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Stanford, California
APPROACHING STANFORD I  
STANFORD OVERSEAS STUDIES  
SCHOOL OF MEDICINE  
STANFORD TODAY  
APPROACHING STANFORD II  
COURSES AND DEGREES  
INFORMATION  
SUMMER BULLETIN

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

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Telephone number, all University departments: Area code: (415) 497-2300

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UNIVERSITY CALENDAR

AUTUMN QUARTER, 1985

Sept 23-24 (Mon-Tues) Registration
Sept 25 (Wed) Instruction begins
Sept 26 (Thurs) Confering of degrees - Summer
Oct 15 (Tues) Last day for registration
Nov 28-Dec 1 (Thurs-Sun) Thanksgiving recess (no classes)
Dec 2 (Mon) Last day for filing A.B., B.S., and B.A.S. applications for January (Autumn) conferral
Dec 6 (Fri) Last day for filing advanced degree candidacy applications:
A.M., M.S., M.F.A., Educational Specialist and Engineer,
for April (Winter) conferral
Dec 6 (Fri) Last day for filing A.M., M.S., Engineer theses, D.M.A. final project Ph.D. dissertations, and "Notice of Intention"
for Autumn Quarter degree conferral
Dec 9-13 (Mon-Fri) End-Quarter examinations

WINTER QUARTER, 1986

Jan 6 (Mon) Registration
Jan 7 (Tues) Instruction begins
Jan 9 (Thurs) Confering of degrees - Autumn
Jan 20 (Mon) Martin Luther King Day (holiday, no classes)
Jan 31 (Mon) Last day for registration
Jan 31 (Fri) Last day for filing graduate "Notice of Intention" and candidacy application for June Diploma
Feb 17 (Mon) Presidents' Day (holiday, no classes)
Mar 9 (Sun) Observance of Founders' Day
Mar 14 (Fri) Last day for filing advanced degree candidacy applications:
A.M., M.S., M.F.A., Educational Specialists and Engineer,
for June (Spring) conferral
Mar 14 (Fri) Last day for filing A.M., M.S., Engineer theses, D.M.A. final project Ph.D. dissertations, and "Notice of Intention"
for Winter Quarter degree conferral
Mar 17-21 (Mon-Fri) End-Quarter examinations

SPRING QUARTER, 1986

Mar 31 (Mon) Registration
Apr 1 (Tues) Instruction begins
Apr 3 (Thurs) Confering of degrees - Winter
Apr 11 (Fri) Last day for filing undergraduate scholarship applications, matriculated undergraduates
Apr 21 (Mon) Last day for registration
May 26 (Mon) Memorial Day (holiday, no classes)
June 4 (Wed) Last day for filing advanced degree candidacy applications:
A.M., M.S., M.F.A., Educational Specialist and Engineer,
for September (Summer) conferral
June 4 (Wed) Last day for filing A.M., M.S., Engineer theses, D.M.A. final project, Ph.D. dissertations, and "Notice of Intention"
for Spring Quarter degree conferral
June 6-11 (Fri-Wed) End-Quarter examinations
June 14 (Sat) Baccalaureate Saturday and Senior Class Day
June 15 (Sun) Commencement

SUMMER QUARTER, 1986

June 23 (Mon) Registration
June 24 (Tues) Instruction begins
July 4 (Fri) Independence Day (holiday, no classes)
Aug 14 (Thurs) Last day for filing advanced degree candidacy application:
A.M., M.S., M.F.A., Educational Specialist and
Engineer, for January (Autumn) conferral
Aug 14 (Thurs) Last day for filing A.M., M.S., Engineer theses, D.M.A. final projects, Ph.D. dissertations, and "Notice of Intention"
for Summer Quarter degree conferral
Aug 15-16 (Fri-Sat) Eight-week term examinations
Aug 16 (Sat) Eight-week term closes
Sept 1 (Mon) Labor Day (holiday)
Sept 2 (Tues) Quarter closes

1986-87
Registration
Autumn: Sept 23-30
Winter: Jan 5
Spring: Mar 30
Summer (8-week term): June 22
Last day of Finals
Autumn: Dec 19
Winter: Mar 20
Spring: June 10
Summer: Aug 15
Commencement
Autumn: Summer
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- Neurobiology
- Pathology
- Pharmacology
- Physiology
- Radiology

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- Cancer Biology Program
- Neurosciences Program

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- Economic Policy Research (CEPR), Center for
- Hansen, W.W., Laboratories of Physics
- Humanities Center, (SHC), Stanford
- International Studies Center for Research in (CRIS)
- African Studies
- East Asian Studies
- Chinese Language Studies in Taipei, Inter-University Program for

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- Japanese Language Studies in Tokyo, Inter-University Center for
- International Strategic Institute at Stanford (ISIS)
- Materials Research (CMR), Center for
- Mathematical Studies in Social Sciences (IMSSS), Institute for
- Research on Women (CROW), Center for
- Stanford Linear Accelerator Center (SLAC)
- Stanford Synchrotron Radiation Laboratory (SSRL)

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- Hoover Institution on War, Revolution, and Peace
- Libraries
- Information Services
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- Information Technology Services (I.T.S.)
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Stanford University celebrates the Centennial of its Founding in November, 1885; the Centennial of its Opening in 1981. 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, ten-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 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 1983 it was 488.

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 1984 totaled 13,261, of whom 6,593 were undergraduates and 6,668 were graduate students. Blacks, Hispanics, Puerto Ricans and Native Americans numbered 1,121 undergraduates and 439 at the graduate level. Stanford awarded 4,233 degrees in 1983-84, of which 1,645 were baccalaureate and 2,588 were advanced degrees.

Among the 1,315 faculty members who make up the Academic Council there are 10 Nobel laureates, 80 members of the National Academy of Sciences, 124 members of the American Academy of Arts and Sciences, 39 members of the National Academy of Engineering, 10 members of the National Academy of Education, 12 winners of the National Medal of Science, and 3 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 6 million items.
DEGREES

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

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

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

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

UNDERGRADUATE DEGREES

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

The degree of Bachelor of Arts (A.B.) or the degree of Bachelor of Science (B.S.) is conferred upon the candidates recommended by the Subcommittee on Academic Standing, Petitions, and Exceptions who have applied in advance for graduation (see deadlines in Time Schedule calendar) and 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 the recommendation of the department(s). (Curricula and other special requirements are listed under each department in Courses and Degrees.)
4. Completed at least 45 units (including the last 15) at Stanford. (In special cases, students who have obtained at least 135 units in resident work and have completed major and Writing, 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 election by the student, upon candidates recommended by the Subcommittee on Academic Standing, Petitions, and Exceptions who have applied in advance for graduation. Candidates must fulfill requirements (1), (2), (4) and (5) above, and in addition fulfill requirement (3) in two major departments or programs, one leading to a Bachelor of Arts degree and the other leading to a Bachelor of Science degree.

Entering students may be allowed up to 45 units of credit toward graduation for superior work completed in high school. Such advanced credit will be awarded on the basis of scores achieved on College Board Advanced Placement Examinations, subject to University and departmental approval.

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.)

An undergraduate is limited to a total of twelve (12) courses or thirty-six (36) units, whichever is greater, to be counted toward graduation from the following extradepartmental programs combined: the Center for Teaching and Learning (CTL), the innovative academic programs, and the Program in Urban Studies. Furthermore, not more than twenty-seven (27) units may be from any one of these programs. There is, however, no limit on the number of courses or units which may be taken from these programs in any given quarter.

An undergraduate is also limited to a total of twelve (12) units of Physical Education activity courses and twenty-four (24) units of ensemble Music courses to count toward graduation. There is no limit for either of these per quarter.

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

Candidates who fulfill these requirements in the Schools of Earth Sciences and Engineering, or the Departments of Biological Sciences, Chemistry, Mathematics, Physics, and Statistics in the School of Humanities and Sciences,
or the Program in Mathematical and Computational Science, or when appropriate the Program for Individually Designed Majors, or Medical Microbiology in the School of Medicine receive the degree of Bachelor of Science; candidates who fulfill these requirements in other schools or departments receive the degree of Bachelor of Arts.

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

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

SECOND BACHELOR DEGREE

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 139, Old Union, during the student's tenth or eleventh quarter. This statement should be in the form of a petition and should have the favorable recommendation of the appropriate representatives of the two departments in which the student expects to receive degrees.

In order to qualify for both degrees a student must (1) complete the stated University requirements and the departmental requirements for each degree; and (2) complete 15 full-time quarters (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 eleventh 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

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

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

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

These educational goals are achieved through study in individual "courses" which bring together groups of students examining a topic or subject under the supervision of scholars. Courses are assigned credit units. To earn a bachelor's degree, the student must complete at least 180 units and, in so doing, also complete the Writing Requirement, the Distribution Requirements, 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 of an area of specialization. These Requirements ensure that every student is exposed to different ideas and different ways of thinking. They enable the student to approach and to understand the important "ways of knowing"—to assess their strengths and limitations, their uniqueness, and, no less importantly, what they have in common.

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

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

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 Academic Information 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 as vis-a-vis the 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. Questions regarding specific courses that satisfy the distribution requirements and distribution status are 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 see 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 Two through Eight);

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

The subject areas, 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, and will be designated with an asterisk, e.g., (DR:3*).

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 Distribution Requirement. Exceptionally, a single course whose content is approximately equally divided between two areas of study may be certified as fulfilling either one of two Distribution Requirements. No single course may fulfill more than one Distribution Requirement for a given student.

For students who enter Stanford in Autumn Quarter and thereafter, courses which have been certified as satisfying the Distribution Requirements are annotated according to the symbols above to show how they fulfill the Distribution Requirements. A complete list of courses appears as an Appendix at the back of this bulletin.

C. CREDIT TRANSFER

Where students propose to use work taken in another college or university in satisfaction of 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 (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 Graduate Assistant (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 specific language and encourages further study of 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, formally may declare more than one major within either program. The student may do that either at the time of initial major declaration or, as may be more advisable given the planning required to complete more than one major, by amending the original declaration. If the student’s degree is formally to reflect more than a single major:

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

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

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

PURPOSE OF THE MAJOR

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

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

STRUCTURE OF THE MAJOR

The structure of a major should be 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 (formally the Academic Information Center). The Center provides and coordinates information and services which will help the student and advisor to work together toward the establishment and accomplishment of the student’s goals.

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

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

The Undergraduate Advising Center, located on the third floor of the Old Union, 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, assistant-
ships, scholarships, and special study programs available at other schools; a complete collection of graduate and undergraduate catalogs from other institutions in the United States and Canada; 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: 306 Old Union
Hours: Monday through Friday, 8:00-12:00 and 1:00-5:00
Phone: 497-2426.
Pre-professional phone: 497-1151.

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

There are a number of advanced degrees offered at Stanford. Each Stanford advanced degree requires an approved course of study which meets University and department requirements for units (a minimum of 36 unduplicated units for each advanced degree taken at Stanford) and residency (time spent on studies measured in terms of tuition payments).

UNIT AND RESIDENCE REQUIREMENTS

For each advanced degree there is a minimum of work as a graduate student at Stanford. The minimum is listed under each degree and may not be less than 36 unduplicated quarter units. The last units of a degree program, whether for a course, directed reading, research or thesis, are expected to be registered for at Stanford.

The residence requirement for each advanced degree is stated under the individual requirements for that degree in the following pages and is never less than three full-tuition quarters or the equivalent in partial tuition quarters for each Stanford advanced degree.

Residence for an advanced degree is the time devoted to graduate study measured in terms of full or partial tuition for Stanford registrations rather than in units of credit. Credit toward the residence requirement of a degree program is based on the percentage of full tuition paid each quarter. Registration for 8, 9 or 10 units is available to graduate students in schools/departments approving less than full tuition. Unit basis registration (3-10 units) is available only to graduate students who are members of the Stanford staff; students eligible for AGR or TGR; students holding assistantships; students who with this work will be able to complete course requirements for an advanced degree; Honors Cooperative students, or full-time teachers in the area.

If a graduate student has completed academic requirements before fulfilling the residence requirement, he or she may wish to make a tuition deficiency payment to the University, rather than continue registering until residence is complete. Such a tuition deficiency is calculated in terms of the percentage of full tuition still lacking. For example, a doctoral student who has met 8.62 quarters of the 9.00 of full tuition required will have a tuition deficiency of .38 of a full quarter's tuition. The outstanding tuition payment will be calculated at the current year's tuition rates. Note: In the Summer Quarter when tuition is permitted to all graduate students on a unit basis, 15 units are required for the equivalent of a full tuition quarter. Information on the student's status with respect to residence may be obtained in the Graduate Program Office (Building 590, Room 104).

Specific departmental requirements for advanced degrees are listed in the appropriate sections in this bulletin. To expedite progress toward degrees, schools and departments have developed guidelines that enable the student to determine when he or she is making satisfactory progress. Doctoral study involving more than one department is described under Graduate Division Special Programs.

CONTINUOUS REGISTRATION

Candidates for advanced degrees are required to enroll for at least three quarters of each year from the time of matriculation until receipt of the degree—the only exception to that requirement being for officially approved leaves of absence. All graduate students must be registered in the quarter a degree is conferred or in the quarter immediately preceding the quarter in which the degree is to be conferred. During leave or non-registration students may submit a change of major or degree level request, the "Notice of Intention to Complete Advanced Degree Requirements", and a thesis or dissertation. No other university
action, e.g., the University Oral Examination, may be taken while a student is on leave or is not registered.

Students should consult their department chairmen or, as appropriate, the school dean, in case the expectations of progress in the degree program are unclear. Students who fail to make satisfactory progress will be so informed by their department chairmen or school deans. Failure to correct deficiencies in a timely manner will be cause for dismissal. "Guidelines for Dismissal of Graduate Students for Academic Reasons" were approved by the Senate of the Academic Council in 1982. For details see current bulletin, Information.

IN ABSENTIA

Graduate students at Stanford are expected to be in residence on the campus unless specific arrangements have been made in advance with their department to study in absentia for a period of one or more quarters. To study in absentia students must file a "Petition for In Absentia Registration," obtainable at the Registrar's Office, with appropriate departmental signatures. Students on fellowship must arrange with the Graduate Awards Office for the mailing of any fellowship checks while they are away.

CANDIDACY

Candidacy for A.M., M.S., M.A.T., Ed.S., M.F.A., Engineer, D.M.A., and Ph.D. degrees must be approved by the Committee on Graduate Studies of the Academic Council. Students working toward the master's or Engineer degree must apply for candidacy no later than the last day of class of the quarter preceding the quarter in which they expect their degree. Doctoral candidates are expected to apply for candidacy by the end of their second graduate year in the doctoral program, that is, by the end of the sixth quarter of 9 units or more of registration. All students must be registered in the quarter in which they apply for candidacy.

Candidacy is valid for five years from date of approval by the Graduate Division (if it has not been terminated earlier by the major department because of unsatisfactory progress). The Graduate Division will place a hold on further registration upon expiration of candidacy unless candidacy is renewed or extended by department recommendation and Graduate Division approval.

All applications or petitions to the Committee on Graduate Studies must be submitted to the major department for approval before being forwarded to the Graduate Program Office.

REGISTRATION CATEGORIES

In addition to conventional registration, three other forms of registration are open to eligible graduate students:

1. **Advanced Graduate Registration (AGR):** If a doctoral student has been admitted to candidacy, registered for all required courses and completed nine quarters of residency, but has not completed the degree, he or she may register in Advanced Graduate Registration (AGR) status for the equivalent of nine units for each of three quarters.

2. **Terminal Graduate Registration (TGR):** Students who have been admitted to candidacy, completed all required coursework and residence requirement (10.5 quarters of residency for doctoral students) may register in Terminal Graduate Registration (TGR) status.

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

Work on the thesis or other remaining requirements will be evaluated each quarter by the advisor with an "N" or "N—" mark as a measure of continuing academic progress. The Graduate Division will place a hold on the registration of a student who receives two consecutive "N—" grades.

3. **Unit Basis Registration** when only a few units or a fractional amount of tuition remain to complete the student's advanced degree requirements. In the final quarter of residency before applying for AGR or TGR a student may petition the Graduate Program Office to register on a unit basis to cover the exact remaining unit requirement. A student may use this option only once to reach either AGR or TGR, not both.

Eligibility for these forms of registration can be determined by the student at the Graduate Program Office.

ADDITIONAL DEGREES AND CHANGES IN MAJOR OR DEGREE LEVEL

Students already admitted to a degree program who wish to obtain additional degrees, or change the degree for which they were originally admitted, must have departmental and Graduate Division approval. Such students must fill out the "Application for Additional Degree or Change Major or Intended Degree Level" available at the Registrar's Office or the Graduate Program Office. The only exception to this are doctoral candidates who apply for a master's degree in the same department on the way to fulfilling requirements for the doctorate. The application must have appropriate department
approval and must be submitted to the Graduate Division (through the Associate Dean of Graduate Studies, Graduate Awards Office Building 590, Room 209). The application must be received by the Graduate Division before candidacy papers can be processed.

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 GREs, letters of recommendation, or a new statement of purpose. There is no additional graduate application fee. Foreign students must file a new Financial Resources Certification, available through the Graduate Awards Office, before approval will be granted, and have prior approval from the International Center.

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.) or Master of Science (M.S.) is conferred on candidates who have satisfactorily completed at least three full-time quarters of work as a graduate student at the University and fulfilled such other requirements as may be prescribed by the school or department concerned. Note: A longer period will be necessary for students who are inadequately prepared or who do not enroll full time. (See Partial Residence Credit under Residence Requirement above).

The University minimum unit requirement for the A.M. or M.S. is 36 quarter units earned at Stanford as a graduate. Most departments require more. At the discretion of the major department, 6 quarter units earned elsewhere as a graduate if validated by the department may be used as replacement for specific Stanford courses. Such courses must be reported on the application for candidacy, with the name and number of each Stanford course and the number of units allowed at Stanford for the course. The method of validation should be indicated, e.g., transcript information or examination. However, the minimum residence requirement for the A.M. and M.S. remains unchanged.

For admission to candidacy, see Candidacy under “Advanced Degrees” above.

If a thesis is a degree requirement, three copies, each bearing the approval of the instructor under whose supervision it was prepared, must be submitted to the Graduate Program Office on or before the last day of classes in the final quarter of candidacy. Directions for the preparation and submission of theses are available in the Graduate Program Office, Building 590, Room 104.

For a second Stanford master’s degree an additional three quarters of residence (full tuition or the equivalent in partial registrations) and an additional unduplicated program of total units of course work normal to that department will be required. The “Application for Additional Degree or To Change Major or Intended Degree Level” form must be filed with the Graduate Awards Office before a student can be admitted to candidacy in an additional program.

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 fulfilled such other requirements as may be 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

General Regulations—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 this University and fulfilled such other requirements as may be prescribed by the Art Department.

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

MASTER OF BUSINESS ADMINISTRATION

Upon recommendation to the Senate of the Academic Council by the faculty of the Graduate School of Business and the 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). In addition, field based projects are required.

ENGINEER

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 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), presented an acceptable thesis, and fulfilled such other requirements as may be prescribed by the major school or department. A longer period will be necessary for students who are inadequately prepared or who do not enroll fulltime.

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

Thesis—Three copies of the thesis, bearing the approval of the instructor under whose supervision it was prepared, must be submitted to the Graduate Program Office on or before the last day of classes in the final quarter of candidacy.

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

MASTER OF LEGAL STUDIES

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

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

MASTER OF JURISPRUDENCE

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

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

DOCTOR OF EDUCATION

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the Committee on Graduate Studies, the degree of Doctor of Education (Ed.D.) is conferred on candidates who have satisfied the academic requirements of the School of Education and the University residence requirement (see Doctor of Philosophy General Regulations). At the announced time in the quarter at the end of which the degree is to be conferred, the candidate must deposit with the School of Education two copies of the dissertation and two copies of an approved abstract of the dissertation (maximum length 350 words). If extra copies of the bound dissertation are desired, extra copies of the manuscript may be submitted for binding with the required two.

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

(Further information concerning these requirements will be found in the “School of Education” section of this bulletin and may also be secured from the School of Education Degree Program Office.)

DOCTOR OF MUSICAL ARTS

Upon recommendation to the Senate of the Academic Council by the faculty of the Department of Music and the 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
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

Academic 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.

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

Acceptable work completed elsewhere as a graduate may be applied to this requirement to a maximum of three quarters. A doctoral program may include a master’s or Engineer degree. There must, however, be a minimum of 36 unduplicated units for the Ph.D. beyond those required by any of these other degrees. A Stanford graduate student who has already received three quarters of residence credit under these rules may request as much as three additional residence quarters for work to be done at another institution. This work must have prior approval of the department and the
Graduate Division. The amount of credit to be earned must be determined before the student begins the course of study.

ADMISSION TO CANDIDACY

By the end of the doctoral student's second year of study at Stanford he or she is expected to have completed the major department's qualifying procedures and to apply to the University for candidacy. The department certifies the student's readiness for admission by appropriate signatures on the Application for Candidacy form that is then submitted to the Graduate Program Office. If the student's program includes a minor, the certification of that department is required also. The application form must show at least three units of work taken or to be taken with each of at least four or more Stanford faculty members. Candidacy, when approved by the Committee on Graduate Studies, is valid for five years (if not terminated earlier by the major department because of unsatisfactory progress) and may be renewed only upon recommendation of the major department.

