office.

Students from other countries may contact the appropriate Admissions Office for Information for Prospective Graduate (or Undergraduate) Applicants from Other Countries; Bechtel International Center also provides helpful information to the international community.

Stanford University Bulletins of general interest (Courses and Degrees, Information, Summer Session) are available through the 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 1986-87 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 1986-87. 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, 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 1986-87 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.

AREA 1: WESTERN CULTURE

English 7, 8, 9; Literature and the Arts in Western Culture (entire sequence must be completed)
History 1, 2, 3; Europe from the Middle Ages to the Present (entire sequence must be completed)
Humanities 61, 62, 63; Western Thought and Literature (entire sequence must be completed)
Philosophy 5A, B, C; Ideas in Western Culture (entire sequence must be completed)
SLE 91, 92, 93; Program in Structured Liberal Education (entire sequence must be completed and thereby also satisfies Area 2 and 3)
VTSS 1, 2, 3; Western Culture and Technology (entire sequence must be completed)
Western Culture 1, 2, 3; Great Works of Western Culture (entire sequence must be completed)
Western Culture 10, 11, 12; Conflict and Change in Western Culture (entire sequence must be completed)

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 and Medieval 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 and History 65); Medieval Culture and Society

*Asian Languages 91; Traditional East Asian Civilization
*Asian Languages 110; Japanese-Western Literature and Cultural Interaction
*Asian Languages 114; Haiku
*Asian Languages 131; Chinese Poetry and Drama in Translation
*Asian Languages 132; Chinese Fiction in Translation
*Asian Languages 133; Modern Chinese Literature in Translation
*Asian Languages 136; Early Japanese Literature in Translation
*Asian Languages 137; Japanese Literature in Translation 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
Classics 21; Comedy and Romance
Drama 50; Introduction to Drama
Drama 60; Introduction to Theatrical Style  
Drama 152; Medieval and Renaissance Drama  
Drama 154; Romantic and Early Realistic Drama  
Drama 154N; American Drama since 1920  
Drama 156; American Women Playwrights  
Drama 157N; Contemporary Black Playwrights

English 5; Introduction to Literature  
English 10; Masterpieces of English Literature I  
English 11; Masterpieces of English Literature II: Enlightenment to Modern Period  
English 12; Masterpieces of American Literature

English 30; Introduction to the Novel  
English 40; Drama  
English 50; 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

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 Drama

German Studies 154; Modern Short Prose

Humanities 90; Introduction to the Humanities

Italian 233; Dante

Music 1; Introduction to Music  
Music 2A; The Symphony  
Music 4A; The Music of J.S. Bach  
Music 4D; The Operas of Mozart  
Music 5A; Music in America  
Music 21; Elements of 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 1 and 3)

VTSS 165; Technology and Musical Expression

B) More advanced courses that can still be appropriate:

Art 100A; Archaic and Early Classical Greek Art  
Art 100B; Classical and Hellenistic Greek Art  
Art 100C; Roman Art: Etruscans to Constantine  
Art 105; Medieval France  
Art 105A; 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

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: Impressionism  
Art 120D; Modern Art IV: Alternatives to Impressionism  
Art 130; American Art Before The Civil War  
Art 130A; The Gilded Age: American Art 1860-1900

Art 130B; Paris and NY: Transatlantic Exchange in Early Modernism  
Art 130C; 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 173; 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; Survey of Italian Literature I: 13th-16th Centuries  
Italian 228; Survey of Italian Literature II: 17th-19th Centuries

Spanish 130B; Mexican and Chicano Cultural Readings
Spanish 131B; Latin American Cultural Readings and Composition
Spanish 132B; Hispanic Cultural Readings and Composition
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 51; 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; German Culture and Civilization III: Democracy, Protest, and Political Culture
*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.)
History 136A; European Thought in the 19th Century
History 136B; European Thought in the 20th Century
*History 187A; The Middle East 570-1718
Humanities 90; Introduction to the Humanities
Philosophy 10; The Self
Philosophy 20; Personal Morality: Introduction to Moral Philosophy
*Philosophy 46; (same as Asian Languages 46, Philosophy 120, Religious Studies 55) Introduction to Chinese Philosophy
Philosophy 60; The Growth of Scientific Knowledge
Philosophy 100; Greek Philosophy
Philosophy 102; Modern Philosophy, Descartes to Kant
Philosophy 130A; (same as History of Science 130A, Classics 130A, History 130A); Ancient Cosmology
Philosophy 130B; (same as History of Science 130B, Classics 130B, History 130B); Cosmology in the Middle Ages and Renaissance
Philosophy 130C; (same as History of Science 130C, History 130C); Cosmology from Newton to Einstein