TEACHING REQUIREMENT

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

FOREIGN LANGUAGE REQUIREMENT

The requirement of a reading knowledge of one or more foreign languages is at the option of individual departments or schools. Fulfillment of the requirement to the satisfaction of the department is shown by the chairman's signature on the Foreign Language Report form. These forms are submitted to the Graduate Program Office.

UNIVERSITY ORAL EXAMINATION

A University oral examination is a requirement of the Ph.D. and is arranged through the Graduate Program Office after the candidate has been admitted to candidacy. The candidate must be registered the quarter the examination is taken. The examination will not exceed three hours, and will not be held during the first two weeks, or after the last day of classes, in any quarter. The University Oral Examination Schedule must be submitted to the Graduate Program Office at least three weeks prior to the date proposed for the examination. The purpose of the examination is to test the candidate's command of the fields of study and to confirm fitness for scholarly pursuits. The examining committee is to be composed of the chair, appointed by the Dean of Graduate Studies and Research, presiding, and four or more faculty members appointed by the Dean of Graduate Studies and Research to represent the major and minor departments (upon the departments' recommendation). The chair must be from outside the student's own department and any other department represented by a committee member.

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

In the event the Committee votes to fail a student, the Committee chair, within five days of the examination, transmits to the candidate's major department a written evaluation of the student's performance. Within 30 days, after discussion with the student, advisor and appropriate faculty, the chair of the student's major department should send the student a written statement indicating final action of the department. Copies of this document and that of the oral examination's chair should also be sent to the Dean of Graduate Studies and Research. Detailed guidelines are available in the file prepared for the presiding chair.

DISSERTATION

Submission of a dissertation that demonstrates the candidate's capacity for independent advanced research to the satisfaction of the school or department concerned is a requirement of the Ph.D. The dissertation must first be approved on behalf of the major school or department by a reading committee consisting of the candidate's principal advisor and two other members. At least one member of the committee must be from the major department. (For regulations governing membership on dissertation committees, consult the Graduate Program Office.) In most departments, well before the University oral examination, the department chair will appoint this reading committee, using the Appointment of a Ph.D. Dissertation Reading Committee form. Each member of the reading committee signs the signature page of the final copy of the dissertation when he or she is ready to certify that the work is of acceptable scope and quality.

Theses and dissertations must be in English. Any exceptions will need approval of the Graduate Dean prior to commencement of the work. Exceptions will be made only in most unusual circumstances where there is strong scholarly justification for submitting the dissertation in another language.
One member of the committee will read the dissertation in its final submitted form and so certify on the Certificate of Final Reading of Dissertation.

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

The Graduate Program Office will arrange for the microfilming and binding of the dissertation. A negative microfilm copy of the dissertation will be kept on file by University Microfilms, Ann Arbor, Michigan, from whom positive microfilm copies may be ordered. When bound, two copies are filed in the Stanford University Library, and one copy goes to the major department. Extra copies for binding may be submitted with the three required.

Directions regarding the preparation of the dissertation and the abstract may be obtained from the Graduate Program Office. The candidate will be charged a fee to cover the cost of microfilming the dissertation, binding three copies of the dissertation, plus any extra copies, and publishing the abstract. This fee is payable at the Cashier's office on or before the last day of classes in the final quarter.

NONMATRICULATED GRADUATE STUDY

Graduates of colleges and universities of recognized standing are eligible to apply for nonmatriculated status in the Graduate Division of the University. Nonmatriculated status is granted to students of demonstrated ability who are not seeking an advanced degree from Stanford University, but who would benefit from course work at Stanford for a variety of reasons. Some schools and departments do not permit nonmatriculated students to enroll in courses. Some programs also require full-time registration if nonmatriculated students are to take any courses. Details can be obtained from the Graduate Admissions Office. This status is granted for the current academic year only. Any extension of enrollment privileges into the next academic year requires approval in writing from the Graduate Admissions Office. Should a nonmatriculated student later apply for matriculated status, the normal admission requirements must be completed at that time. Nonmatriculated students should not anticipate any special priority for admission to a degree program because of work completed in nonmatriculated status.

No more than one 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 Engineer or doctoral residency requirements.

Applicants interested in nonmatriculated status for the Summer Quarter only need not apply through the Graduate Admissions Office but rather through the Summer Sessions Office and if approved will be permitted to register as summer visitors.

Nonmatriculated students will obtain academic credit for courses satisfactorily completed and may obtain an official transcript for the usual fee. They are eligible to use University facilities and services. In classes of limited enrollment, however, students in degree programs have priority over nonmatriculated students. Nonmatriculated students may apply for housing, but will not receive placement until the needs of all matriculated students have been cared for.
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 from 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.
GRADUATE SCHOOL OF BUSINESS


Dean: Robert K. Jaedicke

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

Assistant Deans: Jeffrey H. Moore, Robert W. Simon, Gary G. Williams


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

Lecturers: John R. Berthold, David L. Bradford, Robert E. Decker, Kirk O. Hanson, Robert Hessen, F. Pitcher Johnson, Bruce R. Judd, John McMahon, Jeffrey H. Moore, Richard T. Pascale, Dennis M. Rohan, David B. Zenoff


Courtesy Associate Professor: Myra H. Strober

Courtesy Assistant Professor: Timothy F. Bresnahan

Visiting Professors: Peter G. Clark, Kasra Ferdows, H. I. Grousbek, Bengt Holmstrom, Gerald Keim, Donald Lessard, Kathleen T. McEachan, Jeffery C. Miller

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, geochemistry, geophysics, petroleum geology, petroleum engineering, geomechanics and engineering geology, hydrology, petroleum exploration, and environmental studies; (2) to conduct research in the earth sciences; and (3) to provide opportunities for Stanford undergraduates to learn about our planet’s history, to understand the natural resource base that underlies our economy, and to appreciate the geological and geophysical factors that contribute to the quality of our environment.

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

UNDERGRADUATE PROGRAM

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:** Marco T. Einaudi

**Associate Chairman:** George A. Parks

**Professors:** Marco T. Einaudi*, John W. Harbaugh, Ronald J. P. Lyon, George A. Parks**, Irwin Remson*

**Associate Professor:** Stephan A. Graham*, André G. Journel, David D. Pollard*

**Senior Lecturer:** George Mader

**Affiliated Faculty:** James O. Leckie**, Paul Switzer (Professors), John Bredehoeft, Steve Gorelick, Warren K. Kourt, Pierre Mousset-Jones, Jacob Rubin, Ward C. Smith, Eugene Thiers (Consulting Professors)

### 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
- Environmental Earth Sciences
- Geologic Remote Sensing
- Geomechanics and Engineering Geology
- 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.

#### COMMON ENVIRONMENTAL CORE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 130,131,132</td>
<td>Environmental Earth Sciences</td>
<td>A, W, S, 15</td>
</tr>
<tr>
<td>A.E.S. 133</td>
<td>Measurement of the Environment-Remote Sensing</td>
<td>W 3</td>
</tr>
<tr>
<td>A.E.S. 180</td>
<td>Introduction to Earth Structures</td>
<td>S 4</td>
</tr>
<tr>
<td>A.E.S. 192</td>
<td>Computing in Geology</td>
<td>A 3</td>
</tr>
<tr>
<td>Chem. 31</td>
<td>Chemical Principles</td>
<td>A, W 4</td>
</tr>
<tr>
<td>Geol. 1</td>
<td>Interpreting the Earth</td>
<td>A, W, S, Sum 5</td>
</tr>
<tr>
<td>Geol. 80</td>
<td>Rocks and Minerals</td>
<td>S 5</td>
</tr>
<tr>
<td>Geol. 102</td>
<td>Introduction to Field Geology</td>
<td>Sum 3</td>
</tr>
<tr>
<td>Geol. 193</td>
<td>Introduction to Probability and Statistics in Geology</td>
<td>W 3</td>
</tr>
<tr>
<td>Math 19-20</td>
<td>Analytic Geometry and Calculus or Math. 41</td>
<td>6</td>
</tr>
<tr>
<td>Environmental Core Subtotal</td>
<td></td>
<td>51</td>
</tr>
</tbody>
</table>

#### ENVIRONMENTAL EARTH SCIENCES

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

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Environmental Core</td>
<td></td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 110</td>
<td>Elements of Photo Interpretation</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Chem. 135</td>
<td>Physical Chemical Principles</td>
<td>WS</td>
<td>3</td>
</tr>
<tr>
<td>Civ. Engr. 170</td>
<td>Environmental Science and Technology or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Civ. Engr. 171</td>
<td>Environmental Planning)</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
<td><strong>Qtr.</strong></td>
<td><strong>Units</strong></td>
</tr>
<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
<td><strong>Qtr.</strong></td>
<td><strong>Units</strong></td>
</tr>
<tr>
<td><strong>Course No.</strong></td>
<td><strong>Subject</strong></td>
<td><strong>Qtr.</strong></td>
<td><strong>Units</strong></td>
</tr>
</tbody>
</table>

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* Joint appointment with Geology
** Joint appointment with Civil Engineering
Civ. Engr. 270. Movement, Fate and Effects of Contaminants in Natural Waters A 3
Math. 21,22,23. Analytic Geometry and Calculus or (Math. 42, 43) 9
Mech. Engr. 137. Air Pollution S 3
Phys. 21,22,23,24. Elementary Physics A, W 8
(students intending to enter graduate programs in science and engineering should substitute 2 courses from Phys. 51 series)
Urban Studies 160. Introduction to Urban Design W 5
Urban Studies 175. Managing Local Government W 4
Total .................................................. 90

ENVIRONMENTAL EARTH SCIENCES MANAGEMENT

The Environmental Earth Sciences 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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 136</td>
<td>Environmental Earth Sciences Management</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 145</td>
<td>Mineral Economics</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 146</td>
<td>Introduction to Mining Methods</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 251</td>
<td>Oil Field Exploration and Development</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 290</td>
<td>Geostatistics for Exploration and Development</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>A.E.S. 298</td>
<td>Decision Analysis in Petroleum Exploration</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>Econ. 1.</td>
<td>Elementary Economics</td>
<td>A, W, S</td>
<td>5</td>
</tr>
<tr>
<td>Ind. Engr. 133.</td>
<td>Industrial Accounting</td>
<td>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>A, W, S</td>
<td>3</td>
</tr>
<tr>
<td>P.E. 103.</td>
<td>Survey of the Energy Industries</td>
<td>A, S</td>
<td>3</td>
</tr>
<tr>
<td>Total ..................................................</td>
<td></td>
<td>93</td>
<td></td>
</tr>
</tbody>
</table>

LAND RESOURCES PLANNING

The Land Resources Planning Program prepares students for graduate study in city and regional planning, conservation, landscape architecture, law, resource management and allied programs. It is not designed for students intending to enter graduate study in engineering or science.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 110</td>
<td>Elements of Photo Interpretation</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>A.E.S. 145</td>
<td>Mineral Economics</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

One Course From:
Anthro. 146. Urban Problems in Anthropological Perspective
Soc. 150. Urban Sociology

Total .................................................. 84

HONORS PROGRAM IN APPLIED EARTH SCIENCES

The Department of Applied Earth Sciences offers a program leading to the degree of Bachelor of Science in Applied Earth Sciences with Honors. The program is available to Seniors have grade point averages of at least 3.5.

a) Students should find a research project, either theoretical, field or experimental.

b) The student shall submit his or her proposal to the Honors Subcommittee, which will decide on its suitability as an Honors Project.

c) Course credit for the project will be assigned by the advisor within the framework of AES 199.

d) A written report of the work at its completion will be required for Honors.

e) Before the end of the year, each Honors candidate shall give a seminar on his or her work. This seminar will be announced publicly and will be open to the general audience. The expectation is that the student's advisor along with all the other Honors candidates shall attend the seminar.

f) The decision as to whether a given independent study project does or does not merit award of Honors shall be made jointly by the Honors Subcommittee and the student's advisor. This decision shall be based on the quality of both the Honors work and the entire academic record.

g) The work done on the Honors Program should not be used as a substitute for regularly required courses.

GRADUATE PROGRAMS

The Department of Applied Earth Sciences 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 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.

CURRICULA RECOMMENDED FOR THE MASTER’S DEGREE

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.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 192</td>
<td>Computing in Geology</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 231</td>
<td>Oil Field Exploration and Development</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

A.E.S. 252. Sedimentary Basins | A | 3
A.E.S. 253. Petroleum Geology and Exploration | S | 3
A.E.S. 296. 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, 280, 284; 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.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 135</td>
<td>Soil Science</td>
<td>alt. A</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 255</td>
<td>Introduction to Solute Transport</td>
<td>alt. A</td>
<td>2</td>
</tr>
<tr>
<td>A.E.S. 258</td>
<td>Role of Fluids in Geologic Processes</td>
<td>W</td>
<td>2</td>
</tr>
<tr>
<td>Civ. Engr. 260</td>
<td>Engineering Hydrology</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Civ. Engr. 361</td>
<td>Soil Moisture and Groundwater</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>Civ. Engr. 270</td>
<td>Movement, Fate and Effects of Contaminants in Natural Waters</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 193</td>
<td>Intro. to Probability and Statistics</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 230</td>
<td>Hydrogeology</td>
<td>W</td>
<td>5</td>
</tr>
<tr>
<td>O. R. 152</td>
<td>Introduction to O. R. I</td>
<td>A</td>
<td>4</td>
</tr>
</tbody>
</table>

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).

ENVIRONMENTAL EARTH SCIENCES

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

Requirements for all students in Environmental Earth Sciences:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 130, 131, 132</td>
<td>Environmental Earth Sciences</td>
<td>A,W,S</td>
<td>9</td>
</tr>
</tbody>
</table>
Subtotal .............................................. 13

A program comprising 32 additional units of graduate-level courses may be used to design a substantive, coherent program to meet individual interests and career objectives. Typical programs involve additional course work in Applied Hydrogeology, Geomechanics and Engineering Geology, Geostatistics for Natural Resources Evaluation, and Remote Sensing.

LOW TEMPERATURE AQUEOUS GEOCHEMISTRY

Courses and research opportunities in theoretical and experimental low temperature aqueous chemistry and environmental geochemistry 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 program. Students 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 still further 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.

GEOLOGIC REMOTE SENSING

Remote sensing covers a wide range of interactive 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: Geobotany, 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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 192</td>
<td>Computing in Geology</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 233</td>
<td>Measurement of the Environment</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 295(A,B,C,D,E)</td>
<td>Research Seminar</td>
<td>(3 of any sequence)</td>
<td>A,W,S</td>
</tr>
<tr>
<td>A.E.S. 296</td>
<td>Radar for Structural Mapping Alt.</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 297</td>
<td>Airborne Exploration-Lithology</td>
<td>Alt.</td>
<td>S</td>
</tr>
<tr>
<td>Geol. 193</td>
<td>Intro. to Probability &amp; Statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stat. 110</td>
<td>Statistical Methods in Engineering and Physical Sciences</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>or Stat. 116</td>
<td>Theory of Probability</td>
<td>A,S,Sum</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Total .............................................. 34-35 units

GEOMECHANICS AND ENGINEERING GEOLOGY

This program emphasizes the use of solid, fluid, and fracture mechanics to solve problems in structural and engineering geology. 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. A thesis is required for the M.S. degree. All students in this program are required to complete the following core courses in the School of Earth Sciences:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 280</td>
<td>Stress Analysis and Elastic Deformation</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 281</td>
<td>Strain Analysis and Viscous Deformation</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 282</td>
<td>Rock Fracture</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 380A,B,C</td>
<td>Research Seminar: Geomechanics</td>
<td>A,W,S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 185</td>
<td>Volcanology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 230</td>
<td>Hydrogeology</td>
<td>W</td>
<td>5</td>
</tr>
<tr>
<td>Geophys. 174</td>
<td>Seismology</td>
<td>A,3</td>
<td></td>
</tr>
<tr>
<td>Geophys. 262</td>
<td>Rock Physics</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 290</td>
<td>Tectonophysics</td>
<td>S</td>
<td>3</td>
</tr>
</tbody>
</table>

Total .............................................. 32

Students must take nine units selected from the following courses in the School of Engineering: Chem. Engr. 140, 150; C.E. 201, 202, 282, 289, 291, 292, M.S. and E. 185, 203, 237, 238; Mech. Engr. 200, 238, 239, 240. Other courses well suited to the program include A.E.S. 255, 258; Geophys. 190, 195. Substitutions in the program based on research needs may be approved by petition.

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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 292</td>
<td>Applications of Computers in Geology</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Required Earth Sciences or Statistical background</td>
<td></td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Subtotal .............................................. 34-35 units
A.E.S. 145. Mineral Economics S 3
A.E.S. 290. Geostatistics for Exploration and Development A 5
A.E.S. 291. Practice of Geostatistics on Simulated Deposits W 5
A.E.S. 293. Topics in Advanced Geostatistics S 3

Total .................................................. 31

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

Other recommended courses:
Comp. Sci. 135. Numerical Methods 3
O.R. 240. Linear Programming 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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 275</td>
<td>Solution-Mineral Equilibria</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 277</td>
<td>Field Mapping of Mineral Deposits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 220</td>
<td>Advanced Ore Deposits</td>
<td>W</td>
<td>5</td>
</tr>
<tr>
<td>A.E.S. 290</td>
<td>Geostatistics for Exploration and Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geophys. 191</td>
<td>Geophysical Field Techniques</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total .................................................. 20

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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 163</td>
<td>Optical Mineralogy</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 171</td>
<td>Introduction to Geochemistry</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 120</td>
<td>Introduction to Ore Deposits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 192</td>
<td>Computing in Geology or Comp. Sci. 106.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Introduction to Computing A 3-4
Geophys. 190. General Geophysics A 4
Geol. 151. Introduction to Sedimentary Facies W 3
Geol. 181. Igneous Petrology A 3-5
Geol. 182. Metamorphic Petrology S 5
Geol. 183. Introduction to Probability and Statistics in Geology W 3

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.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 251</td>
<td>Oil Field Exploration and Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.E. 267</td>
<td>Engineering Valuation and Appraisal of Oil and Gas</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 252</td>
<td>Sedimentary Basins</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 253</td>
<td>Petroleum Geology</td>
<td>S</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 251</td>
<td>Continental Margins</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 254</td>
<td>Sedimentary Facies and Environments alt.</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 278</td>
<td>Organic Geochemistry</td>
<td>W</td>
<td>2</td>
</tr>
<tr>
<td>Geophys. 190</td>
<td>Geologic Interpretation of Reflection Seismograms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pet.Engr. 150A</td>
<td>Well Log Analysis I</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Pet.Engr. 150B</td>
<td>Well Log Analysis II</td>
<td>W</td>
<td>3</td>
</tr>
</tbody>
</table>

Total .................................................. 27

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, 245, 253; Geophysics 150, 262, 280, 284; Applied Earth Sciences 258, 290, 292, 296, 297, 298; Petroleum Engineering 103, 151A, 151B, 152A, 250, 267.

SPECIAL APPLIED EARTH SCIENCES PROGRAM

A program with 45 units of courses approved by the department faculty.

ENGINEER DEGREE

A minimum of two years (six quarters) of graduate study is required. At least one of these years, ordinarily the last, must be spent as a
registered student at Stanford. The candidate must complete 90 units of course work, no more than 10 of which may be applied to overcoming deficiencies in undergraduate training. The student must prepare a thesis meeting the approval of the supervising instructor and the University Committee on Graduate Studies.

DOCTOR OF PHILOSOPHY

Objectives—The degree of Doctor of Philosophy is conferred upon candidates who have demonstrated substantial scholarship, high attainment in a particular field of knowledge, and ability to do independent investigation.

Requirements—The University’s requirements are described in the section “Advanced Degrees” in this bulletin. A brief summary of additional departmental requirements follows. A complete statement of requirements may be obtained from the office of Applied Earth Sciences.

Graduate students are admitted with a degree goal: M.S., Engineer, or Ph.D. An approved petition is required to change goals. Those with a Ph.D. goal initiate qualifying procedures after earning faculty recommendation, at the end of the first year. After completion of the qualifying procedures, the department may recommend that the student apply to the University for Ph.D. candidacy. Passing of the University Oral Examination and acceptance of a dissertation by the Graduate Division of the University complete the academic requirements for the degree.

The department qualifying procedures involve four steps: completion of core course sequence, faculty recommendation, departmental oral examination and proposal of research project. The first three steps must be completed within the first eighteen months after initial registration.

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

Departmental Oral Examination—The student must pass the department oral examination, which is a test of mastery of the major option and at least one related area, 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.

UNDERGRADUATE COURSES

110. Elements of Photo Interpretation—Brief introduction to the interpretation of B&W aerial and satellite-photography and imagery, concentrating upon the analysis of cultural/urban patterns from their spatial point of view. Some coverage of photo-geological aspects of geological and geomorphic features. Prerequisite: Geology 1 or consent of instructor.

2 units, Aut (Lyon) T 1:15
lab T or Th 2:15-4:05

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

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

127. Geochemistry and Natural Waters—A quantitative introduction to the chemical processes and principles instrumental in determining the compositions of natural waters. Prerequisites: Chemistry 135 and Geology 80.