Religious Studies 1B; Comparative Religious Personalities
*Religious Studies 1C; Comparative Religious Thought
*Religious Studies 1D; Religions of the East
*Religious Studies 13; Hinduism
*Religious Studies 14; Buddhism
*Religious Studies 18; Zen Buddhism
Religious Studies 23; Judaism
Religious Studies 24A; Christianity
*Religious Studies 31; Founders in Myth and History
Religious Studies 42; Philosophy of Religion
*Religious Studies 116; Japanese Buddhism
Religious Studies 126; (same as History 110); Age of the Reformation
Sociology 170; Classics of Modern Social Theory
VTSS 110; Philosophical and Ethical Issues in Public Policy
VTSS 145; Chemistry and the Life Sciences in Historical and Philosophical Perspective

AREA 4: HUMAN DEVELOPMENT, BEHAVIOR, AND LANGUAGE

*Anthropology 1/101; Social and Cultural Anthropology
Anthropology 5; (same as Human Biology 113, Linguistics 65); Biology and Evolution of Language
*Anthropology 165; Psychological Anthropology
Classics, Greek 51, 52; Accelerated First-Year Greek (entire sequence must be completed)
Classics, Latin 51, 52; Accelerated First-Year Latin (entire sequence must be completed)
Communication 170; Communication and Children
Education 215; (same as Psychology 145); Psychological Foundations of Education
English 101; (same as Linguistics 71L); Linguistics and Literature
English 102; History of the English Language
English 105; (same as Linguistics 72L); Linguistic Approaches to Point of View in Fiction
German 19A/119; (same as Linguistics 75L); Introduction to the Germanic Languages
German 118/218; (same as Linguistics 176L); Introduction to German Dialects
History 163; (same as English 163D); The Female Experience: Victorian Heritage
Human Biology 2B, 3B, 4B; Human Biology Core (entire sequence must be completed and thereby also satisfies Area 5)
Linguistics 1L; Introduction to Linguistics
Linguistics 35L; (same as Computer Science 75); Computers and Language
Linguistics 55L; (same as Anthropology 4); Language and Culture
Linguistics 70L; The Structure of English Words
Linguistics 73L; Black English
Linguistics 145L; (same as Psychology 146); Language and Thought
Linguistics 176L; (same as German Studies 118/218); Introduction to German Dialects
Philosophy 181; Philosophy of Language
Psychology 1; General Psychology
Psychology 102; Perception
Psychology 111; Developmental Psychology
Psychology 115; Social Development
Psychology 132; Theories of Personality
Psychology 145; (same as Education 215); Psychological Foundation of Education
Psychology 146; (same as Linguistics 145L); Language and Thought
Psychology 159A; Perception, Cognition, and Music
*Religious Studies 1E; Eastern and Western Conceptions of the Self
Religious Studies 149; Approaches to the Study of Religion
Slavic Languages 1A, 2B, 3C; Beginning Russian (entire sequence must be completed)
Sociology 5; Status, Friendship, and Social Pressure
Sociology 120; Interpersonal Relations
Sociology 122; Introduction to Sociophysics
Sociology 149; Youth in Modern Society
Spanish 11B, 12B, 13B; Second Year Spanish for Bilingual Students (entire sequence 11B, 12B, 13B must be completed)

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; Africa and the Black Diaspora
*Anthropology 1/101; Introduction to Sociocultural Anthropology
*Anthropology 3; Human Pre-History
*Anthropology 8; Introduction to China
*Anthropology 11; Sex Roles and Society
Anthropology 15/116; Anthropological Perspectives on American Culture
*Anthropology 21; (same as History 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 Anthropology 22, also satisfies Area 3)
*Anthropology 102; Native Peoples of North America