3 units, (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. No prerequisites.

3 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 wetlands. “Hands-on” use of computer to analyze LANDSAT satellite coverage of campus. Introductory physics recommended; A.E.S. 110 strongly recommended.

3 units, Win (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. The course is 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 1985-86

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, Spr (Thiers) by arrangement

146. Mining Methods—An introduction to underground and surface mining methods, mining and materials handling cycle. Ancillary mining problems of water, ventilation, safety and environmental impact will also be discussed. Process of mine feasibility will also be included.

3 units, Aut (Mousset-Jones) 3 hrs. per week by arrangement
alternate years, given 1985-86

180. Introduction to Earth Structures—A first course in structural geology for students of applied earth sciences and geotechnical or petroleum engineering. Basic earth structures (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 examples. The roles of these structures in environmental and engineering problems, resource recovery, and earthquake hazards are discussed. Prerequisites: Geology 1, Mathematics 19, 20.

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

192. Computing in Geology—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 COURSES

220. Advanced Ore Deposits—Lectures are designed to integrate field, theoretical, and laboratory data on the origin of ore 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 by hand lens,
polished thin section microscopy, X-ray diffraction, electron microprobe and fluid inclusion techniques. Individual projects. Prerequisites: 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. 224 or equivalent.

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.

2 units, Win (Parks) by arrangement
not given 1985-86, consider A.E.S. 299

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 stability, aqueous thermodynamics. Topics include the preceding quarter. Prerequisites: Geology 175 or Material Science 181 and A.E.S. 224. Offered only if formal enrollment is at least six.

3 units, Win (Parks) TTh 9, plus one hour by arrangement, not given 1985-86, consider A.E.S. 299

223. Measurement of the Environment—Remote Sensing—For graduate students. Lectures the same as A.E.S. 133. Term paper required.

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

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

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

252. Sedimentary Basins—Analysis of the depositional framework and tectonic evolution of sedimentary basins. Topics 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—Course covers basics of petroleum geology origin and occurrence of hydrocarbons and exploration for hydrocarbons. Subjects considered include thermal maturation history in hydrocarbon generation, significance of sedimentary and tectonic setting, principles of accumulation, geological and geophysical exploration techniques, economic considerations, and unconventional hydrocarbon resources. 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
alternate years, given 1986-87

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 (Bredheoefit) Th 3:15

259. Seminar: Ground-Water Investigations—A ground-water investigation and analysis of an undeveloped ground water basin. Objective will be to structure an investigation leading to description and analysis of the system. Each participant will "bid the job" just 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 (Bredheoefit) by arrangement

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

2 units, Win (Graham) by arrangement

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

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

280. Stress Analysis and Elastic Deformation of Rock—Development of the basic concepts and equations for stress analysis and elastic deformation in rock. Elementary solutions for bending layers, loads on the Earth's surface, boundary loading of crustal blocks, and underground openings will be reviewed. Emphasis will be on a physical understanding of the fundamental equations and applications to problems in structural geology and geotechnical engineering. Prerequisites: Introductory geology and elementary calculus.

4 units, Aut (Pollard) MWF 10


4 units, Win (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: 280.

4 units, Spr (Pollard) MWF 10


5 units, Aut (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, Win (Journel) TTh 8-10

292. Research Seminar in Geological Computing—Extension of topics introduced in 192 with opportunity for extended individual research. Prerequisite: 192.

2 units, Spr (Harbaugh) by arrangement

293B,C. Topics in Advanced Geostatistics—Topics chosen from the following: 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; convex analysis for production optimization with quality control. Course may be repeated for credit. Prerequisites: 290, advanced calculus.

3 units, Win, Spr (Journel) by arrangement

295A,B,C,D,E. Research Seminar in Remote Sensing—Weekly two-hour discussion of recent advances covering aspects of remote sensing, especially those 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. No prerequisites. Pass/No Credit grading. Sequence (A,B,C,D,E) varies by year.

295A. Pattern Recognition (Spatial & 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, Spr (Lyon) TTh 1:15 and lab TTh 2:15-4:05 alternate years, given 1985-86

297. 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, Spr (Lyon) TTh 1:15 and lab TTh 2:15-4:05 alternate years, given 1986-87

298. 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) MWF 11

299. Special Problems in Applied Earth Sciences—Individual research or guided reading on special problems.
any quarter (Staff) by arrangement

any quarter (Staff) by arrangement
UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

The program leading to the degree of Bachelor of Science in Geology provides a high degree of flexibility for each individual student because the required 34-35 units of chemistry, physics, and mathematics plus 64-67 units of geology leave ample room to satisfy University general requirements (distribution and language) and explore other subjects as well. The required courses for a student majoring in geology can be grouped into three categories: (1) courses offered within the Department of Geology; (2) courses in chemistry, physics, and mathematics that are essential to the geology curriculum but are taught in departments other than the Department of Geology; and (3) the University’s requirements pertaining to courses in subjects other than science.

CORE COURSE SEQUENCE IN GEOLOGY

The geology courses that are required form an integrated core course sequence totaling a maximum of 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</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sophomore Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geol. 1. Interpreting the Earth</td>
<td>W,S</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 2. Earth History</td>
<td>A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 3. Earth History Lab</td>
<td>A</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Geol. 80. Rocks and Minerals</td>
<td>S</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 102. Introduction to Field Geology</td>
<td>Sum</td>
<td>3</td>
<td></td>
</tr>
</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

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 151. Crystal Chemistry and Mineralogy</td>
<td>A</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 163. Optical Mineralogy</td>
<td>W</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 151. Sedimentary Geology and Petrology</td>
<td>W</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 151L. Introduction to Sedimentary Petrography</td>
<td>W</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Geol. 110. Structural Geology</td>
<td>S</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 152. Stratigraphy and Paleocology</td>
<td>S</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 103A, B. Advanced Field Geology</td>
<td>Sum</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

(Required basic science and mathematics courses can be completed during this year. Room available for electives from list of choices below.)

Senior Year

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 181. Igneous Petrology</td>
<td>A</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

(Room available for electives from list of choices below during this year.) 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.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 143. Principles of Paleontology</td>
<td>W</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 171. Introduction to Geochemistry</td>
<td>A</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 182. Metamorphic Petrology</td>
<td>S</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 193. Statistics in Geology</td>
<td>W</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 120. Introduction to Ore Deposits</td>
<td>A</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geophys. 150. Plate Tectonics</td>
<td>W</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics</td>
<td>A</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>or Geophys. 180. Geologic Interpretation of Seismic Reflection Records</td>
<td>W</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. For students who wish to complete the requirements for calculus and analytic geometry in three quarters: Mathematics 41, 42, 43</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. For students who wish to cover the same subjects in five quarters: Mathematics 19, 20, 21, 22, 23</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 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) | 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)

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)

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 elective units afford an opportunity to acquire substantial strength in one or more of the many subdisciplines in geology and allied earth sciences at the undergraduate level. Alternatively, elective units can be utilized to complete requirements for a teaching credential or to acquire depth in a discipline outside the earth sciences such as civil engineering or marine biology. Appropriate electives, which are in accord with the interests of a student, can be selected in conference with the advisor. There are no constraints on elective courses, and they may be taken in the Department of Geology or any other department of the University.

All courses numbered in the 100's and 200's are open to qualified undergraduate students. The number of courses offered within a given subdiscipline of Geology commonly exceeds the number of elective units available to a student.

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

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

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. Laboratories and analytical facilities are available for research in various branches of geology, including mineralogy, metamorphic petrology, igneous petrology, volcanology, mineral deposits, geochemistry, geological archeology, groundwater geology, marine geology, paleontology and micropaleontology, palynology, petroleum geology, photogeology, rock mechanics, sedimentology, stratigraphy, and structural geology.

Course programs in the areas of faculty interest can be 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.
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 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—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. 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 teaching assistant for at least one course.
4. The student must file for candidacy by the last day in the quarter preceding the degree quarter.
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; 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 department requirements:

1. The student must successfully complete the courses that form his or her individualized academic program. The requirements include a minimum of four courses of at least three units each from four different faculty members in the School of Earth Sciences at Stanford. University rules require a minimum of 36 unduplicated units for the degree.
2. The student must serve as a teaching assistant for at least one quarter course.
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 depart-
ment 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

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

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

1. Interpreting the Earth—Introduction to and survey of the physical and chemical processes, 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. Consider 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)

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, 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. No prerequisites. Students intending to major in Geology must take Geology 3 (Earth History Laboratory) 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: Geology 2, which may also be taken concurrently. Recommended for all students taking Geo-2; required for Geology majors who took Geo-2 in 1985-86 or later. Mandatory P/NC grading.

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. 3-17

103A, B. Advanced Field Geology — This course provides an opportunity of junior- and senior-level students to become involved in a substantial field investigation of professional scope and assumes familiarity with elementary techniques of field mapping and a proficiency in basic geologic concepts. The aim of the course is to provide an in-depth exposure to independent analysis of relatively complex geologic problems in the field and the presentation of research results in the form of a professional geologic report. The course is conducted from a tent camp at one or more localities in the western states and involves a coordinated field study 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 lithologic features; conducted from a field camp in California or Nevada. Credit for 103A requires completion of 103B.

8 units (Miller) June 16-Sept. 1

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

4 units (Miller) June 16-Sept. 1

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

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

110. Structural Geology—Introduction to how and why rocks deform and mountains are built. Emphasis is on the geometry, style, and mechanisms of folding and faulting and the stereographic projection and analysis of structural data. Some lab sessions involve the study of faults and folds in the field (all day Thursday or Saturday) others are at Stanford (Thursday afternoon or evening). One week-end long field trip, if offered, is required. Prerequisite: 1 and 102 or consent of instructor.

5 units, Spr (Miller) MWF 9
plus field lab Th or Sat

119. Geoarchaeology: the evolution of Landscape and Civilization in the Aegean—(Same as Classics 119) Nature offers us survival options according to our economic, social, and psychological conditions and prejudices. People modify the landscape by their intensive or cavalier use, or by over-exploitation. Lessons for the present and the future can be learned by studying past interactions between man and landscape, and their consequences. Using the prehistory and history of Greece and the Aegean, course explores the impact of man on landscape and landscape on man, with special regard to geomorphic processes, soil formation, alluviation, coastal changes, and climate, attempting to draw conclusions regarding the interdependence of rural economics and geomorphology, and bringing reconstructions of the ancient landscape to bear on our understanding of our past. No prerequisites; course is open to all undergraduates.

3 units, Spr (van Andel, Munn) TTh 2:15-4

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

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

150. The Oceans: An Introduction to the Marine Environment—The course provides an introduction into the science of oceanography including the nature of sea water, the interplay between circulation of the oceans and atmosphere, the tides, waves, sea floor topography, and history of the major ocean basins. Particular attention is paid to the interface between continents and ocean basins: beaches, estuaries, and the continental shelves. Lectures and discussions include a broad view of the biology of the oceans emphasizing the sympatric interaction between the distribution of inorganic constituents, oceanic circulation, and biologic productivity. The course closes by examining real and potential marine resources together with attendant legal conflicts. Lectures, occasional demonstrations and one coastside field trip required. (DR:7)

3 units, Win (Ingle) MWF 11;
demonstrations, and field trips by arrangement; alternate years, given 1986-87

151. Introduction to Sedimentary Facies—Inquiry into depositional systems. Topics explored
include grain size analysis, origin of bedding and sedimentary structures, origin of sedimentary facies. Siliciclastic depositional systems and environments studies include alluvial, fluvial, eolian, deltaic, nearshore, shelf, deepsea. Summary of carbonate deposition: reef models, tidal flats and shelves, evaporites and deepsea. Three field trips, one with write-up, are required. Students desiring a more complete understanding of sedimentary geology are urged to take 151L concurrently. Prerequisites: 1, 2.

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

151L. Introduction to Sedimentary Petrography—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 sedimentary particles, introduction to point counting, tectonics and sandstone composition, cementation and diagenesis, thermal maturation. 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 variations of modern and ancient biofacies and lithofacies are traced in time and space. Concepts of biostratigraphy, stratigraphic techniques and correlation are interwoven with discussions of the dynamics of the marine ecosystem, basin analysis, and paleoceanography. 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—Course to provide familiarity with polarizing microscope to study rocks and minerals. It covers fundamental principles of optical properties and systematic study of common rock-forming minerals. Prerequisites: 161.

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

171. Introduction to Geochemistry—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, stable and radiogenic isotopes and the distribution and transport of elements by geologic processes. Prerequisites: 102, 161, and Chemistry 135.

4 units, Aut (Bird) MWF 9

175. Solution-Mineral Equilibria: Theory—This course will develop 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 placed on the generation and utility of phase diagrams depicting solution-mineral equilibria relevant to 1) phase relations associated with diagenetic, hydrothermal and metamorphic processes, and 2) 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.

3 units, Win (Bird) MW 2-3:30

181. Igneous Petrology—Origin of igneous rocks, emphasizing magmatic differentiation processes displayed in the chemistry of volcanic rocks. Subjects covered will 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 classifica-
tion schemes. Course is 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) TWTh 8 lab TTh 1:15-4:05

182. Metamorphic Petrology—Genesis of metamorphic rocks and the imposed physico-chemical conditions for their formation. Topics covered will include textures and structures of metamorphic rocks, chemistry, paragenesis and phase relations of metamorphic minerals, metamorphic reactions, role of oxygen fugacity and mixed volatiles in metamorphic recrystallization, metamorphic belts, ocean-floor and subduction zone metamorphism. Laboratory exercises include petrographic study of common metamorphic rocks. Prerequisite: 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 pyroclastic flows and characteristics of resulting deposits; classification of volcanic landforms and their relation to the composition and physical properties of the magma; characteristics of magma chambers; volcanic gases; eruptive histories of volcanic centers. To obtain the full benefit of this course, it is recommended that Geology 185L be taken concurrently. One four-day field trip is required. Prerequisite: 80 or its equivalent.

3 units, Spr (Mahood) MWF 11 alternate years, given 1986-87

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. Prerequisites: 163 is required; 181 is helpful but not required.

1 unit, Spr (Mahood) W 1:15-4:05 alternate years, given 1986-87

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 will be reviewed, as will the theory behind and the use of geothermometers and geobarometers. The basic principles and mechanisms that control trace element behavior will be discussed. Solution models, which allow the prediction of solid-melt phase equilibria will be introduced. Laboratories will 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—Course explores 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 one-day field trips are required on weekends. Prerequisites: 151, 152 or equivalent background.

3 units, Spr (Clifton) M 11-12, T 11-1

230. Hydrogeology—Theory of underground water, analysis of field data and pumping tests, geologic groundwater environments, solution of field problems, groundwater modeling. Prerequisites: 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 1985-86

244. Advanced Micropaleontology—Discussion and practice in use of marine microfossils
250. Ocean Basins—Physiography, tectonics and sedimentation of the modern and ancient ocean with emphasis on familiarization with the current Maine 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 Geology 251. Prerequisites: 1, 150, or consent of the instructor.

3 units, Aut (van Andel) MWF 9

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; causus and effects and the role of transgressions and regressions in geological history problems in the utilization of continental margins; politics and management of continental margin research, exploration and exploitation. A term project is required. Prerequisites: 1, 150 or consent of the instructor. 151 recommended.

4 units, Aut (van Andel) MWF 9

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. Emphasis is placed on sandstones of all kinds including calcarenites, but limited study of volcaniclastic rocks, lutes and cherts, phosphorites, ironstones, evaporites, and carbonate rocks is included. Prerequisites: 151L.

2 units, Spr (Larue) TTh 9

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)

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

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

1 or 2 units, Aut (Larue)

256. Rock Forming Minerals—Systematic examination of the structures, chemistry, physical properties, and paragenesis of the major rock forming silicates and related mineral groups. Review of the properties and structures of silicate melts and glasses with an introduction to crystal growth from the melt. Discussion of mineral geothermometry and geobarometry. Laboratories will be concerned with crystal chemical principles and current theories of chemical bonding as applied to minerals, with measurement of basic physical properties, and characterization of minerals by powder x-ray diffraction and infrared techniques. Several labs will also be devoted to basic hand specimen identification.

4 units, Win (Brown) TTh 10

264. Techniques in X-ray Fluorescence—Course designed to accommodate students requiring an introduction or a more advanced
knowledge of modern fluorescence instrumentation and associated computing available to earth scientists at Stanford. Course will emphasize proper and efficient instrument use and accepted techniques in data interpretation. Students will learn to use all of the data collection and reduction software available, including wavelength scanning, qualitative to quantitative analysis, instrument calibration, matrix corrections, fundamental parameters, and the statistics of precision for counting and analysis.

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

275. Solution-Mineral Equilibria: Research Applications—Individual research projects associated with thermodynamic analysis of phase relations in experimental and/or geological systems with emphasis on reactions among aqueous solutions and minerals. To be taken concurrently with 175.
4 units, Win (Bird) MW 2-3:30

278. Organic Geochemistry—Course unites aspects of geology and chemistry in study of origin and occurrence and fate of organic materials in geological environments. Principles of organic geochemistry are applied to sedimentology, paleontology, petroleum geology, and environmental science. There are no formal prerequisites although introductory courses in geochemistry and organic chemistry are helpful.
2 units, Win (Kvenvolden) TTh 4:15

280. Rock Sampling Preparation—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 (Mahood) F 1:15-4:05
alternate years, given 1985-86

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

293. Applications of Probability and Statistics in Geology—A variety of techniques will be presented along with their applications to geological problems. Students will then be expected to offer critical reviews of selected published research papers with respect to the appropriateness and correctness of statistical usage. Prerequisite: 193 or consent of instructor.
3 units, Spr (Switzer) TTh 11-12:15
alternate years, given 1985-86

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 VG ESCALAB Mk II at Stanford's Center for Materials Research. Class size limited. Prerequisites: consent of instructor.
3 units, Aut (Hochella) M 10
lab by arrangement

317. Advanced Field Mapping—Ten to fourteen days mapping in 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 Marine Geology and Geophysics—Advanced level discussion of current research problems in the tectonics, sedimentation and history of the ocean basins. Topics for discussion will be selected where possible with the advice of prospective participants.
2 units, Spr (van Andel) by arrangement

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

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

371. Seminar in Geochemistry.
1 unit, Win (Staff) by arrangement.

381. Seminar in Igneous Petrology-Volcanology
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 and Coleman)
by arrangement alternate years, given 1986-87

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 Paleoeocology.
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 Paleoeocology.
455. Research in Oceanography.
469. Research in Mineralogy.
479. Research in Geochemistry.
489. Research in Petrology and Volcanology.
499. Research in Geomathematics.

GEOPHYSICS

Chairman: George A. Thompson
Professors: Jon F. Claerbout, Allan V. Cox, Robert L. Kovach, Amos M. Nur, Norman H. Sleep, George A. Thompson, Mark Zoback. Affiliated: Tjeerd H. van Andel
Assistant Professors: Robert J. Geller (on leave 85-86), Michael O. McWilliams
Professor (Research): Zvi Ben-Avraham
Consulting Professors: David M. Boore, Cecil Green, Walter Mooney, William Ostrander, Carl Wentworth
Lecturer: Andrew Michael
Research Associates: Rosemary Knight, Dale Morgan
Visiting Research Scholar: Richard Ottolini

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 Wattis Mitchell Earth Sciences Building and the Salvatori Laboratory of Geophysics. The department has a number of research facilities among which are a rock-magnetism laboratory, several large scale 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, paleomagnetic investigations of regional tectonics, behavior of the geomagnetic field, free oscillation and surface wave studies, and major research programs in reflection seismology and experimental and theoretical rock physics. Graduate programs lead to the degree of Master of Science and Doctor of Philosophy.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

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

The following course requirements for the degree of Bachelor of Science in Geophysics are in addition to the University requirements in general studies. A written report on original research or an honor’s thesis is also required. Normally, this will be undertaken as part of the student’s participation in three quarters of Research Seminar (Geophysics 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
9 units of Geophysics chosen from the list below.
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

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

Requirements for the Degree—The candidate must fulfill the following requirements:
1. Be registered in the graduate school for at least three quarters.
2. Complete 45 units with at least a B average. At least 6 of these units must be independent work on a research problem, resulting in a written report accepted by the candidate’s faculty advisor. Normally this research will be undertaken as part of the candidate’s participation in three quarters of Research Seminar (Geophysics 385, Sections A, B, C, D, E, F, G, H, J).
3. Make up deficiencies in previous training. Not more than 10 units of such work may be counted as part of the minimum total of 45 units. Background in field geology should be at the level of Geology 103A and 103B.

Students who do not meet the standard course requirements (see undergraduate curriculum) but who have unusual competence in other areas, such as environmental geophysics or space physics, may petition the geophysics faculty to arrange individual programs.

MASTER OF SCIENCE IN EXPLORATION

Objectives—To provide the theoretical background needed for a career in petroleum exploration geophysics. The program takes four quarters, beginning and ending in the Autumn Quarter, and in addition includes a 2-week field geology course given just before registration in the Autumn for students entering without an equivalent course. 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

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

**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

**Spring Quarter**
- A.E.S. 253. Petroleum Geology and Exploration 3
- Geol. 80. Rocks and Minerals 5
- Geol. 110. Structural Geology 5
- Geophys. 284. Reflection Seismology I 3

**Second Year**

**Autumn Quarter**
- 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

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, 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 one academic quarter) is required for the Ph.D. degree. The student must pass the departmental written qualifying examination which is given annually in January, by his or her second year; pass the Departmental Oral Exam by presenting and defending a written research paper or proposal by the end of the second year; fulfill the requirements of the minor department, if a minor is elected; 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 Univer-
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. Pre-requisites: Geology 1 or 2; Recommended: Geophysics 150, Geology 110 and Physics 53.

3 units, Spr (McWilliams) by arrangement alternate years, given 1984-85

**111. Introduction to UNIX**—Lectures designed to familiarize student with UNIX operating system. Topics include: overview of system commands, filing systems, creating and editing text files, and simple programming. Assignments on department computers provide an opportunity for practical application of class material. Limited enrollment.

1 unit, Aut (McWilliams) TTh 12

**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 (Staff) MTTh 1:15

**180. Geologic Interpretation of Reflection Seismograms**—Elementary principles of reflection seismology, seismic data processing, and field operations, including field trip to an operating crew (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) 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 (Staff) 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. Enrollment limited to Geophysics undergraduates and coterminal master candidates. Prerequisite: consent of instructor.

1 unit, Win (Staff) by arrangement

**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

**185C. Research Seminar: Seismology**—Current research in seismology, seismicity, and earthquake source mechanisms. Emphasis on use of wide angle seismic reflection and refraction data for crustal structure studies.

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

185G.H. Research Seminar: Earthquake Seismology and Global Tectonics—Current research in paleoseismology, rock magnetism, global and regional tectonics.

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

185J. Research Seminar: Paleomagnetism and Tectonics—Current research in paleomagnetism, rock magnetism, global and regional tectonics.

2 units, Aut, Win, Spr (Kawakatsu, Kroeger and Sleep) by arrangement


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

185L. Research Seminar: Seismotectonics—Research using seismic reflection and other types of geophysical data to understand structure and processes in seismically active areas.

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

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). A five day fieldtrip immediately precedes the Autumn quarter, for data collection. Students engage in all phases of 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

191A. Geophysical Field Techniques—Field investigations as in Geophysics 191 supplemented with lectures and classroom exercises on the quantitative interpretation and inversion of electrical and electromagnetic prospecting data. Suggested for geophysics majors. Prerequisite: Geophysics 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 unsolved problems, including the formation of the planets and their thermal histories.

3 units, Spr (Sleep) TTh 10-11:30 alternate years, given 1985-86

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 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

276A,B. Advanced Seismology—Techniques of seismology to determine earthquake source mechanisms, necessary theory will be covered but the emphasis will be on current applications and techniques, including programs currently available at Stanford and at the USGS. A hands on approach will be taken 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: Geophysics 174, Geophysics 111.

276A. 3 units, Win (Michael)
   by arrangement

276B. 3 units, Spr (Michael)
   by arrangement

284. Reflection Seismology I—Imaging the earth's interior. Extrapolation of wave fields through 2-D inhomogeneous 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 dislocaton theory to faulting and the earthquake cycle, and the state of stress in the crust. Recommended: Geophysics 262, AES 280.

3 units, Spr (Zoback and 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

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 (Claerbout)
   by arrangement

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

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

385D. Research Seminar: Rock Physics—Research in areas of current interest in rock mechanics, reservoir geophysics, and related problems. Content varies 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 (Kawakatsu, Kroeger and Sleep)
   by arrangement

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

385K. 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

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

387. 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 (McWilliams)
F 3:15

388. Seminar—See Geology 351 for details.

2 units, Win, Spr (van Andel)
by arrangement

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

2-4 units, any quarter (Staff)
by arrangement

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

PETROLEUM ENGINEERING

Emeriti: (Professor) Frank G. Miller, (Consulting Professor) Marshall B. Standing
Chairman: Henry J. Ramey, Jr.
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 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
- Well and Property Economic Evaluation
- Reservoir Engineering
- Well Test Analysis
- Reservoir Simulation
- Well Logging and Log Analysis
- Enhanced Oil Recovery
- Natural Gas Engineering
- Geothermal Energy Production
- Water Production and Reclamation
- Pipeline Transportation
- Environmental Engineering

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 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.

LABORATORY 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 Technology (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 essentially the same as 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 breadth</td>
<td>36 (min)</td>
</tr>
<tr>
<td>Engineering depth</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>110</td>
<td>Structural Geology for non-Geology majors</td>
<td>3</td>
</tr>
<tr>
<td>150A</td>
<td>Well log analysis-I</td>
<td>3</td>
</tr>
<tr>
<td>150B</td>
<td>Well log analysis-II</td>
<td>1</td>
</tr>
<tr>
<td>151A</td>
<td>Earth fluids</td>
<td>3</td>
</tr>
<tr>
<td>151B</td>
<td>Fluid flow in porous media</td>
<td>3</td>
</tr>
<tr>
<td>151D</td>
<td>Reservoir fluids laboratory</td>
<td>3</td>
</tr>
<tr>
<td>151E</td>
<td>Core analysis laboratory</td>
<td>3</td>
</tr>
<tr>
<td>152A</td>
<td>Drilling technology</td>
<td>5</td>
</tr>
<tr>
<td>152B</td>
<td>Production technology</td>
<td>3</td>
</tr>
<tr>
<td>152C</td>
<td>Drilling fluids</td>
<td>3</td>
</tr>
<tr>
<td>160</td>
<td>Report on energy industry training</td>
<td>1</td>
</tr>
<tr>
<td>170</td>
<td>Elements of reservoir engineering</td>
<td>3</td>
</tr>
<tr>
<td>171</td>
<td>Reservoir simulation fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>172</td>
<td>Gas engineering</td>
<td>3</td>
</tr>
<tr>
<td>175</td>
<td>Well Test Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Math 19, 20, 21, 22, 23, 44, and 130</td>
<td>Calculus and differential equations</td>
<td>3 ea.</td>
</tr>
<tr>
<td>Chem 31, 33, and 135. Basic Organic and Physical Chemistry</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Physics 51 and 53-Mechanics, Electricity and Magnetism</td>
<td>4 ea.</td>
<td></td>
</tr>
<tr>
<td>Geol. 1, 2, 151-Earth interpret, History, Structure, Sedimentology</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Engr. 3, 11, 21, 32, 161-Mechanics, Stress, Thermodynamics, Economics</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>C.S. 106-Introduction to Structured Programs</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
Selected courses often taken as electives include: Applied Earth Sciences 251 and 253; and 193; Geophys. 180; Ind. Eng. 133, 161; Engr. 44, 50, 102, 103; Physics 55; Pet. Engr. 173, 180, 190, 267; Stat. 110; Mech. Engr. 103 and 250; Math 113, 131, 132; Comp. Sci. 135; and Chem. Engr. 110, 140, 150, and 160.

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 must take the Graduate Record Examination (GRE) before action will be taken on the application. 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 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 a faculty member.

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. Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 200A. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 200B. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270A. Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270B. Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 271A. Reservoir Simulation Theory</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 271B. Advanced Reservoir Simulation</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 274. Introduction to Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Electives†</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
</tr>
</tbody>
</table>


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

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

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 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 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 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>
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</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 200A. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 200B. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270A. Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270B. Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 271A. Reservoir Simulation Theory</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 271B. Advanced Reservoir Simulation</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 274. Introduction to Research Methods</td>
<td>3</td>
</tr>
<tr>
<td>Electives†</td>
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</tr>
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<td>Total</td>
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</tr>
</tbody>
</table>


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

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

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.

### BUS 210-211. Accounting I and II 4 ea.

### BUS 220. Business Finance I 4

### BUS 261. Decision Making under Uncertainty 4

### BUS 270. Organizational Behavior 4

### BUS 290. Strategic Management 4

### BUS 321. Investment Management 4

### BUS 351. Negotiation and Intervention 4

### BUS 352 Small Business Management 4

### I.E. 270. Managing Technical Companies 4

### BUS 397. Business and the Law 4

Additional units needed to make up the required 90 may be electives. The student must secure at least "Pass" grades in Graduate School of Business courses. In all other courses the student must maintain a "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 of course work including credit for research (Petroleum Engineering 360) beyond the 45 units required for the master's degree. Approximately 65 units are generally required, exclusive of research units. The 65 units in question should represent graduate courses in petroleum engineering offered at Stanford, plus courses picked from the following list, and other courses approved by the department.

### MATH AND APPLIED MATH

| Math. 106. Introduction to Theory of Functions of a Complex Variable | 3 |
| Math. 113. Linear Algebra and its Applications | 3 |
| Math. 114. Linear Algebra and Matrix Theory | 3 |
| Math. 115. Fundamental Concepts of Analysis | 3 |
| Math. 131. Partial Differential Equations—I | 3 |
| Math. 132. Partial Differential Equations—II | 3 |
| Mechanical Engineering 201. Applications of Complex Variables | 3 |
| Stat. 110. Statistical Methods in Engineering and Physical Sciences | 4 |


Comp. Sci. 106. Introduction to Structured Programming

Comp. Sci. 135. Numerical Methods


Comp. Sci. 234. Numerical Methods of Optimization


Aero. & Astro. 192. Vector Analysis and Cartesian Tensors


Aero. & Astro. 291A and B. Linear Transforms and Their Applications to Engineering Problems I and II 3 ea.

### SCIENCE

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

### ENGINEERING

| Chem. Engr. 140. Fluid Mechanics | 3 |
| Engr. 287. Methods and Experiences in Engineering Education | 3 |
| Engr. 298. Seminar in Fluid Mechanics | 1 |
| Mech. Engr. 250. Introduction to Heat Transfer | 4 |
| Mech. Engr. 252A. Convective Heat and Mass Transfer | 3 |

The Ph.D. program is normally a 4-year program. Except in unusual circumstances, the first year is consumed in fulfilling the requirements for the M.S. degree. During the second and third years, the student acquires a minimum of 65 units of credit in courses approved by the departmental faculty. Experience as a teaching assistant (quarter-time for at least one academic quarter) is required for the Ph.D. degree. During the second and third years, the student also completes a minimum of 25 units of research. The student begins the research work by making a literature survey and by formalizing research objectives. The fourth year the student spends full time completing research and writing the dissertation.

The departmental qualifying examinations usually are taken at the beginning of the second year of graduate study, or at any time mutually.
agreed upon by the student and the faculty. The qualifying examinations extend over a period of about ten days and consist of a written part and an oral part. The written part consists of three or four two-hour examinations on different subjects. The oral part is a two-hour examination in which the student is questioned by members of the departmental faculty.

The student’s record must indicate outstanding scholarship. The student must pass the departmental qualifying examination; fulfill the requirements of the minor department, if a minor is elected; and pass the University oral examination, which is essentially a defense of the dissertation problem. The student must prepare 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.

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 solar energy. (DR:8)
3 units, Aut (Horn) MWF 9 and 11 Spr (Horn) MWF 9 and 11

110. Structural Geology for Non-Geology Majors—Similar to Geology 110 with emphasis on interpretation, construction and use of geologic maps and cross sections. Regional tectonic styles and their structural interpretations. A required field trip.
3 units, Spr (Little) 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.
3 units, Aut (Ellis)

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.
1 unit, Win (Lindblom) W 7-10

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)

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 lab TTh 2:15-5:05

152A. Drilling Technology—A course designed to provide a comprehensive picture of modern drilling operations, practices, and equipment both onshore and offshore. Lectures, field trips, problems. Graduate students may register for 3 units.
5 units, Win (Horn) TTh 10-11:50

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

3 units, Aut (Castanier) MW 2:15
lab MW 2:15-5:05

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) by arrangement

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

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


1 unit, any quarter (Staff) by arrangement

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

3 units, Spr (Ramey) MWF 11

alternate years, given 1985-86


3 units, Aut (Staff) MWF 9


Prerequisite: 270A.

3 units, Win (Sageev) MWF 10


3 units, Spr (Horne)

alternate years, given 1985-86
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 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

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


3 units, Aut (Marsden) MWF 10


3 units, Win (Dykstra) by arrangement


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


3 units, Spr (Orr) by arrangement


3 units, Spr (Horne) alternate years, given 1986-87

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.

3 units, Spr (Marsden) MWF 9 alternate years, given 1986-87

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

3 units, Spr (Marsden) MWF 9 alternate years, given 1985-86

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

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

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


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

285C. Research Seminar: Geothermal Reservoir Engineering—Current research in
the Stanford Geothermal Program and other extra-Stanford programs. Presentation required.

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, Horn) 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

Dean: J. Myron Atkin
Associate Dean: Hans N. Weiler (Academic Affairs)
Assistant Dean: Eleanor Worden (Admissions and Financial Aid)

Professors: Paul Brest (by courtesy), Edwin M. Bridges, Robert C. Calfee, Martin Carnoy (on leave, Win, Spr), Elizabeth G. Cohen, Arthur Coladarci, Sanford M. Dornbusch (by courtesy), Elliot W. Eisner, Nathaniel L. Gage, Richard E. Gross, Shirley Heath (on leave, 1985-86), Robert D. Hess, Alex Inkeles (by courtesy), Michael W. Kirst, John D. Krumboltz, Henry M. Levin, James G. March (by courtesy), Lewis B. Mayhew, John W. Meyer (by courtesy), Ingram Olkin, Denis C. Phillips (on leave, Aut, Win), Robert L. Politzer (on leave), Helen W. Schrader (by courtesy), W. Richard Scott (by courtesy), Lee S. Shulman, Alberta E. Siegel (by courtesy), Richard E. Snow, Herbert Solomon (by courtesy), Patrick C. Suppes (by courtesy), Robert B. Textor (teaching overseas, Aut), Carl E. Thoresen, David B. Tyack, Hans N. Weiler

Associate Professors: Arthur Applebee, Michael Bratman (by courtesy), Larry Cuban, Milbrey McLaughlin, Nel Noddings (on leave Spr, Sum), David Rogosa, Joel Samoff, Derek Sleeman, Pamela L. Strathairn (by courtesy), Myra H. Strober, Decker F. Walker

Associate Professor (Research): Judith Langer
Assistant Professors: Beatriz Arias (on leave, Aut, Win, Spr), Martin Ford, Michael Garet, Edward Haertel, Joan E. Talbert

Lecturers: Ray Bacchetti, Patrick Brady, Ronald B. Herring, Robert P. Huff, James W. Lyons, Douglas P. Murray

Acting Assistant Professor: David Grossman
Visiting Professor: Robert Arnowe

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.

Acceptance of Work Done Elsewhere—Students transferring with advanced or graduate standing from other universities may have some equivalent training accepted in lieu of the courses required at this University for degree programs.

The University offers no correspondence or extension courses.

SUMMER SESSION

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

The Summer Session Bulletin, issued each year in February, contains more 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. Applicants must take the general test of the Graduate Record Examination. 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 Petitions for Admission to the Coterminal Degree Program from the School of Education or the Graduate Program Office. They must submit a statement of purpose, a transcript, two letters of recommendation from members of their undergraduate department, and yearly coterminal program sheets.

**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 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 (Aptitude 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, Secondary Education, Teacher Education)
  - Language, Literacy and Culture (Bilingual/Bicultural Education; Second Language Education; Writing, Reading and Language-English)
  - Physical Education with Specialization in Dance
- Social Sciences in Education
- Gender Studies
- Stanford Teacher Education Program*

Other program areas may be arranged for individual graduate applicants when approved by the relevant administrative committee. Ordinarily candidates for the master's degree in the Curriculum and Teacher Education area will have completed student teaching or another practicum, or have one year or more of teaching experience before entering the master's program.

More detailed information about the Master

* 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.
of Arts programs and requirements in specific areas may be obtained from the Admissions Office, School of Education.

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.

NOTE: Application for candidacy for the A.M. degree must be filed with the Degree Program Office no later than two weeks before the last day of class of the quarter preceding the quarter in which degree conferral is expected.

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. General requirements for the degree are as follows:

1. The applicant must have completed a bachelor's degree with an acceptable grade

* 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.

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. The applicant must have teaching experience.

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

4. A minimum of 45 quarter units of graduate study. 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.

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

6. At least 12 units of the A.M.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.)

7. Requirements in the major teaching field are determined by the major department, and the program of professional courses by the School of Education. Both the preliminary plan of study and the application for candidacy for the degree must be signed by a representative of the academic department and of the School of Education.

8. The candidate must achieve at least a "B"
average in approved Stanford courses in the teaching subject and in professional education, or grades in these courses equivalent to those required for the academic department's Master of Arts degree.

9. Approved general background courses outside of the teaching field and professional education may be used to satisfy some of the unit requirements for the degree.

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

NOTE: Application for candidacy for the A.M.T. 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.

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, or from the Director of the Program.

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 Curriculum and Teacher Education with specialization in any of the following fields:

Art Education
Design and Evaluation of Educational Programs (General Curriculum, Curriculum
Evaluation, Elementary Education, Secondary Education, Teacher Education
Language, Literacy and Culture (Bilingual/Bicultural Education; Second Language Education; Writing, Reading and Language — English)
Social Studies Education
*International Development Education (SIDEC)
*Mathematical Methods in Educational Research
*Psychological Studies in Education, with concentrations in:
  Child Development and Early Education
  Counseling Psychology (Health Psychology)
  Educational Psychology
*Social Sciences in Education, with concentrations in:
  Anthropology of Education
  Economic Studies in Education
  History of Education
  Philosophy of Education
  Political Studies in Education
  Sociology of Education
  Social Sciences in Education (interdisciplinary)

For each of the six general program areas there is a corresponding Area Committee.
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" under "Dean of Graduate Studies and Research" in 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 administrative committee.

Information about requirements in specific program areas may be obtained from the Admissions Office, School of Education, or from the secretary to the relevant Area Committee.

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 con-
duct research as faculty members of colleges or universities.

**Residence**—Nine full tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the doctorate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. (See sections on ‘‘Advanced Degrees’’ and on ‘‘Nonmatriculated Graduate Study’’ in this bulletin.) 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 nonmatriculated study may be counted toward the residence requirement for this degree.

Application for formal admission to candidacy for the Ph.D. degree should be made no later than the sixth quarter of graduate study at Stanford. Admission to candidacy is granted by the University Committee on Graduate Studies and expires five years from the end of the quarter in which the candidacy is established.

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

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

**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, to have fundamental grounding in certain foundation fields, 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.

All California institutions must have their credential programs reviewed and approved by the State in 1985. At the present time, Stanford’s credential preparation in educational administration is limited to the Preliminary Administrative Services Credential.

As of Spring 1985, 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 assure 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 as a graduate student 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 Teaching Credential those students who complete the Stanford Teacher Education Program. This program is described below.

STANFORD TEACHER EDUCATION PROGRAM (INTERNSHIP)

The Stanford Teacher Education Program (STEP) is a twelve-month, fifth-year program which leads to a California Single Subject Teaching Credential and the Master of Arts degree in Education. It begins in June with a Summer Quarter of intensive preparation in the process of teaching and experiences in summer programs in nearby schools. During the academic year, students take courses in their academic fields and in professional education; they also teach part time in local schools. Stanford offers training for the credential in the following areas: Art, English, a Foreign Language (French, German, Latin, Spanish), Mathematics, a 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 but now seek to prepare to teach, as well as recent graduates, are encouraged to apply. The number of candidates who can be admitted to prepare in a particular subject area is limited by the facilities of the University and by the number of school assignments available in that subject field.

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

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

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

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

Requirements—To qualify for the clear 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.

An intern teacher must be credentialed during the STEP training year. Therefore, knowledge of subject matter should be verified by one of the above methods before the start of an internship in September.

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 health and special education.

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, reading, work in computers, curriculum and instruction and teaching internship.

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

COURSES IN OTHER DIVISIONS OF THE UNIVERSITY

Teachers, administrators, and specialists in other areas of education are expected to have a substantial knowledge of a variety of academic fields outside the areas encompassed by professional education. Students are therefore urged to consider the courses offered in other divisions of the University in planning their programs.

COURSES IN EDUCATION

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

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

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

"S" suffix denotes a Special Course, given only once, by the School of Education. It is not included as a regular offering. This designation is intended particularly for courses taught by visiting faculty and those dealing with important but transitory subjects.

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 (Stone) 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.

2-3 units, Aut, Win, Spr (Stone) 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. (SSE)

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

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 (J. Krumboltz) alternate years, given 1986-87

132S. Seminar in Cross-Cultural Counseling —(Same as Psychology 131.) 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 appropriateness, bicultural competence, and clinical efficacy with ethnic minority groups. (PSE)

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

134. Counseling for Career Planning—Methods for helping other people learn career decision-making procedures; alternative theories of career choice; information sources for generating alternatives and estimating probable outcomes. (PSE)

3 units, Aut (J. Krumboltz) alternate years, given 1986-87

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

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

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 conventions. 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 units, Aut (Huebner) TTh 2:15-4:05

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)

4-5 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.

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

by arrangement

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 (Cohen)

alternate years, given 1986-87

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.