*Anthropology 105; (same as African and Afro-American Studies 105); Introduction to African and Afro-American Studies
*Anthropology 108; African Societies and Culture
*Anthropology 115; Peoples of Island Southeast Asia
*Anthropology 117; Chinese Culture and Society
*Anthropology 187; (same as Human Biology 183); Hunter Gatherers in Archaeological Perspective
Anthropology 188/Human Biology 188; The Evolution of Prehistoric Civilizations
*Asian Languages 152; (same as History 195); Nomad Empires of Inner Asia
*Asian Languages 156; (same as History 192A); China from Earliest Times to the 9th Century
Classics 14; Art and Archaeology: Classical Athletics
Classics 20; Art and Archaeology: Introduction to Classic Archaeology
Classics 101; (same as History 101H); History of Greece
Classics 102; (same as History 102H); Greek and Roman History from Alexander to Caesar
Classics 103; (same as History 103H); History of the Roman Empire
Classics 107; (same as History 112A); Sailing to Byzantium
Classics 117; Religion and Mythology: Greek Religion and Society
Communications 1; 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; 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)
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<tr>
<th>Course Code</th>
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<tbody>
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<td>History 24A</td>
<td>Russian Civilization 9th-17th Centuries</td>
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<td>History 80</td>
<td>(same as Latin American Studies 80, Anthropology 100) Culture, Politics and Society in Latin America</td>
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<td>History 101H</td>
<td>(same as Classics 101); History of Greece</td>
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<td>History 107</td>
<td>The 12th Century Renaissance: European Society and Culture 1050-1220</td>
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<td>History 109</td>
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<td>History 112A</td>
<td>(same as Classics 107); Sailing to Byzantium</td>
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<td>History 132A</td>
<td>Modern France 1815-1914</td>
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<td>History 132B</td>
<td>Modern France 1914-Present</td>
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<td>History 141</td>
<td>Yorkist and Tudor England</td>
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<td>History 142</td>
<td>Stuart England</td>
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<td>History 145</td>
<td>Britain: 1688-1851</td>
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<td>History 148C</td>
<td>Africa in the 20th Century</td>
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<td>History 165A</td>
<td>History of the U.S.: 18th Century</td>
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<td>History 165B</td>
<td>19th Century United States</td>
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<td>History 165C</td>
<td>The United States in the 20th Century</td>
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<td>History 170</td>
<td>American Society in the 1960’s</td>
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<td>History 172A</td>
<td>Postwar America</td>
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<td>History 173A</td>
<td>American Woman’s History</td>
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<td>History 173B</td>
<td>American Women’s History</td>
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<td>History 176</td>
<td>Spanish America to World War I</td>
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<td>History 187B</td>
<td>The Modern Middle East 1718-Present</td>
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<td>History 192A</td>
<td>(same as Asian Languages 156); China from Earliest Times-9th Century</td>
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<td>History 192B</td>
<td>China from 9th-19th Centuries</td>
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<td>History 192C</td>
<td>Modern China 19th-20th Centuries</td>
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<td>History 194B</td>
<td>The Rise of Modern Japan</td>
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<td>History 195</td>
<td>(same as Asian Languages 152); Nomad Empires of Inner Asia</td>
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<td>*Human Biology 1; (Same as Anthropology 2); Genes, Culture, and Human Diversity</td>
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<td>Human Biology 2B, 3B, 4B; Human Biology Core (Entire sequence must be completed and thereby also satisfies Area 4)</td>
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<td>Latin American Studies 80</td>
<td>(same as History 80, Anthropology 100); Culture, Politics and Society in Latin America</td>
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<td>Linguistics 50</td>
<td>Language and Social Issues in America</td>
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<td>Major Issues of American Public Policy</td>
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<td>Introduction to Comparative Politics</td>
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<td>Colonialism and Nationalism in the Third World</td>
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<td>International Politics</td>
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<td>Political Science 111</td>
<td>Politics and the State in Germany</td>
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<td>Political Science 113A</td>
<td>Politics of Development in Latin America</td>
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<td>Political Science 114</td>
<td>Theoretical Approach to Japanese Politics</td>
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<td>Political Science 115</td>
<td>Government and Politics in China</td>
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<td>Political Science 118</td>
<td>Political Change in Sub-Saharan Africa</td>
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<tr>
<td>Political Science 118B</td>
<td>Southern Africa: Race, Class and Political Change</td>
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<td>Political Science 118F</td>
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<td>Political Science 119</td>
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<td>Political Science 119A</td>
<td>Soviet Union Politics and Society since 1917</td>
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<td>Political Science 124</td>
<td>Latin American Dependency</td>
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<td>Political Science 132</td>
<td>(Same as History 123B); International Communism</td>
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<td>Political Science 136</td>
<td>Soviet Foreign Policy</td>
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<td>Japanese Foreign Policy</td>
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<td>*Religious Studies 27</td>
<td>Islam</td>
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<td>Sociology 1A, 1B, 1C</td>
<td>Introduction to Sociology</td>
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<td>Sociology 121</td>
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<td>Sociology 135</td>
<td>Culture, Economy, and Politics in Western Societies</td>
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<td>Sociology 141</td>
<td>Politics and Society</td>
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<td>Sociology 144</td>
<td>Social Inequality and Social Stratification</td>
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<tr>
<td>Sociology 152</td>
<td>(same as Education 231, VTSS 155); Social Structure and World Society</td>
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<tr>
<td>Sociology 160</td>
<td>Formal Organizations</td>
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<td>VTSS 101</td>
<td>Technology and Science in Contemporary Society</td>
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<td>VTSS 106</td>
<td>The Nature of Technology in Modern Society</td>
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<td>VTSS 107</td>
<td>(Same as Economics 113); Technology and Modern Industrial Society</td>
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<tr>
<td>VTSS 121</td>
<td>The Emergence of Modern Technological Society</td>
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<td>VTSS 122</td>
<td>Technology and Modern Western Culture</td>
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<td>VTSS 170</td>
<td>Work, Technology, and Society</td>
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**AREA 6: MATHEMATICAL SCIENCES**