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

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

any quarter (Staff) by arrangement

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

any quarter (Staff) by arrangement

192. The Anthropology of Play—(Same as Anthropology 154.) Introductory course of lectures on anthropological perspectives on play. First half surveys the social psychological literature for understanding the role of play in shaping cognitive development, images of adult roles, and developmental performance. An historical examination of play will identify concepts of childhood and societal correlates of varying definitions and norms of play. Second half examines play in cross-cultural contexts and focus on paradigms of pretense. Final section reviews educational and social policy issues in the uses of play. (IDE, SSE)

3-5 units, Win (Heath) MWF 9-10

alternate years, given 1986-87

195. An Introduction to Africa Through Film: Tarzan, Terri, and Liberation — The images of Africa that reach American audiences are dominated by a vision of primitive backwardness (Tarzan), armed conflict and terrorists (Terry), and the struggle for self-determination...
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)
3-4 units, Win (Gross) TTh 1:15-3:05

201. History of Education in the United States — (Same as History 158.) Analysis of selected turning points in education in relation to such topics as religion, political socialization, race relations, immigration, and urbanization. (SSE)
3 units, Win (Tyack) MW 12:00
and by arrangement

202. Social Science: Teachers and Schools—This course is 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 specialties. (SSE)
4-6 units, Spr (Cohen) MW 1:15-6:05

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)
4 units, Spr (Phillips) MW 9-11

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 philosophical material will be presented in the context of issues concerning the curriculum. (SSE)
4 units, Spr (Phillips) MW 3:05-5:15

205. Ideology and Education—Analysis of the concept of “ideology” as it has been developed in critical social theories from Marx to the present. Focus critical attention on the claim that all education is ideological and political. The second half of the course will be used for comparative case studies of ideology and education in several distinct national contexts, especially those Third World countries whose leaders have reiterated their commitment to radical social transformation. No prerequisites. (IDE, SSE)
4 units, Win (Staff) alternate years, given 1986-87

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 (Carnoy) 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 (Arias) W 2:15-4:05

207X. International Cooperation in Education Development — (Same as Political Science 24B.) Critical review of current policies, priorities, and practices an 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)
4 units, Spr (Weiler) alternate years, given 1986-87

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)
3 units, Aut (Eisner) MW 10-12

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 (Eisner) MW 10-12

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. No formal prerequisites; previous Third World course work and/or professional experience and familiarity with Education 306A-D topics helpful. (IDE)

4 units, Win (Samoff)
alternate years, given 1986-87

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

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

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

4 units, Spr (Phillips)
alternate years, given 1986-87

212. Practicum in Ethnographic Futures Research—(Same as Anthropology 269.) Instruction 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. No prerequisites, but 287 is recommended. (IDE, SSE)

4 units, Win (Textor)
alternate years, given 1986-87

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

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, Spr (Staff) by arrangement

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

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

216X. Cognitive Behavior Modification—(Same as Psychology 361.) Examines assumptions and issues of cognitive behavioral interventions. Discusses methods such as problem solving, cognitive restructuring, self-instructional training, and self control in counseling and educational settings. (PSE)

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

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. (IDE)

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

218. Perspectives in Dance—(Same as Athletics 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 (Cashion) MW 12:30-2:05
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) alternate years, given 1986-87

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 2:15-4:05 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 (Staff) MWF 9

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

221A. Administration and Organization of Educational Institutions in Context: Administration of Complex Organizations—Introduction to the nature of managerial work in various types of organizations including but not limited to educational institutions. Five topics are examined from the viewpoint of the manager: leadership, change, decision making, conflict resolution, and communication. Case studies of management oriented problems form an integral part of the course. (APA, SSE)
4 units, Aut (Bridges) MW 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—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—I—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) MWF 8:30-10

222B. Decision Analysis in Education II—Considers problems of optimization and de-
sign 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. No previous computer experience is necessary, but Education 222A and 222B or their equivalents are prerequisite. (APA, SSE)

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

226X. Special Topics in Educational Administration—This seminar will review the major conceptual and methodological issues involved in studying topics of relevance to educational administration. Topics change from year to year. In 1985-86, the seminar will focus on the dynamics of organizational exit, with particular emphasis being placed on dismissal. (APA)

3 units, Win (Bridges) alternate years, given 1986-87

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. (IDE, CTE)

4 units, Spr (Arias) T 3:15-6:05 and by arrangement alternate years, given 1986-87

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)

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

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

5 units, Spr (Inkeles) alternate years, given 1986-87

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

3 units, Aut (J. Krumboltz) M 3:15-5:05

237S. Education and Colonialism—This course focuses on education and the colonial experience in different regions of the world. Varying types of colonialism are distinguished (classical, internal, and neo-colonialism) and
examined in relation to educational policy and practice. The appropriateness of colonialism as a conceptual framework is analyzed in relation to feminist ethnic group, and social class movements for self-determination. To the extent possible, a number of ethnographic documentary, and commercial feature-length films will be utilized to illustrate the context and workings of different forms of colonialism. (IDE)

3 units, Win (Arnoce) MW 7-10 p.m.

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

238A. 4 units, Aut (Krumboltz, Thoresen) (Thoresen) by arrangement (Krumboltz) M 8-10

238B. 4 units, Win (Krumboltz, Thoresen) (Thoresen) by arrangement (Krumboltz) M 8-10

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


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

241S. Seminar: Bureaucracy, Education and the State—(Same as Sociology 211.) Weber and others on Western Rationalization. Readings on the modern literature, beginning with Max Weber, on the relation of education to modern bureaucratization. Bourdieu and others on the use of education in the construction of status in modern organization. Professionalization and its relation to classic theories of the organization of modern society. (SSE, SIDEC)

5 units, Spr (Heath) M 2:15-5:05 alternate years, given 1986-87

249. Curriculum and Instruction in Higher Education—Examines the developmental needs of college students and appropriate curricular and instructional means to meet the needs. Considerable stress placed on social-psychological research relevant to curricular concerns. (APA, CTE)

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

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. Analysis of variance and covariance; correlation and regression; analysis of categorical data. Proficiency with statistical computer packages. Prerequisite: Statistics 160. (MME)

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

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


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

250D. Statistical Analysis in Educational Research II: Experimental Design—This course deals with 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) MW 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. (PSE)

3 units, Aut (Calfee) MWF 9

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 discussions the nature, sources and purposes of student financial aid as the means of financing higher education. Students will be expected to investigate and report on a topic relating to subject matter. (APA)

3 units, Win (Huff) Th 3:15-5:05

254A. Ethnographic Monitoring of Rapid Change I—(Same as Anthropology 192A.) Seminar-practicum on the anthropological and empirical study of processes of rapid or sudden change, such as tele-microelectronic, biotechnical, or other technological innovation, an ecological system break, or a fundamental shift in political or managerial control where such change is judged likely in turn to produce profound sociocultural change. The student, working alone or with a team, will select a problem, formulate it in social science terms, and receive training and systematic guidance in using appropriately adapted ethnographic techniques to carry out a fieldwork project in a local community or institution. The resulting paper will assess implications of findings for theory, policy, and education. Previous interviewing or social science background helpful but not essential. Open to graduate students, seniors, and juniors. Enrollment limited to 20. (SSE, IDE)

3-5 units, Win (Textor) TTh 7-10 pm

254B. Ethnographic Monitoring of Rapid Change II—(Same as Anthropology 192B.) Continuation of Education 254A (Anthropology 192A) for the student requiring additional time, training, or guidance to complete a paper, prepare it for publication, develop it into a dissertation proposal, etc. (SSE, IDE)

3-5 units, Spr (Textor) W 7-10 pm

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

3 units, Win (Snow) MWF 9

256. Methods of Teaching Writing—Rationale and methods for using writing in school subjects, including English and other content areas. Discussion of how to structure writing assignments, how to respond to students' writing, and how to evaluate performance. (CTE)

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

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

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

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

2-3 units, Aut (Applebee) T 3:15-5:05

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) MW 3:15-5:05

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

264B. 2-3 units, Aut (Staff) TTh 3:15-5:05

265X. Computers, Cognition and Education—Course attempts to provide an overview of what computer science, artificial intelligence (AI), and cognitive science can contribute to instruction. The course will not assume a knowledge of computer science or programming but clearly some familiarity would allow the material to be appreciated at a deeper level. Having given a broad framework it is anticipated that some students will wish to follow more specialized courses in AI, cognitive psychology, cognitive science, and educational psychology. (PSE)

2 units, Aut (Sleeman) W 4-6
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 — e.g., 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, Tettor); lecture W 7:30-9:30 p.m., workshops by arrangement

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

3 units, Spr (Snow) by arrangement

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, Aut (Noddings) MW 3:15-5:05

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 will be put on functionalist and dialectical models. The literature covered by the course will include work done in the U.S., Europe and the Third World. Specific case studies will be used to illustrate the models. Open to students from all areas. (IDE)

5 units, Win (Carnoy) alternate years, given 1986-87
theoretical and practical issues facing the emerging evaluation profession. Topics to be covered are evaluation as a branch of experimental science; models of evaluation; quantitative and qualitative approaches to evaluation; evaluation as related to decision-making and the political process; and professional standards of evaluation. (SSE)

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

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

3 units, Spr (Bacchetti)
alternate years, given 1986-87

280. Training Seminar: Ethnography of Schooling—(Same as Anthropology 214.) Focuses on ethnographic approaches to the study of schooling emerging from recent anthropological work. The development of such approaches in educational anthropology, and the emerging criteria of good ethnography in schools, will be explored. Problems of ethnographic "evaluation," ethics and ethnography, and the potential relevance of school ethnography to educational policy will be considered. The main focus of the seminar, however, will be upon training participants to observe and record behavior, develop skills in the elicitation of cultural knowledge, and to develop an internally consistent conceptual structure that will orient observation and elicitation productively. Selected techniques of ethnographic research applicable to the study of schooling will be demonstrated. Students will be asked to 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)

3-4 units, Sum (G. and L. Spindler)
W 1:15-4:05

281X. Introduction to Computers in the Classroom—This course is intended to give students an appreciation of several ways computers can be used in the classroom. An introduction to basic classroom applications of computers as well as fundamental programming concepts will also be included. Additionally there will be some consideration of available educational software. (CTE)

2 units, Aut (Staff) MW 3:05-4:30

282. Linguistics and the Teaching of English as a Foreign/Second Language—(Same as Linguistics 289.) Linguistic aspects of the problems of teaching English to speakers of other languages, and standard English to speakers of other dialects. Prerequisite: introductory course in linguistics or consent of instructor. (CTE)

4-5 units, Aut (F. Politzer) MW 1:15-3:05

284X. Seminar on Case Studies in Higher Education — An in-depth study of different dilemmas such as declining enrollment, retention, and loss of revenue. (APA)

3 units, Win (Mayhew)
alternate years, given 1986-87

287. Cultural Approaches to Alternative Futures—(Same as Anthropology 148.) Seminar exploring alternative middle-range futures — of a community, a society, or the world — from an anthropological perspective. Stresses developing ability to read the futures literature critically, using explicit models and systematic data, while at the same time developing imaginative scenario-building skills. Emphasizes the change-driving power of the tele-microelectronic and biotechnical revolutions. Considers global ecological and energy constraints and sociopolitical imperatives. Examines particular Western and non-Western cultures in terms of their adaptive capacity or vulnerability. Addresses implications for the policy-maker, planner, and educator. (IDE, SSE) (DR:5)

3-5 units, Win (Textor)
alternate years, given 1986-87

288. Introduction to Educational Theories — This course is designed to introduce students to four kinds of theories important to educators: learning theories, curriculum theories, general educational theories, and theories of teaching. Many of the "theories" that will be examined are not really theories but more accurately "positions" or "views" or loose collections of principles and maxims. Course will give them careful scrutiny, with the aim 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

289X. Perspectives on Teaching — This is a team taught course designed to introduce STEP students to forms of research on teaching, to alternative models of teaching, and to various philosophical and practical views on teaching. (CTE)

3 units, Aut (STEP faculty) MW 1:15-3:05
290X. Leadership in Education: From the Classroom to the State Capitol—Course covers a conception of leadership that includes the classroom, school, district office, and state capital. It will deal 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, Aut (Hester) TTh 4:15-6:05

297. Language and Literacy in Secondary Schooling—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, Win (Calfee) TTh 1:15-3:05

300S. Nonformal and Popular Education—Course examines different conceptualizations of nonformal and popular education. The historical genesis of nonformal and popular education and the varying definitions, uses, and outcomes of these forms of education in different political contexts are analyzed. Special attention will be given to literacy campaigns and social movements and their implications for popular education. (IDE)
3 units, Spr (Arnowe) by arrangement

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

302X. Cognitive Science and Instruction.
3 units, Win (Sleeman) W 3:15-5:05

305. Philosophy and Empirical Research—Problems of relevance to the researcher will be explored from the point of view of philosophers of science such as Karl Popper and Carl Hempel, but much of the material dealt with will have been written by researchers themselves. (SSE) For relevant course material see Philosophy 164.
3 units, Aut (Phillips) alternate years, given 1986-87

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

306B. Education and Political Change—(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, Win (Samoff) TTh 2:15-4:05

306C. Education and Sociocultural Change—(Same as Anthropology 238.) (Undergraduates register for Anthropology 138.) 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 (Textor) TTh 2:15-4:05 and by arrangement

306D. Sociology of Development and Education—This course offers a systematic comparison between modernization and dependence approaches to development, emphasizing the different treatment education receives in each of them, and the consequent different approach
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 seminar for doctoral students; consent of instructor required. (IDE, SSE) 5 units, Aut (Arnow) MW 1:15-3:05

310. Sociology of Education—(Same as Sociology 310.) For doctoral and master's students. Meets with Education 210 (see course description). Emphasis on conceptualizing and analyzing applied sociological research in education. Features short written assignments, individual feedback and work with actual research data. (SSE) 4 units, Win (Weiler) M 3:15-5:05 and by arrangement

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 (Cohen, Talbert) MW 3:15-5:05

312A,B. Economics of Education—Major attention devoted to the "production," distribution, and financing of education; contribution of education to economic growth; education and the distribution of income; role of educational characteristics in labor markets. Prerequisites: economic theory and quantitative methods and consent of instructor (SSE) 5 units, Win (Staff) alternate years, given 1986-87

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) alternate years, given 1986-87

315. Cultural Transmission—(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) 3-5 units, Win (George and Louise Spindler) T 7-10 p.m. and by arrangement

316. Cognitive Psychology of Education—Review of research on perception, learning, and memory processes. Emphasis on research procedures and analysis of problems of school learning. For doctoral students in Psychological Studies. Open to others with consent of instructor. Prerequisites: Education 350A, B. (PSE) 3 units, Aut (Calfee) MW 10

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. Enrollment in 321A is limited to 25 students, with at least second year doctoral status; 321B,C is limited to 15 students, selected from students who have taken 321A. (CTE, PSE) 321A. 4-5 units, Aut (McLaughlin, Shulman) MW 10-12
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. Implementation of Policy Decisions on Local Schools—This course offers students a working knowledge of how local, state and federal decisions are implemented at the local school. In addition to knowledge, the course offers 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

332A. Educational Evaluation and Federal Education Policy—The formulation and administration of federal education policy. Includes federal/state delivery systems and policy evaluation as well as the key actors of coalitions. (APA)
3 units, Spr (Kirst)
alternate years, given 1986-87

332B. School Governance and School Community Relations—Analyzes the local and state governance of public education with particular stress on community politics, teacher bargaining, and state control.
3 units, Win (Kirst)
alternate years, given 1986-87

332. 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

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) TTh 4:15-6:05
alternate years, given 1986-87

333A.B. Seminar in Interactive Educational Technology—A disciplined introduction to the application of microcomputers to education. Emphasis on the design of software to apply currently available computer systems to education problems in today's elementary and secondary schools. Topics include: How and why are computers used in education? What are the effects of their use? For what types of educational problems are computer-based programs most appropriate? How is educational software designed? How can it be evaluated? Students read and discuss books and articles pertaining to these topics. Students will conduct several small projects outside of class, such as a review of educational software, observation of a computer-based program in a local school, intensive study of students' learning difficulties, and designing a small educational program for a microcomputer. Prerequisite: CS 105A or 106 or equivalent. Enrollment limited to 20, for Education 333A. Preference given to students in IET Master's Degree Program. Consent of instructor required. (CTE, PSE)

333A. 2 units, Aut (Hess) Th 4:15-6:05
333B. 3 units, Win (Walker and Hess) T 4:15-6:05

334A.B.C. Practicum in Interactive Educational Technology—A hands-on approach to the development of software for education. In Autumn Quarter computer programs will be designed using design aids, such as storyboards, pseudocode, and flowcharts, and authoring systems such as PILOT. Prerequisite: CS 105A or equivalent. In Winter Quarter algorithms will be developed and implemented in PASCAL to accomplish the major component tasks involved in computer-assisted education—screen design, data structures for representing educational content, and student-computer interactions. Prerequisite: 334 and CS 107 may be taken concurrently. In Spring Quarter a master's project will be proposed, designed, coded, and evaluated in field tests. Prerequisite: 334B.

334A. 2 units, Aut (Staff) T 4:15-6:05
334B. 2 units, Win (Walker) T 4:15-6:05
334C. 4 units, Spr (Walker and Sleeman) TTh 4:15-6:05

337. Ethnography of Communication: Research Methods—(Same as Anthropology 167.) 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, choosing among transcription systems, and analyzing and comparing cross-language data) will be examined. Case studies include: (1) selected speech events for interpreting value orientation to language and social roles, (2) oral-literate continuum models, and (3) use of cognitive style theories for understanding cross-cultural dimensions of first/language acquisition. (CTE, IDE, SSE)

4-5 units, Win (Heath) MW 2:15-5:05
alternate years, given 1986-87
338A, B, C. Internship in Counseling Psychology—Intensive supervised field experience in local schools or social agencies. (For Counseling Psychology majors only.) (PSE)

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

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

338C. 1-6 units, Spr
(Krumboltz, 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—The course is intended primarily for psychological studies students, interested in problems of motivation and perception in achievement-related situations. Course content includes the study of traditional theories of motivation and related research, an in-depth examination of recent reconceptualizations of traditional theories of motivation in information processing terms, motivational development in children, including home and school influences, and educational outcomes. Particular attention is given to implications for classroom instruction, teacher training, and curriculum development. (PSE)

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

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

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

4 units, Spr (Eisner) MW 10-12

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

4 units, Spr (Gage)
alternate years, given 1986-87

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)

0 units, Aut (Gage and Hess) W 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 Education 350A during the Fall 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 Education 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.

0-2 units, Aut, Win, Spr (Calfee) by arrangement

353. Problems in Measurement—(Same as Psychology 249.) Models, methods and applications of factor analysis. Models for factor analysis; estimation procedures; factor rotation; factor scores; using factor analysis in research; confirmatory factor analysis; methods for dichotomous variables. Prerequisites: 250B and 252
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 1986-87

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, Sum (Arias) M 10-12

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

4 units, Spr (Staff) alternate years, given 1986-87

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 (Staff) alternate years, given 1986-87

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

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

388. Recent Research in Bilingual Education: A Critical Appraisal—Course will familiarize 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 conducting research with language minority populations will be identified. Both quantitative
and qualitative research will be critically evaluated. (CTE)

4 units, Win (Arias) T 4:15-6:05
and by arrangement
alternate years, given 1986-87

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

4 units, Aut (Applebee) M 3:15-5:05
and by arrangement

390X. Research Issues Affecting Minority Students.
3-5 units, Win (Huebner) W 4:15-6:05

395. Education and Radical Change: African Experiences—(Same as Political Science 221S.) Focuses on two dimensions of education and radical change: 1) schools as the targets of protest and 2) education as a core element in development strategy. Begins with an examination of the education system in South Africa, where access and quality are limited by race. Proceeds to an exploration of the efforts of South African students—most visible since the uprising of June, 1976—on the educational system as a mechanism for organizing broader changes. The second dimension will be concerned with efforts of educators in those African states that have achieved majority rule. The experiences of Tanzania and Guine-Bissau will offer comparative insight and through student research presentations insight will be gained of Angola, Mozambique and Zimbabwe. (IDE)

5 units, Spr (Samoff and Amove) TTh 12-2:05
and by arrangement


2-4 units, Aut (Cross) Th 3:15-5:05

404. Advanced Seminar in Philosophy of Education—The seminar intended primarily for specialists in philosophy of education, will focus on current controversies in the field, and on the work of leading analytic philosophers of education (Scheffler, Peters, Hirst and others). (SSE)

3 units, Win (Siegel) T 7-10 pm

408A,B,C. Research Workshop in International Development Education—Continuing research workshop for the review of (a) key issue in the methodology and epistemology of 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 (Samoff and Arnoce) MW 3:15-5:05

408B. Research Workshop in IDE II
2-5 units, Win (Textor) MW 3:15-5:05

408C. Research Workshop in IDE III
2-5 units, Spr (Weiler, Arnoce) MW 3:15-5:05

411. Research Seminar in Child Development and Early Education—(Same as Psychology 362.) 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 and 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 1986-87

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

3 units, Win (Snow) MW 3:35-5:05

417X. Seminar on the Development of Complex Reasoning Skills—The course will involve students in an in-depth study of the various definitions of higher-order reasoning skills, measures of skill development and attempts to teach such skills. Students will compare and critique theories and methods of fostering complex skill development. (PSE)

3 units, Win (Staff) T 2:15-5:05

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)
alternate years, given 1986-87

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

422A,B,C. 1-3 units, Aut, Win, Spr (Bridges) 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 Aut (Staff)
alternate years, given 1986-87


3 units, Win (Staff)
alternate years, given 1986-87

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 1986-87

426. Theory and Practice in Criterion-Reference Test Interpretations—Definitions of criterion-reference tests, objective methods of domain definition and test construction, problems and methods of standard setting, statistical analysis of criterion-referenced test data, and applications to minimum competency testing. Prerequisite: 252 or equivalent course work, or consent of instructor. (PSE)
3 units, Win (Haertel) MW 3:15-5:05

431. Doctoral Seminar in Counseling Psychology—Designed for all doctoral candidates in counseling psychology and related areas. Analysis of professional problems. May be repeated for credit. Prerequisite: consent of instructor. (PSE)
1 unit, Aut, Win, Spr (Krumboltz, 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 multiracial 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, Spr (Arias) T 1:15-4:05
and by arrangement
alternate years, given 1986-87

448X. Experimental Design for Evaluation—Advanced course on the application of experimental design concepts to field-based evaluation of educational and social programs. The student will gain experience in applying the concepts to actual problems. Stress will be on comprehensive and efficient designs for sample selection, curriculum development, and instrumentation. Prerequisites: 250D or equivalent. (CTE, PSE)
3 units, Sum (Calfee) MW 3:15-4:30

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—This seminar critically examines major traditions in the design of evaluation research. The class will assess 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 educa-
tional processes and institutions. Discussion
will focus on dilemmas central to the design and
conduct of educational evaluations and will
pursue alternative, “state-of-the-art” approach-
es. (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 cri-
tique 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 disserta-
tions.