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<tr>
<td>Biology 141</td>
<td>Biostatistics</td>
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<td>Computer Science 108A</td>
<td>Fundamentals of Computer Science</td>
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<td>Linguistics 25L</td>
<td>Mathematics for the Study of Language</td>
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<td>Mathematics 19</td>
<td>Calculus and Analytical Geometry</td>
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<td>Calculus and Analytical Geometry</td>
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<td>Mathematics 41</td>
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Mathematics 42; Calculus and Analytical Geometry
Mathematics 43; Calculus and Analytical Geometry
Mathematics 43H; Honors Calculus and Analytic Geometry
Mathematics 44H; Honors Calculus
Mathematics 45H; Honors Advanced Calculus
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 History of Science 138A, 138B, History 138A, 138B); Cosmology (Both courses must be completed to satisfy Area 6)
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 7 and 8)

AREA 7: NATURAL SCIENCES
Anthropology 6; Human Origins
Applied Physics 10; The Nature of Physics and Technology
Applied Physics 50; Astronomy Laboratory and Observational Astronomy
Applied Physics 100; Introduction to Observational Astronomy and Astronomy Laboratory
Biology 50; Biology and the Oceans
Biology 101; Biology for Humanists
Biology 165; Animal Behavior
Chemistry 31; Chemical Principles
Chemistry 33; Structure and Reactivity
Chemistry 123; Introduction to the Chemical Sciences
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 21/21H; Mechanics and Heat (or Honors M and H)

Physics 23; Electricity and Optics
Physics 25; Modern Physics
Physics 51; Mechanics
Physics 53; Electricity and Magnetism
Physics 55; Light and Heat
Physics 57; Modern Physics
Physics 61; Advanced Freshman Physics
Physics 62; Advanced Freshman Physics
Physics 63; Advanced Freshman Physics
VTSS 51, 52, 53; Nature of Technology, Mathematics, and Science (entire sequence must be completed and thereby also satisfies Areas 6 and 8)

AREA 8: TECHNOLOGY AND APPLIED SCIENCE
Applied Earth Sciences 130; Environmental Earth Sciences I
Civil Engineering 170; Environmental Science and Technology
Civil Engineering 176; Small Scale Energy Systems
Computer Science 75; (same as Linguistics 35L); 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
Engineering-Economic Systems 31; Introduction to Decision Analysis
Engineering 10N; Applied Mechanics - Statics (formerly Engineering 3)
Engineering 12; Intermediate Dynamics
Engineering 30; Introduction to the Thermosciences
Engineering 35; Automotive Technology
Engineering 40; Basic Electronics
Engineering 50; (same as Material Science 50); Introductory Science of Materials
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 145; Physics of Nuclear Weapons
VTSS 51, 52, 53; Nature of Technology, Mathematics, and Science (entire sequence must be completed and thereby also satisfies Areas 6 and 7)
VTSS 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 Council Members.

BERLIN

A) Courses taught by Non-Academic Council Members:

Area 2:
Overseas Studies 120X; New Ways of Seeing
Overseas Studies 123X; Art in the Weimar Republic and the Nazi Reich 1919-1945
Overseas Studies 124X; German Art Since 1945 in the European Context

Area 5:
Overseas Studies 140X; The German Federal Republic in the International System
Overseas Studies 230B; Berlin: Its History, Politics and Culture

FLORENCE

A) Courses taught by Academic Council Members:

Area 3:
History 115; Renaissance Florence

Area 5:
History 135A; 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
Overseas Studies 125A; Masterpieces of Italian Literature I: From the Origins through Dante
Overseas Studies 125C; Masterpieces of Italian Literature: 1800-1900

Area 5:
Political Science 110X; Contemporary Italian Politics

OXFORD

A) Courses taught by non-Academic Council Members:

Area 2:
Art 176X; History of English Architecture

Area 5:
Economics 114; British Economy Since World War II
History 143B; British History, 1870-1970

TOURS

A) Courses taught by non-Academic Council Members:

Area 2:
French 131T; French Literature Survey: 17th Century
French 132T; French Literature Survey: 19th Century
French 133T; French Literature Survey: 20th Century

Area 5:
Economics 122X; The Economy of Modern France
Economics 128X; Contemporary Problems of Economic Growth
Political Science 120X; French Foreign Policy

VIENNA

A) Courses taught by non-Academic Council Members:

Area 2:
Overseas Studies 5; Opera and Operetta in Vienna
Overseas Studies 6; The Viennese Tradition in Instrumental Music from Haydn to Mahler
Overseas Studies 101B; Drama in Vienna Theatres I
Overseas Studies 101C; Drama in Vienna Theatres II
Overseas Studies 167; Austrian Literature

Area 3:
Overseas Studies 243; The Intellectual Scene Since 1900