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 under-
standing the role of the arts in education. Con-
sent of the instructor is required. (CTE)

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

462X. Assessing the Consequences of Teach-
ing with Computers
—Seminar will focus 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. The seminar will not cover studies of
effects on institutions, the polity, society, or
culture. (CTE)

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

463X. Advanced Seminar in Computers and
Cognition—Topics of the seminar will vary, but
will always focus around topics considered to be
of contemporary concern by the research com-
pany. The group will be required to critically
review a set of recent papers and to discuss these
in class. Prerequisites: Intelligent Tutor-
ning System course or Cognitive Science and
Instruction (preferably both) and at least one
introductory programming course (e.g. Com-
puter Science 106). (PSE)

3 units, Spr (Sleeman) W 4-6

465. Research Seminar on the Writing Pro-
cess and Writing Instruction—State-of-the-art
review of the contributions of various disci-
plines to the understanding of writing pro-
cesses. Critical analysis of assumptions, meth-
odologies, 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

466. Doctoral Seminar in the Design and Eval-
uation of Educational Programs (DEEP)—
Required of all doctoral students in DEEP.
Intended to give students in DEEP the oppor-
tunity to become acquainted with research in
this field. Students will be able to learn in a
relatively intimate setting about research activi-
ties in which they are engaged and the
kinds of problems that they believe to be im-
portant in the field. Intended to introduce
doctoral students to research and scholarship
related to the DEEP program at Stanford. All
DEEP faculty participate, along with other
Stanford faculty and outside speakers. Upon
completing the seminar, students should be
acquainted with the major problems addressed
in this field and different ways these are
addressed by current investigators. (CTE)

1-5 units, Spr (DEEP faculty)
by arrangement

467. Research Seminar on Literary Under-
standing and the Teaching of Literature —
Review of the contribution of various disciplines
to the understanding of literary representation
and response to literature. Critical analysis of
assumptions, methodologies, and results.
Studies examined will be drawn from the field of
literary criticism, psychology, anthropology,
linguistics and education. (CTE)

4 units, Win (Applebee) alternate years,
given 1986-87

470. Practicum—For advanced graduate stu-
dents. (All areas)
by arrangement

470E. Practicum in Evaluation—Topics of cur-
rent interest in the area of educational evalu-
ation will be discussed. Restricted to student
members of the Evaluation Consortium. (All Areas)

Aut, Win, Spr (Staff) by arrangement

477. Organization and Style in Research Re-
ports—Some major considerations in preparing
formal reports of scholarship and inquiry, in-
cluding theses and dissertations. Emphasis on
organization; the achievement of clarity, tech-
nical, ethical and legal considerations; alterna-
tive conventions; general stylistic practices. (All Areas)

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

480. Directed Reading—For advanced grad-
uate students. (All areas)
by arrangement

482. Research Seminar in Problems in
Teaching and Learning of a Second Language
—Investigation of second language acquisition
processes. Measurement of linguistic achieve-
ment and of cultural and cognitive correlates of
second language acquisition and bilingualism.

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

493A. 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 and Rogosa)
Th 11-1 and by arrangement

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
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 Politics of Education (Same as Political Science 187.)
220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education
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 (Same as History 301C.)
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
226X. Special Topics in Educational Administration
245. Language Planning and Public Policy
249. Curriculum and Instruction in Higher Education
253X. Finance of Higher Education: Financial Aid
279X. Managing in Higher Education
284X. Seminar in Case Studies in Higher Education
290X. Leadership in Education: From the Classroom to the State
313A, B. Economics of Education
320X. Research Seminar: Using Computers for Empirical Research
322. Implementation of Policy Decisions in Local Schools
323A. Education and Public Policy: Federal Education Policy and Administration
323B. School Governance and School Community Relations
365. Seminar: Planning Policy-Oriented Research
366. Language Planning and Public Policy (Same as Linguistics 253.)
369. Personnel Administration
370. Legal Basis for Education
422A, B, C. Internship in Educational Administration
423A, B, C. Research on Educational Administration and Policy Analysis
424. Structure and Functioning of Institutions of Higher Education
450. Seminar on Ethical Concerns in Research and Evaluation
470E. Practicum in Evaluation (See Psychological Studies in Education.)
477. Organization and Style in Research Reports

CURRICULUM AND TEACHER EDUCATION (CTE)

142. Practical Inquiry in Education
154. Psychology of Reading
156X. Discourse Analysis
192. The Anthropology of Play (Same as Anthropology 154.)
200. History of Education
202. Social Sciences: Teachers and Schools
202A. Introduction to Curriculum
213. Foundations of Aesthetic Education
215. Psychological Foundations of Education (Same as Psychology 145.)
217. Teaching a Global Perspective: Cross-Cultural Approaches
218. Perspectives in Dance (Same as Athletics 265.)
219. Artistic Development of the Child
227. The Assessment of Culturally Diverse Populations
239A, B, C. Observation and Directed Teaching of Study Skills and Developmental Reading in College
240. Adolescence: Health and Special Needs
243. Student Behavior and School Discipline: Problems, Perspectives and Proposals
246A, B, C, D. Secondary School Teaching Practicum
247. Affective Education
256. Methods of Teaching Writing
262A. Curriculum and Instruction in English
262B. Curriculum and Instruction in English: The Teaching of Literature
263A, B. Curriculum and Instruction in Mathematics
264A, B. Curriculum and Instruction in Foreign Language
267A, B. Curriculum and Instruction in Science
268A, B. Curriculum and Instruction in Social Studies
269. Foundations of Learning for Teaching
272. Classroom Observation
276X. Feminist Perspectives on Ethics and Education
281X. Introduction to Computers in the Classroom
282. Linguistics and the Teaching of English as a Foreign/Second Language (Same as Linguistics 289.)
285X. Introduction to Educational Theories
288X. Perspectives on teaching
291. Methods of Teaching German (Same as German Studies 302.)
292. Methods of Teaching Spanish (Same as Spanish 301.)
293. Methods of Teaching French (Same as French 293)
297. Language and Literacy in Secondary Schooling
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
333A,B. Seminar in Interactive Education Technology
334A,B,C. Practicum in Interactive Education Technology
340. Curriculum Theories and Curriculum Change
342A,B. Curriculum Construction
345. Educational Connoisseurship and Educational Criticism
349. Professional Education of Teachers
356. Seminar in Physical Education Research
357. Seminar in Physical Education Curriculum
359. Seminar in Physical Education (Motor Learning)
366. Literacy: Social and Historical Perspectives
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. Linguistic Theories of Language Acquisition and Language Teaching
388. Foreign Language Education and Bilingual Education in the Elementary School
390. Language and Mental Development: Implications for Schooling
390X. Research Issues Affecting Language Minority Students
396. Recent Developments in Secondary School Social Studies
438. Culture in the Curriculum
448X. Experimental Design for Evaluation
450. Seminar on Ethical Concerns in Research and Evaluation
459. Seminar on Physical Education Issues
460. Advanced Seminar in Evaluation
461. Seminar for Doctoral Students in Art Education
462X. Assessing the Consequences of Teaching with Computers
463. Seminar for Doctoral Students in the Design and Evaluation of Educational Programs
464X. Research Seminar in Reading Theory and Practice
465. Research Seminar in the Writing Process and Writing Instructions
466. Doctoral Seminar in the Design and Evaluation of Educational Programs
467. Research Seminar on Literary Understanding and the Teaching of Literature
470E. Practicum in Evaluation—(See Psychological Studies in Education.)
477. Organization and Style in Research Reports
482. Seminar in Research Problems in Teaching and Learning of a Second Language
496. Seminar in Social Studies Education

INTERNATIONAL DEVELOPMENT EDUCATION (IDE) (SIDEC)
161. Introduction to Teaching and Learning in Asia
192. The Anthropology of Play (Same as Anthropology 154.)
195. Introduction to Africa Through Film: Terrs, and Liberation
205. Ideology and Education
206A. Introduction to the Study of International Development Education
206B. Project Workshop in International Development Education
207X. International Cooperation in Educational Development
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
227. The Assessment of Culturally Diverse Populations
231. Social Structure of World Society (Same as Sociology 152, same as Values, Technology, Science and Society 153).
237S. Education and Colonialism
248. Language Planning and Public Policy (Same as Linguistics 253.)
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
287. Cultural Approaches to Alternative Futures (Same as Anthropology 148.)
300S. Nonformal and Popular Education
306A. Education and Economic Development
306B. Education and Political Development (Same as Political Science 221.)
306C. Education and Sociocultural Change (Same as Anthropology 238.)
306D. Sociology of Development and Education
307X. Knowledge and Legitimation: The Politics of Educational Research (Same as Political Science 328.)
337. Ethnography of Communication: Research Methods (Same as Anthropology 167.)
SCHOOL OF EDUCATION

366. Literacy: Social and Historical Perspectives (Same as Linguistics 254.)
392. Practicum in Cultural Pluralism
376X. Education, Economics and the State
395. Education and Radical Change: African Experiences
405A,B,C. Research Workshop in International Development Education
450. Seminar on Ethical Concerns in Research and Evaluation
470E. Practicum in Evaluation (See Psychological Studies in Education.)
477. Organization and Style in Research Reports

MATHEMATICAL METHODS IN EDUCATIONAL RESEARCH (MME)
250A,B. Statistical Analysis in Education Research I
250C. Statistical Analysis in Educational Research II
250D. Statistical Analysis in Educational Research II: Experimental Design
251. Experimental Methods in Educational Research
353. Problems in Measurement (Same as Psychology 249.)
450. Seminar on Ethical Concerns in Research and Evaluation
470E. Practicum in Evaluation (See Psychological Studies in Education.)
493A. Seminar on Methodological Problems in Educational Research

PSYCHOLOGICAL STUDIES IN EDUCATION (PSE)
130. Counseling and Therapy: An Introduction (Same as Psychology 144.)
132S. Seminar in Cross-Cultural Counseling (Same as Psychology 131.)
134. Counseling for Career Planning
154. Psychology of Reading (Same as Psychology 143.)
215. Psychological Foundations of Education (Same as Psychology 145.)
216X. Cognitive Behavior Modification (Same as Psychology 361.)
229. The Development of Social Competence: Theory, Research and Practice
232. Science and Research in Counseling Psychology (Same as Psychology 253.)
234. Individual Counseling Psychology (Same as Psychology 250.)
238A,B,C. Counseling 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.)
265X. Computers, Cognition and Education
275X. Contemporary European Psychology (Same as Psychology 277.)
302X. Cognitive Science and Education
316. Cognitive Psychology of Education
317. Introduction to Research on Teaching
321A,B,C. Qualitative Methods of Educational Research: Issues in Design and Data Collection
338A,B,C. Internship in Counseling Psychology
343. Motivational Processes in Education
350A. Psychological Studies in Education
350A,B,C,D. Research Seminar in Educational Psychology
352X. The Psychology of Instruction
353. Problems in Measurement
354X. Intelligent Tutoring Systems
411. Research Seminar in Child Development and Early Education (Same as Psychology 362.)
415. Seminar in the Psychology of Reading
416. Seminar on Aptitude
417X. Seminar on Complex Reasoning Skills
419. Seminar in Research on Teaching
426. Theory and Practice in Criterion-References Test Interpretations
431. Doctoral Seminar in Counseling Psychology
448X. Experimental Design for Evaluation
450. Seminar on Ethical Concerns in Research and Evaluation
463X. Seminar in Computers and Cognition
470E. Practicum in Evaluation
477. Organization and Style in Research Reports

COMMITTEE ON SOCIAL SCIENCES IN EDUCATION (SSE)
105. American Education and Public Policy (Same as History 158B; Political Science 186K.)
108X. The New Families Implications for Education and Employment
170. Sex and Education (Same as Sociology 112, Feminist Studies 130.)
171. Women's Self-Directed Re-Education
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.)
192. The Anthropology of Play (Same as Anthropology 154.)
200. History of Education
201. History of Education in the United States (Same as History 158.)
202. Social Science: Teachers and Schools
203. Models of the Child in Contemporary Educational Thought
204. Introduction to Philosophy of Education
205. Ideology and Education
208X. Implementing Educational Reforms
210. Sociology of Education (Same as Sociology 210.)
211. Introduction to Philosophy of Social Science (Same as Philosophy 186.)
212. Practicum in Ethnographic Futures Research (Same as Anthropology 269.)
216. Cultural Pluralism and American Educational Policy
220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education
220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education
220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education (Same as Sociology 143.)
### Administration and Organization of Educational Institutions in Context

#### 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 (Same as History 301C.)

#### Decision Analysis in Education

#### 222A. Decision Analysis in Education I

#### 222B. Decision Analysis in Education II

#### 222C. Decision Analysis in Education III

#### 247. Affective Education

#### Language Planning and Public Policy

#### 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

#### Introduction to Issues in Evaluation

#### Training Seminar: The Ethnography of Schooling (Same as Anthropology 214.)

#### Cultural Approaches to Alternative Futures (Same as Anthropology 148.)

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

#### Philosophy and Empirical Research

#### 305. Philosophy and Empirical Research

#### Education and Economic Development

#### 306B. Education and Political Change (Same as Political Science 221.)

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

#### Sociology of Development and Education

#### 307X. Knowledge and Legitimation: The Politics of Educational Research (Same as Political Science 328.)

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

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

#### Economics of Education

#### Cultural Transmission (Same as Anthropology 266.)

#### Research Practicum: Social Science in Education

#### Ethnography of Communication: Research Methods (Same as Anthropology 167.)

#### Literacy: Social and Historical Perspectives

#### Practicum in Cultural Pluralism

#### Advanced Seminar in Philosophy of Education

#### Research Workshop in International Development Education

#### Seminar on Ethical Concerns in Research and Evaluation

#### Advanced Seminar in Evaluation: Learning and Control

#### Practicum in Evaluation (See Psychological Studies in Education.)

#### Organization and Style in Research Reports

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

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

453. Doctoral Dissertation. Any Quarter (Staff) by arrangement

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

490. Directed Reading—For advanced graduate students. By arrangement

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

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

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

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

UNDERGRADUATE ADMISSION

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

PREPARATION RECOMMENDED FOR FRESHMEN

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

PREPARATION RECOMMENDED FOR TRANSFER STUDENTS

Students who do the early part of their college work elsewhere and then transfer to Stanford to complete their engineering programs should follow an engineering or pre-engineering program at the first school, selecting insofar as possible courses applicable to the requirements of the School of Engineering, i.e., courses comparable to those discussed under "Undergraduate Programs." 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 several accredited liberal arts colleges in providing a program that leads to concurrent award of the A.B. degree by the first college and the B.S. degree in a field of engineering by Stanford. These programs comprise three years of study at the first college, with some emphasis on
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.

Beginning with the 1985-1986 school year, undergraduate engineering programs are designated as either Departmental Majors or School of Engineering Majors. Students who have matriculated before September 1985 may choose between programs described in this Courses and Degrees bulletin and those described in earlier editions.

In addition to the special requirements for Departmental Majors and School of 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.

DEPARTMENTAL MAJORS

The curriculum for Departmental Majors has the following components: Math; Science; Values, Technology, Science, and Society; Engineering Fundamentals; and Engineering Depth. Engineering Depth courses are specified by the individual departments (Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering). Included within the courses taken to fulfill these curricular components is a requirement in experimentation. Completion of a Departmental Major leads to a Bachelor of Science degree in the chosen field.

MATHEMATICS

(21 units minimum)

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. A list of courses that satisfy the engineering mathematics requirement can be found in the Undergraduate Handbook available in the office of the Dean of Engineering.

SCIENCE

(20 units minimum)

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 must be in basic science rather than in applications of science. A list of approved courses can be found in the Undergraduate Handbook available in the office of the Dean of Engineering.

VALUES, TECHNOLOGY, SCIENCE AND SOCIETY

(One course)

It is important to obtain a broad understanding of engineering in its human, social, and cultural contexts. To introduce this aspect of professional development, every Departmental engineering program must have one course on the interaction of technology with values and beliefs, social institutions, or behavior. A list of courses satisfying this component of the major can be found in the Undergraduate Handbook available in the office of the Dean of Engineering.

ENGINEERING FUNDAMENTALS

(Five courses)

The Engineering Fundamentals requirements is satisfied by a nucleus of technically rigorous, introductory courses chosen from the various engineering disciplines. It is intended
to serve several purposes. Firstly, it provides students with a breadth of knowledge concerning the major fields of endeavor within engineering. Secondly, it allows the incoming engineering student an opportunity to explore a number of courses before embarking on a specific academic major. Thirdly, 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. 10N. 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

ENGINEERING DEPTH
(45 units)

Satisfaction of the engineering depth requirement by completion of one of the departmental course sequences constitutes a major in that branch of engineering. Majors are offered in Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering. Departmental requirements are listed below; further details, including sample programs, are contained in the Undergraduate Handbook available in the office of the Dean of Engineering. A student wishing to deviate slightly from one of the departmental depth programs may submit his or her proposed program to the department for approval. Modified programs recommended by a department will normally be approved by the Undergraduate Council of the School of Engineering.

CHEMICAL ENGINEERING*

<table>
<thead>
<tr>
<th>Course No. Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eng. 21. Mechanics of Fluids</td>
<td>4</td>
</tr>
<tr>
<td>Mech.Eng. 33. Introductory Fluids Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 36. Chemical Separations</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 130. Theory and Practice of Identification</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 131. Organic Polyfunctional Compounds</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 173. Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 175. Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Chem.Eng. 120. Separations Processes</td>
<td>3</td>
</tr>
<tr>
<td>Chem.Eng. 140. Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Chem.Eng. 180A,B. Chemical Engineering Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 155. Process Analysis and Control</td>
<td>3</td>
</tr>
</tbody>
</table>

* Chem. 171 may be substituted for Engr. 30 in Engineering Fundamentals.

CIVIL ENGINEERING

<table>
<thead>
<tr>
<th>Course No. Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 11. Mechanics of Material I</td>
<td>4</td>
</tr>
<tr>
<td>Engr. 21. Mechanics of Fluids</td>
<td>4</td>
</tr>
<tr>
<td>CE 130 or CE 171. Urban Planning or Envir. Planning</td>
<td>3</td>
</tr>
<tr>
<td>CE 150. Legal and Professional Aspects of Civil Eng.</td>
<td>3</td>
</tr>
<tr>
<td>CE 160. Water Resources Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CE 170. Environmental Science and Technology</td>
<td>3</td>
</tr>
<tr>
<td>CE 180. Elementary Structural Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CE 190. Geotechnical Engineering</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional CE courses | 16 |

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 and in the Department of Civil Engineering.

Special Requirements: Students majoring in Civil Engineering should include E10N, E60, and E70A or E70X among the courses they take to fulfill the engineering fundamentals requirements. All candidates for the B.S. Degree in Civil Engineering must take E70A or E70X. E10N is a prerequisite to E11 and E60 is a prerequisite to CE 160. Any student who has not had exposure to drafting, either in high school or through work experience, should include ME 102 in his or her program.

ELECTRICAL ENGINEERING

Core Courses required of all majors:

- E.E. 101, 102. Circuits
- E.E. 111, 112, 112. Electronics
- E.E. 121, 122. Laboratory
- CS 106B. Software Engineering
- E.E. 141. Fields and Waves
Three courses from one of the speciality areas shown below. (Consultation with an advisor in the selection of these courses is especially important):

Communications: 139, 278, 279, 244a, 244b, 244c
Controls: Engr. 105, Engr. 206, Engr. 207, Engr. 208, Engr. 209
Electronics: 139, 211, 216, 221a, 221b, 231, 238
Fields and Waves: 142, 241, 242, 245, 246, 249, 252, 254, 268
Signal Processing: 104, 261, 263, 264, 274
Elective Electrical Engineering courses

Total 45

INDUSTRIAL ENGINEERING
Industrial Engineering students must take E40, E60, and E70 in Fundamentals.

Stat. 110. Statistical Methods in Engineering and the Physical Sciences 4
C.S. 106B. Software Engineering 5
O.R. 152. Introduction to Operations Research I 4
O.R. 153. Introduction 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. Introduction to Financial Decisions 3
I.E. 260. Analysis of Production Systems I 3
I.E. 180. Senior Project—Organizations, or I.E. 183. Senior Project—Financial Analysis, or I.E. 186. Senior Project—Production 4

MATERIALS SCIENCE AND ENGINEERING
E. 51. Materials Technology for Structural Application 3
M.S. & E. 151. Thermodynamics and Phase Equilibria 5
M.S. & E. 160, 161, 162, 163. Experimental Methods in Materials Science 6
Plus 10 units from the following list:
E. 5. The Microscopic World of Technology 2
E. 11. Mechanics of Materials I 4
E. 104. Dynamic Response 3
Chem. 173, 175. Physical Chemistry 3, 3
E.E. 111, 112, 113. Electronics 3, 3, 3

SCHOOL OF ENGINEERING 91
MS. & E. 210. Semiconductor Materials Processing 3

MECHANICAL ENGINEERING
Engr. 10N. 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. Design Engineering 3
M.E. 131A. Fluid Mechanics 4
M.E. 131B. Heat Transfer 5
M.E. 131C. Thermodynamics 5
M.E. 161. Dynamic Systems 4

PETROLEUM ENGINEERING
(Petroleum Engineering is offered through the School of Earth Sciences. Consult the appropriate section of this Bulletin for their requirements).

EXPERIMENTATION
Every departmental engineering program 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 a Departmental 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.

ACCREDITATION
The Accreditation Board for Engineering and Technology (ABET) accredits college engineering programs on a nationwide basis. Accreditation is important in many areas of the engineering profession; students wishing more information about accreditation should consult their departmental office or the office of the Dean of Engineering.

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

The School of Engineering itself offers degrees in General Engineering and in Engineering Science. The School of Engineering major is intended to offer a more flexible alternative to the traditional four-year accredited engineering degree, especially for students intending to go on for graduate work. These degrees are not accredited. By appropriate choice of courses, the School of Engineering majors can provide a strong engineering background for graduate work either within or outside of the field of engineering.

School of Engineering programs must be approved by the Undergraduate Council. There are two types of programs: Individually Designed Majors and majors which have been proposed by cognizant faculty groups and which have been pre-approved by the Council. At present there are two pre-approved majors: Product Design (General Engineering), and Aeronautics and Astronautics (General Engineering).

School of Engineering Majors must have the following curricular components: Mathematics (21 units minimum), Science (17 units minimum), Engineering Courses (40 units minimum), Additional Courses (12 to 29 units). Total units required for these majors is from 90 to 107.

PRODUCT DESIGN

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math*</td>
<td>21</td>
</tr>
<tr>
<td>Science**</td>
<td>20</td>
</tr>
<tr>
<td>VTSS*</td>
<td>4</td>
</tr>
<tr>
<td>Technical Electives***</td>
<td>15</td>
</tr>
<tr>
<td>Engr. 11. Mechanics of Materials I</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 101. Visual Thinking</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 103. Manufacturing Technology</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 111. Stress, Strain and Strength</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 112. Mechanical Systems</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 115a. Human Values in Design</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 115b. Concept Presentation</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 116a,b,c. Adv. Product Design</td>
<td>3,3,3</td>
</tr>
<tr>
<td>M.E. 191. Engr. Problems</td>
<td>1</td>
</tr>
<tr>
<td>Art. 60. Basic Design</td>
<td>3</td>
</tr>
<tr>
<td>Art. 160. Design I</td>
<td>3</td>
</tr>
<tr>
<td>Art. 164. Color</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>105</strong></td>
</tr>
</tbody>
</table>

*From approved lists for departmental majors
**3 units may be a Behavioral Science, rest from departmental list

AERONAUTICS AND ASTRONAUTICS

Math, Science, VTSS, Engineering Fundamentals as specified by departmental majors, plus the following depth courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 10N. Applied Mechanics: Statics</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 11. Mechanics of Materials I</td>
<td>4</td>
</tr>
<tr>
<td>Engr. 104. Dynamic Response</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 33. Intro. Fluids Engineering</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 131a. Fluid Mechanics</td>
<td>5</td>
</tr>
<tr>
<td>A.A. 100. Intro. to Aeronautics and Astronautics</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 131. Experimentation in Aero/Astro</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 192. Vector Analysis and Caretsian Tensors</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 200a. Applied Aerodynamics</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 210a. Fundamentals of Compressible Flow</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 114. Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>Math 150. Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>

INDIVIDUALLY DESIGNED MAJORS

The Individually Designed Major option is intended for undergraduates interested in pursuing an engineering program that falls outside the purview of Departmental Majors or the pre-approved School of Engineering Majors. Programs are designed by the students themselves, with the assistance of two faculty advisors of their choice, and presented to the Undergraduate Council for approval. Students may propose programs that lead either to the bachelor's degree in General Engineering or in Engineering Science.

Students should submit a written proposal to the Undergraduate Council detailing their program. Programs must comply with the guidelines established for all School of Engineering Majors, i.e., Mathematics (21 units minimum), Science (17 units minimum), Engineering courses (40 units minimum) with additional courses to bring the total to at least 90 units. Proposals 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. In consultation with the faculty advisors, the statement should indicate whether the degree of Engineering Science or General Engineering is appropriate and justification should be provided.

The proposal statement should be followed by a list of courses to be counted toward the major. Normally, the courses selected should represent a coordinated sequence that provides mastery of the important principles and techniques in a well-defined field. 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 en-
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 an Individually Designed Major must have at least three quarters' undergraduate work remaining at Stanford after the proposal is submitted. Any changes in a previously approved major must be endorsed by the faculty advisors and reapproved by the Undergraduate Council.

Additional information and assistance on the preparation of proposals can be obtained from the office of the Associate Dean of Engineering, Room 208, Terman Engineering Center.

POLICY ON PASS/NO CREDIT GRADING AND MINIMUM LETTER GRADE INDICATOR

The Undergraduate Council of the School of Engineering has established the following policies with regard to pass/no credit grading and minimum letter grade indicator.

For Departmental Majors, courses taken in satisfaction of the Mathematics, Science, VTSS, Engineering Fundamentals, and Engineering Depth requirements must be taken for a letter grade. For School of Engineering Majors, courses taken in fulfillment of the Math, Science, and Engineering requirements (40 units), must be taken for a letter grade.

For Departmental Majors, the minimum letter-grade-indicator required for graduation is a 2.0 on all courses taken in fulfillment of the Engineering Fundamentals and Engineering Depth components of the major. For School of Engineering Majors, the minimum letter-grade-indicator is a 2.0 on all engineering courses taken for the major.

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.

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

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

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

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

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 admis-
ision is authorized. Inquiries may be addressed to the Dean of Engineering or to the Chairman of the Department. While most graduate students have undergraduate preparation in an engineering curriculum, it is feasible to enter from other programs including chemistry, physics, or mathematics.

THE HONORS COOPERATIVE PROGRAM

A number of industrial firms, government laboratories, and other organizations participate in the Honors Cooperative Program (HCP), a plan which permits qualified professional employees to register for graduate Stanford courses on a part-time basis. Most of the students in the HCP are in the School of Engineering though several departments within the Schools of Humanities and Science and Earth Sciences also offer graduate degree programs under this plan. The majority of coursework taken in the HCP is done via the Stanford Instructional Television Network (SITN). A four-channel network enables students to enjoy live lectures with talk-back privileges at their company plants. Further details can be obtained from the Stanford Instructional Television Network (415) 497-3616.

GRADUATE REGISTRATION

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

GRADUATE PROGRAMS

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

CHEMICAL ENGINEERING

Newtonian and Non-Newtonian Fluid Mechanics
Polymer Adsorption
Rheo-optics of Polymeric Liquids and Colloidal Suspensions
Hydrodynamic Stability
Electrochemical and Photochemical Energy Conversion
Applied Chemical Thermodynamics and Kinetics
Surface and Interface Science
Kinetics and Catalysis
Bioengineering
Polymer Science
Membrane Separation Processes
Applied Statistical Mechanics
Equilibrium and Transport Properties of Colloidal Dispersions

CIVIL ENGINEERING

Construction Engineering and Management
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

Environmental Engineering and Science

Water Resources Engineering (including elements of hydraulics, hydrology, hydromechanics and nuclear environmental engineering)
Bioelectronics
Communications and Information Theory
Computer Applications
Computer Systems
Electromagnetic Theory and Microwaves
Electronic Circuits and Devices
Information Processing
Integrated Circuits
Integrated Systems
Modern Optics and Optical Devices
Network Theory
Plasmas
Quantum Theory and Applications
Radioscience
Solid State Materials and Properties
Systems and Control Theory
VLSI

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

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT
Production Systems
Engineering Economy — Financial Analysis
Organizational Design and Control
Engineering Management
Manufacturing Systems Engineering

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
Solar Energy
Thermodynamics
Transport Processes
Turbulence

OPERATIONS RESEARCH
Applied Probability
Combinational Optimization
Dynamic Programming
Simulation Methodology
Inventory Theory
Queueing Theory
Reliability Theory
Mathematical Programming
Networks
Energy and Economic Modeling

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

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

MABER 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 back-
ground 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 department within the school; (2) the student's program must include at least 21 units of courses within the School of Engineering with numbers 200 or above in which the student receives letter grades; (3) the program must include a total of at least 45 units. These programs are administered by the departments and of course must meet the standard of quality of the departments.

Applications for admission to the engineering program should indicate the department in the school in which the student expects to take most of his or her courses, or, if undecided, indicate the Office of the Dean, School of Engineering. Transfer into this program is also possible from any department program within the school by application to the appropriate department.

ENGINEER

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

DOCTOR OF PHILOSOPHY

Programs leading to the degree of Doctor of Philosophy are offered in each of the departments of the school. Special Ph.D. programs which may be interdepartmental in nature (e.g., Bioengineering) can be arranged. See "Graduate Division Special Programs" section in this bulletin. University regulations for the Doctor of Philosophy are given in the section "Degrees" in this bulletin. Further information will be found in the departmental listings.

FELLOWSHIPS AND ASSISTANTSHIPS

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 above.

Of the courses described in this section, many are of general interest to both engineering and non-engineering students. In addition, certain departmental courses are of general interest and without prerequisites.

Students interested in the interactions between technology and society should also consult the "Values, Technology, Science, and Society" section of this bulletin.


Associate Professors: Bruce Lusignan, J. David Powell, Robert Sinclair

Assistant Professors: Lambertus Hesselink, M. Elisabeth Paté-Cornell

Lecturers: Gerd Wallenstein, David Lougee
COURSES OF INTEREST PRIMARILY TO 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, Spr (Brauman) T 1:15-3:05

6. Engineering at Stanford — Weekly seminar designed for freshman and undeclared sophomores interested in engineering. The course will provide information on the various engineering majors and the resources available for engineering undergraduates. Speakers will include departmental representatives, faculty and industry researchers, and representatives from Overseas Studies, Career Planning and Placement, and the Academic Information Center.
   1 unit, Win (Masters) M 3:15-4:45

7. Black Perspectives in Engineering—(Same as Afam 127.) Designed to assist students in understanding the basic benefits and opportunities available to Blacks in the various fields of Engineering. The emphasis will be on diversity. Experts from various fields will lecture on pre-college needs, the social obligations of students and engineers; problems faced by Black Engineers, Black women in engineering; M.B.A., J.D., M.D. and sales options for engineers; small versus large companies, graduate versus industrial opportunities; consulting and starting one's own business; opportunities for Black Engineers and businesses in Third World Countries; trips to industrial and academic laboratories. Each student will have weekly reading assignments with a short paper due each week; a final term paper will be assigned.
   3 units, Spr (Bates)

10N. 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 (Barnett) MWF 9

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. Prerequisites: Engr. 10.
   4 units, Win (Staff) MWF 9

12. Intermediate Dynamics—Review of first and second order linear dynamic systems; damping, resonance, instability, characteristic equations. Rigid body dynamics; gyroscopes; balancing rotating machinery; vibrations, and dynamic response of simple mechanical systems. Writing dynamic system equations of motion, their solution and interpretation. Prerequisites: Math 23 or 43 and Physics 51. (DR:8)
   4 units, Aut (Powell) MWF 9

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: Engineering 10, Physics 51 and Math 23 or 43; Engineering 12 recommended but not required.
   4 units, Aut (Hsu) MWF 10

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 prob-
lems. 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 (Eustis) MWF 10
   Aut (Kays) MWF 11
   Win (Bowman) MWF 10

35. Automotive Technology—An engineering description of today’s automobile, how it works and why it’s designed the way it is. How the auto affects air pollution and aspects of engine design for improving exhaust emissions. 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 (Manning) MWF 11-12:15
   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


3 units, Aut (Shyne) MWF 11
   Win (Sherby) MWF 11
   Spr (Sinclair) MWF 11

51. Materials Technology for Structural Applications—Metals, alloys, ceramics, glass, materials used primarily for their mechanical properties. Description of materials processing techniques, e.g., heat treatment, used to develop optimum properties. This course provides information necessary for materials selection and processing for engineering applications. Prerequisite: 50.

3 units, Win (Wadsworth) MWF 1:15

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 photosensitive materials and techniques. Assembly and packaging technology. Prerequisite: 50.

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

60. Engineering Economics—Economic analysis for decision making among alternative courses of action in engineering, business, government and personal finance. Use of compound interest calculations to compare the consequences of different alternative decisions is stressed. Effects of depreciation accounting methods, national and state income taxes, decision under uncertainty, and the selection of appropriate minimum attractive rates of return are considered in problems relating to multiple alternatives, sunk cost, incremental cost, replacement, resource allocation and publicly financed projects. May be taken by freshmen, but recommended for second year or higher students. Two lectures and one small problem session, plus one optional question session per week. Prerequisite: Math 41 or equivalent.

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, pro-
duction planning, inventory control, transportation, pollution control, personnel assignment, construction management. Prerequisites: Mathematics 43 or consent of instructor. (DR:8)
4 units, Aut (Hillier) MWF 1-2:05
Spr (Hillier) 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.)

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 12:15, Th 7:30-9:30 pm

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 Communications Program.
3 units, Spr (Staff) W 7:30-10 p.m.

102. 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 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 video taped 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 purpose nature. Emphasis is placed 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; radioisotope 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, etc.

3 units, Win (Sher) TTh 11-12:15
   Spr (Hesselink) MWF 1:15

190. Problem Solving—(Same as VTSS 181, Industrial Engineering 201 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 presented. The advantages of integrating various problem solving strategies will be stressed through use of reading, abstracted problem situations, and projects. Open to undergraduates and graduates in any field.

3 units, Spr (Adams) MW 2:15-4:05

199. Special Studies in Engineering—Special studies, laboratory work, or reading under the direction of a faculty member. Often research experience opportunities exist in ongoing research projects. Interested students are invited to make arrangements with individual faculty. By consent only.

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

COURSES OF INTEREST PRIMARILY TO 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)


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 (Staff) 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 (Powell) TTh 11-12:15
   lab by arrangement


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

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, entrepreneurship, and governmental regulation for divergent national markets.

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

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

3 units, Aut (Craig)

220B. Methods of Mathematical Physics—(Enroll in Mathematics 220B.) Continuation of 220A.
3 units, Win (Craig)

220C. Methods of Mathematical Physics—(Enroll in Mathematics 220C.) Continuation of 220B.
3 units, Spr (Venakides)

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 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, Fuenzalida, Lusignan, McWhorter, Siegel) lecture M 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 (Staff) T 4:15
Win (Staff)
Spr (Staff)

299. Special Studies in Engineering—Special studies, laboratory work, or reading under the direction of a faculty member. By consent only.
1 or more units, any quarter (Staff) by arrangement
Emeriti: (Professors) Nicholas J. Hoff, John V. Breakwell, Chi-Chang Chao, Erastus H. Lee, Jean Mayers, Walter G. Vincenti
Chairman: Robert H. Cannon, Jr.
Associate Chairman: Daniel Bershader
Associate Professors: Brian J. Cantwell, Lameritus Hesselink
Assistant Professor: Ilan Kroo
Professors (Research): Dean R. Chapman, Bradford W. Parkinson, Leonard Roberts
Professor (Teaching): Richard S. Shevell
Consulting Professors: Robert T. Jones, Harvard Lomax, Emery Reeves, Vincent Salmon, Fredric H. Schmitz, Clarence A. Syvertson
Visiting Professors: Nicholas Rott

OFFERINGS

This department prepares the student for a professional career in aeronautics and astronautics by offering a comprehensive program of graduate teaching and research. Particular emphasis is given to structural, aerodynamic, guidance and control, and propulsion problems of aircraft, missiles and spacecraft. Courses in the teaching program lead to the degrees of Master of Science, Engineer, and Doctor of Philosophy. Aeronautics and Astronautics offers two curricula for the Master of Science and Doctor of Philosophy—one oriented toward the sciences, the other emphasizing engineering. Specific programs are available in the following areas:

Acoustics
Aerodynamics
Aeroelasticity
Aerophysics and Experimental Space Science

AERONAUTICS AND ASTRONAUTICS

Aerospace Structures
Aerospace Systems Synthesis and Design
Analytical and Experimental Methods in Solid and Fluid Mechanics
Biomedical Solid and Fluid Mechanics
Composite Materials
Computational Fluid Dynamics
Flight Mechanics
Gaskinetics
Guidance and Control
Modern Optical Diagnostics in Fluid Mechanics
Physical Gas Dynamics
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
Aerophysics of Hypervelocity Fluid Motion and Atmospheric Entry
Aircraft Performance and Control
Astrodynamics
Bio-Fluid Mechanics and Physiological Acoustics
Computational Fluid Dynamics
Control of Flexible Spacecraft
Control of Robots
Differential Games
Experimental Space Sciences
Geophysics
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 Viscelasticity
Propulsion
Structural Aeroacoustics
Conventional and Composite Structures/Materials Systems Optimization
Wave Propagation

FACILITIES FOR INSTRUCTION AND RESEARCH

The work of the department is centered in the William F. Durand Building for Space Engineering and Science. This 120,000 square foot
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.

The Spectro-interferometric Laboratory does tuned-laser experiments on resonant refractivity in gas flows. The Stanford high-pressure combustion-driven shock tube is utilized for aerodynamic studies as well as hypervelocity aerophysics research. Diagnostics of shock-wave phenomena emphasizes modern optical methods, including resonant interferometry and holography. There is also a specially designed laboratory for studies of aerodynamic noise. Other laboratories recently outfitted include dealing with holography, tomography, optical data processing and related problems involving Fourier optics. Several student instructional laboratories include facilities to study supersonic jets, flame temperature by line reversal, supersonic flow fields with schlieren techniques, refractive index of gases and free-correction flow fields with interferometer equipment, shock-wave interaction by use of a shock tube, gyroscopic behavior, vibration modes of a simulated wing, blunt-body flow with ballistic freeflight range equipment, and hot-wire application with a small low-turbulence air-flow apparatus. An experiment using laser holography is currently being designed. A continuous low-speed wind tunnel with an 18" X 18" working section and speeds to 200 feet per sec. is available for use in instructional laboratories and research.

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

The Experimental Fluid Dynamics group has developed an extensive capability in modern optical diagnostics methods for fluids studies, including several applications of laser techniques, interferometry and Fourier optics. Special opportunities exist for students with overlapping interests in fluid dynamics and experimental physics.

Included among the facilities in the Durand Building are the Structures and Composites laboratories for studying and testing the behavior of small scale structures made of metal and fiber reinforced composites. Equipment is
also available to fabricate composite material structural elements made of prepreg tape. A static/dynamic testing bed for large scale structural tests is provided in the central structures laboratory of the School of Engineering.

Service facilities in the building include a full machine shop, chemistry laboratory, an aeronautics library, several conference rooms, extensive digital and analog computer equipment, including several time sharing terminals. Attached to the building is a modern classroom building which is equipped for televising lectures and which contains a lecture auditorium.

The University's Computation Center 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.

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 emphasis on CFD may register for the M.S. in Engineering or Engineering Science (see below) and design a program in consultation with specialized needs. Students intending to seek a Ph.D. degree with an emphasis on CFD should prepare for the post-master's series in CFD (AA214A-C and AA215A-B) by planning a M.S. program strong in mathematics and numerical analysis (ME200A-C or the equivalent) and in advanced fluid mechanics (e.g., AA200A-B, ME251A-B, AA210A-B, ME261, 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 AND REGISTRATION

To be eligible for registration in the department a student must have received the bachelor's degree in engineering, physical science, mathematics, or an acceptable equivalent. Stu-
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 Courses and Degrees.

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.

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>AA.200A</td>
<td>Elementary Linear Algebra</td>
</tr>
<tr>
<td>AA.210A or AA.206A</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>AA.249A or AA.240B or AA.246 AA.247 or AA.256</td>
<td>Calculus I, II, III, or Linear Algebra</td>
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<td></td>
<td>or</td>
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<tr>
<td>AA.245A or AA.245B or AA.246 or AA.247 or AA.249A</td>
<td>Calculus I, II, III, or Linear Algebra</td>
</tr>
</tbody>
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B. Mathematics Courses—Each candidate is expected to develop a competence in the applied mathematics methods pertinent to his or her major field. This requirement can be met 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 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 Science, 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.
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 AAS90).

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 (4 selected faculty members, plus a chairman assigned by the University Graduate Program Office representing the University at large). The University Oral normally occurs toward the end of the fourth graduate year. Once the oral has been passed, the student finalizes his or her thesis for Reading Committee review and final approval. Forms for the Ph.D. Reading Committee and University Oral scheduling are obtained from the department's academic secretary and submitted with a one-page thesis abstract at least 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 $17,000 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 $680-$800 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**

10. Aeronautics and Astronautics—(Enroll in Engineering 9.)

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) 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, Spr (Hesselink and Staff) Th 1:15-2:15; lab Th 2:15-3:05 or T 1:15-4:05

132. Introduction to Modern Optics — (Enroll in Engineering 170.)

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

3 units, Aut (Karamcheti, Yu) MWF 10


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


3 units, Spr (Hesselink and Staff) lec. Th 1:15-2:05; lab Th 2:15-3:05 or T 1:15-4:05
nautics are expected to be familiar with the basic subject matter covered in this course.)

Prerequisite: Mathematics 44.

3 units, Aut (Chang) TTh 9:30-10:45

200A. Applied Aerodynamics — Atmospheric flight vehicles, the reasons for their configuration, and the nature of airflows associated with their operation. 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 connections; interference; discussion of other topics as time permits. Prerequisites: 100 and 210A or equivalents.

3 units, Win (Baganoff) 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 vehicles in the atmosphere. Dynamic stability and response; open-loop modes of the rigid flight vehicle; integrated treatment of aerodynamic stability derivatives. Further discussion of topics 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, intensity, and power; r.m.s. pressure; plane, spherical, and cylindrical waves; harmonic (monochromatic) waves; simple sound radiators; reflection and transmission of sound at interfaces between different media; multiple consideration of stationary and moving surfaces at interfaces between different media; multiplicity of sound radiation—monopole, dipole, and quadrupole distributions; inhomogeneous wave equation; Kirchhoff integral representation; scattering and diffraction of sound; propagation through ducts—dispersion, attenuation, group velocity; sound in enclosed regions—reverberation; elements of sound propagation in an elastic solid. Prerequisite: first year graduate standing in engineering, mathematics, sciences, or consent of instructor.

3 units, Win (Karamcheti, Yu) MWF 10

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

3 units, Spr (Karamcheti, Yu) MWF 10

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

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

plus lab by arrangement

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

204. Classical Aerodynamics — Selected topics emphasizing important results of classical wing theory. Early theories of Lanchester, Kutta and Joukowski. Adaptation of Joukowski theory to modern airfoils and the home computer. Munk's thin airfoil theory. Reverse flow and reciprocal theorems. Slender wing theory, swept wings, oblique wings. Material for outside reading (NASA RP 1050) and computer program will be available. Knowledge of elementary aerodynamics and complex variables is required.

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

205. Current Topics in Aerodynamic Design — A review of useful theoretical models is followed by practical applications of these analytical tools including: computer graphics in computational aerodynamics; CFD as applied to aircraft design; fundamentals of airfoil and wing design; simple analyses on small computers; unconventional aircraft; and nonaerodynamic aerodynamics. The course involves "hands-on" experience with aerodynamic design using various computational facilities. Guest lectures will deal with the design and development of several existing aircraft. Prerequisite: 200A, preferably 241A.

3 units, Spr (Bershader) MWF 1:15

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

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

207. Turbulence — (Enroll in Mechanical Engineering 261A.)


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

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, quasione-dimensional flow, conical flow, Prandtl-Meyer flow. Prerequisite: 192 (may be taken concurrently) and Mechanical Engineering 131B or equivalent.

3 units, Aut (Baganoff) MWF 1:15

3 units, Spr (Bershader) MWF 1:15

210B. Fundamentals of Compressible Flow — Continuation of 210A with emphasis on more general flow geometry. Use of exact solutions to explore the hypersonic limit and identification of similarity parameters. Review of solution methods for the linearized potential equation with applications to wings and bodies in steady flow; relation to physical acoustics and wave motion in nonsteady flow. Nonlinear solutions for nonsteady constant area flow and introduction to the Riemann invariants. Elements of the theory of characteristics, nozzle design; extension to 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. Hypervelocity Aerothermodynamics and Atmospheric Entry—Energetics of very high-speed motion of vehicles in planetary atmospheres. Includes underlying aerophysics dealing with energy storage and transfer in real gases excited by strong shocks. Effects of vibrational excitation, dissociation and ionization on thermodynamic properties and heat transfer are presented, along with an introductory treatment of gas radiation and radiative transfer. General discussion of the overall hypersonic flow field around blunt bodies is presented, followed by an analysis of hypersonic drag and heat transfer experienced by entry vehicles with applications which include the space shuttle, the Galileo Jupiter probe and aerobraking orbital transfer configurations. The last-mentioned application provides an example
for some introductory remarks on flows which deviate from thermochemical equilibrium. Familiarity with elements of compressible flow is desirable as a prerequisite.

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

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


2 units, Win (Warming) TTh 9:30-10:20

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.

2 units, Spr (Holst) TTh 9:30-10:20

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


220. Optical Methods in Engineering Science—Emphasis is on design and understanding of modern optical systems. Topics include: geometrical 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

225. Stochastic Processes in Aeronautics—Applications of probability theory to problems in aeronautics; analysis of a linear system subject to a random forcing function; correlation function; power spectrum; difference and differential equations for probability densities; Fokker-Planck equation with application to diffusion; Ehrenfest model and approach to thermodynamic equilibrium; random walk model for vibrational relaxation; introduction to the statistical theory of turbulence.

3 units, Spr (Baganoff) MWF 1:15

226. Modern Photodiagnostics in Gas Dynamics—An introduction for Engineering students to aerodynamic flow and combustion diagnostics using nonintrusive laser—spectroscopic techniques. Topics include: diagnostic requirements in aerodynamic and combustion research; laser velocimetry, the fundamentals of linear and nonlinear laser spectroscopic methods including laser—induced florescence. As time allows, other topics such as Rayleigh scattering, Raman processes, and multi-photon processes will also be considered. Emphasis will be placed on the practicality and limitations of these methods in realistic diagnostic environments. Recommended prerequisites: Engineering 170, Electrical Engineering 231, Mechanical Engineering 262A or equivalents.

3 units, Spr (McKenzie) MW 2:15-3:35

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


3 units, Spr (Chang) TTh 9:30-10:45 alternate years, given 1986-87

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 mission performance of the modern helicopter and other VTOL aircraft are considered using simple preliminary design methods.

3 units, Aut (Schmitz) MWF 3:15

231. Basic Rotor Control, Trim, and An Introduction to the Dynamic Stability of Rotary Wing Aircraft—The known methods of controlling the modern helicopter and other VTOL aircraft (tilt-rotor, tilt-wing, jet, etc.) are explored, as are questions of control uniqueness and redundancy. The equations governing flapping and feathering of "rigid" and "soft" rotor systems are investigated including rigid blade response to control and body motion inputs. The VTOL aircraft as a dynamic body is considered using linearization techniques. Laplace transform-root locus techniques are used to deduce the vehicle's dynamic stability and open loop response characteristics. These are related to ease of control by a human operator with and without feedback compensation. Primary emphasis is on basic understanding of principles involved. Prerequisite: 230 or equivalent.

3 units, Win (Schmitz, Lebacqz) MWF 3:15

232. Structural Dynamics and Aeroelasticity of Rotary Wing Aircraft—Techniques are introduced to handle aeroelastic problems of rotating blades. The kinematics of finite rotation are used to describe nonlinear deflections in the blade. The principle of virtual work is used to obtain equations of motion including the contributions of simple aerodynamic models. Model and finite element solution techniques are compared. Effects of aeroelastic couplings on the stability of rotating blades are explored. Ground and air resonance problems of the helicopter are also addressed. Primary emphasis is on a basic understanding of the principles involved. Prerequisite: 230, 231; recommended, 244A, and either 242 or Mechanical Engineering 231A.

3 units, Spr (Hodges) MWF 3:15

233. 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

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

240A. Analysis of Structures — Elements of one- and two-dimensional linear and nonlinear elasticity theory. Boundary value problems; energy methods; analyses of solid and thin walled section beams, trusses, frames, rings, semimonocoque structures. Prerequisite: Civil Engineering 114 or equivalent.

3 units, Aut (Springer) MWF 10

240B. Analysis of Structures — Material behavior. Failure theorems; buckling; plastic behavior of solids; thermal effects. Dynamics of structures. Introduction to finite element analysis. Prerequisite: 290A or consent of instructor.

3 units, Win (Springer) MWF 10

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

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

242. Classical Dynamics—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 considered throughout the course. Prerequisite: Engineering 12 or equivalent.

3 units, Aut (Staff) MWF 2:15

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 4:30-5:45 alternate years, given 1986-87

243B. Spacecraft Dynamics II—(Same as Mechanical Engineering 232B.) Force functions. Generalized active forces, potential energy, generalized inertia forces, formulation of dynamical equations of motion of complex spacecraft. Linearized dynamical equations. Discrete multi-degree-of-freedom systems. Lumped mass models of spacecraft. Spacecraft with continuous elastic components; use of the finite element method in the simulation of spacecraft motions. 3 units, Spr (Kane) WF 4:30-5:45 alternate years, given 1986-87

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 one-dimensional and two-dimensional systems. Prerequisite: 244A or equivalent.

3 units, Win (Ashley) MWF 8 alternate years, given 1986-87

244C. Aeroelasticity—Continuation of 244B. The unrestrained elastic flight vehicle. Modern unsteady aerodynamic theory, including transonic flow and numerical methods for three-dimensional surfaces. Review of experimental methods. Special topics of current interest, such as optimization, coupling between aeroelastic phenomena and automatic controls systems, and problems of power machinery, windmills, etc. Prerequisite: 244B.

3 units, Spr (Ashley) MWF 9, alternate years, given 1986-87

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. Introduction to 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 10

261A. Turbulence—(Enroll in Mechanical Engineering 261 A.)

270. Introduction to Linear System Theory— (Enroll in Electrical Engineering 363.)


3 units, Aut (Bryson) TTh 9:30-11


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


3 units, Win (Staff) MWF 10


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

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.)


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


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


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

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, alternate years, given 1986-87

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

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 1-D gas dynamics, physical parameters and cycle analysis of ramjets, turbojets, turbofans and turbo-props; design of supersonic inlets and nozzles, compressor maps, component matching, fuel injector, 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 alternate years, given 1986-87

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 (Chang) 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)

291A. Linear Transforms and Their Applications to Engineering Problems I—Introduction to Laplace and Fourier transforms. Applications to boundary and initial value problems in acoustics, fluid mechanics. Waves in elastic medium, random vibration, heat and mass transfer. Inverse transformation, contour integration. Method of steepest descent, stationary phase and other asymptotic analysis. Fast Fourier transforms. Prerequisite: Mathematics 106 or its equivalent (may be taken concurrently.)

3 units, Aut (Chang) TTh 2:15-3:30 alternate years, given 1986-87

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

297. Seminar in Flight Mechanics and Control—Problems in all branches of vehicle 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

Chairman: Robert J. Madix
Professors: Andreas Acrivos, Michel Boudart, Curtis W. Frank, George M. Homsy, Robert J. Madix, David M. Mason, Channing R. Robertson, John Ross (by courtesy)
Associate Professor:
Assistant Professor: Gerald G. Fuller, 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, Robert M. Kendall, Ralph Landau

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 Ch.E. 110, 120, 130, 180A, B may be included as part of the 45-unit master's program. Any departure from these guidelines is to be resolved by petition of the student to the chairman of the Department of Chemical Engineering. Credit toward the M.S. degree will not be given for Chemical Engineering Special Topics courses numbered Ch.E. 270-277, or for the colloquium, Ch.E. 300. Note, however, that the student must register for Ch. E. 300 and attend the colloquia. Students wishing to obtain research experience should choose a research advisor and enroll in Chemical Engineering Research 290, for which up to 6 units may count toward the 45-unit requirement; Ch.E. 290, however, may not be substituted for any of the required four lecture courses in the Chemical Engineering 200-series. A written report describing the results of this research must be submitted to and approved by the research advisor.

To insure that an appropriately balanced program is being taken by all M.S. candidates, the student's program must be approved by the departmentally appointed graduate advisor, and a tentative program for the entire academic year should be worked out by the student and advisor at their first meeting of the academic year.

Minimum Grade Requirement—All courses

* The curriculum leading to the B.S. degree in Chemistry is described in the School of Humanities and Sciences section in this bulletin.
taken to satisfy the M.S. degree requirements must be taken for letter grades, if offered, with the minimum 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, with six courses being chosen from the Chemical Engineering 200-lecture series. The remaining electives must be advanced technical courses chosen with the consent of the departmental advisor according to the guidelines noted for the master’s degree in chemical engineering. All courses must be taken for a letter grade, if offered, and a minimum letter grade equivalent of 3.0 must be maintained. After completion of this series of courses and at least three quarters of residence (36 units or more of course work) the student will be eligible to apply for the M.S. degree in chemical engineering.

Thesis Requirement—the thesis must represent a substantial piece of research equivalent to nine months of full time effort and must be approved by a reading committee consisting of two members of the chemical engineering faculty.

Qualification for the Ph.D. Program by Students Receiving the Degree of Engineer—After completing all the requirements for the Engineer’s degree, a student may request to be 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 six courses chosen from the Chemical Engineering 200 lecture series. After completion of this series of courses and at least three quarters of residence (36 units or more of course or research work) the student will be eligible to apply for the M.S. degree in chemical engineering. The remaining courses, to total 60 units, may be chosen from the basic sciences and engineering, including up to six units of Chemical Engineering 270 through 277. A few selected students may participate in a research project during their first year. Following consultation with their advisor and approval by the Graduate Committee, they may register for up to six units of Chemical Engineering Research. This research need not be the same as the student’s ultimate Ph.D. research. These research units may be applied toward the 36-unit requirement for the M.S. but may not be applied toward the 60-unit requirement for the Ph.D. degree. No credit will be given for Chemical Engineering 300, undergraduate Chemical Engineering courses, or courses usually required for the B.S. degree. All courses taken to satisfy the degree requirements must be taken for letter grades, if offered, and a letter grade equivalent of a 3.00 average must be maintained.

Qualifying Examination—to be advanced to candidacy for the Ph.D. degree, the student must pass a qualifying examination. (1) First-year students identified by the Graduate Committee as making less than satisfactory progress in their courses during the academic year will be asked to present orally and defend a critical review of a published paper before the faculty at the beginning of the Spring Quarter. This examination shall be used as the basis for deciding whether or not these students will be allowed to choose research advisors and begin their thesis research. Failure of this examination will lead to termination of the student's study with an M.S. degree and precludes financial aid beyond that already promised. (2) Students considered to be making satisfactory progress in course work are permitted to choose a research advisor and begin their Ph.D. research in the Spring Quarter of their first year. These students and those passing the examination described in (1) above will take a qualifying examination consisting of an oral defense of their research work before the faculty early in the 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 three to 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—Review of the postulates of thermodynamics; 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 (Staff) 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) MWF 2:15-3:30

140. Fluid Mechanics—The flow of isothermal fluids from a momentum transport viewpoint. Continuum hypothesis; scalar fields; fluid statics; deformation of continuous media; non-Newtonian fluids; the equations of motion; creeping flow; potential flow; boundary layer theory; turbulence; 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, Aut (Homsy) MWF 9


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

150A,B. 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 of this group of experiments must be performed.

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

COURSES PRIMARILY FOR GRADUATE STUDENTS

In addition to the courses listed below, graduate students in chemical engineering would be expected normally to enroll in relevant graduate courses offered by the other engineering departments, as well as the Departments of Mathematics, Physics, and Chemistry.


3 units, Aut (Staff) TTh 1-1.5-2:30

201. Bioengineering—Properties and classifications of microorganisms; metabolic pathways, regulation and genetic manipulation; analysis of cell metabolism; cell cultivation techniques; structured models of microbial growth; mixed microbial populations; sterilization; mass transfer in suspension culture; large-scale culture of plant and animal cells; immobilized enzymes and cells; sensors and instrumentation; separation processes; biomaterials; renal transport phenomena; advanced drug delivery systems.

3 units, Win (Robertson) given 1986-87

204. Kinetics of Chemical Processes—Elementary steps; sequences at the steady-state. Reaction networks. Theoretical principles and applications to the study of chain and catalytic reactions. In particular, the kinetics of heterogeneous catalytic reactions is discussed in detail, with emphasis on quantitative aspects.

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

205. Transport Processes in Reacting Systems—Treatment of engineering problems where transfer of mass, energy or momentum is accompanied by chemical reactions. Topics include behavior of reactors; nonisothermal porous catalysts with complex kinetics; thermal properties of reacting fluids; combustion, electrode, and photochemical kinetics; and oscillatory reactions. Physical problems solved analytically for simplified models and with the aid of the computer for complex systems.

3 units, Aut (Mason) TTh 2:30-3:45

206. 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. Prerequisites: 140 and 200 or equivalent.

3 units, Win (Fuller) TTh 10:00-11:15

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

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

210A.B. Viscous Flow Theory (with Applications to Heat and Mass Transfer)—An intensive course dealing with the fundamental principles of momentum, heat and mass transfer and their application to problems of physical interest. Derivation and analysis of the Navier-Stokes equations, the energy equation, and the equation for mass transport; flows at small Reynolds numbers and Stokes' law; the method of matched asymptotic expansions; laminar boundary layer theory; hydrodynamic stability and the Orr-Sommerfeld equation; interfacial instability.

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

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

212. 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) MW(F) 11-12:15
alternate years, given 1985-86

217. 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 11-12:15
alternate years, given 1986-87

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.
(Acivos)

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 of Polymeric Liquids.
(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.)
OFFERINGS AND FACILITIES

The undergraduate Civil Engineering major provides a preprofessional program stressing the fundamentals common to many special fields of civil engineering. Free elective units, plus the proper selection of courses for the requirements in mathematics, science, and engineering fundamentals, permit the student to obtain either a broad general civil engineering education or a more specialized education in a specific branch, such as construction, environmental engineering, hydraulics, transportation, public works administration, structures, or a great variety of other branches. Laboratory facilities are available to the student in construction, fluid mechanics, environmental engineering and science, materials, soil mechanics, structural and earthquake engineering, and experimental stress analysis.

At least one year of graduate study is essential for the professional practice of civil engineering and is strongly recommended. Students who contemplate advanced study at Stanford should discuss their plans with their advisors late in their junior year. The opportunity to participate in the coterminal B.S.-M.S. program should be explored by students desiring an integrated five-year program.

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

Construction Engineering and Management
Computer Applications
Human Resource Management
Legal and Contractual Administration
Operations Analysis and Design
Project Planning, Estimating and Control
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
Structural Mechanics
Foundation Engineering
Soil Mechanics
Environmental and Water Studies
Environmental Engineering and Science
Water Resources Engineering (including elements of hydraulics, hydrology, hydromechanics and nuclear environmental engineering)

Research work and instruction under these programs is carried out in the following facilities—the hydromechanics laboratory, the water quality control research and teaching laboratories, the construction research laboratory (SCRL), the materials laboratory, the concrete laboratory, the soil mechanics laboratory, and the structural engineering laboratory. Research in earthquake engineering is conducted in the John A. Blume Earthquake Engineering Center. Office space is provided for most of the graduate students who act as research or teaching assistants.

PROGRAMS OF STUDY
CONSTRUCTION

The Construction Engineering and Management program prepares technically qualified students for responsible management roles in all phases of the development of major constructed facilities. The program emphasizes management techniques useful in planning, coordinating and controlling the activities of diverse specialists—designers, contractors, subcontractors and client representatives—within the unique project environment of the construction industry. In addition, the program offers subjects which focus on engineering aspects of heavy construction 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 construction faculty also offers a program leading to a Master of Science in Engineering-Industrial Construction; this program is primarily intended for students having undergraduate degrees in electrical, mechanical, mining or chemical engineering. Each student, together with an advisor, can design a curriculum to meet individual educational goals.

The program leads to the degrees of Master of Science, Engineer and PhD. Opportunities are available to support a limited number of 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.

CONSTRUCTION SUPPLEMENT

The following civil engineering courses are particularly recommended as depth electives for students planning to work in construction engineering and management following their Bachelor of Science degree.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.E. 114</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 140</td>
<td>Surveying</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 144</td>
<td>Construction Engineering &amp; Management</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 145</td>
<td>Construction Equipment &amp; Methods</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 181</td>
<td>Design of Steel and Reinforced Concrete structures</td>
<td>5</td>
</tr>
</tbody>
</table>

RESOURCES PLANNING

The 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 program.

STRUCTURAL AND GEOTECHNICAL ENGINEERING

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

ENVIRONMENTAL AND WATER STUDIES

This program covers a broad spectrum of specialties, 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, nuclear, 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, environmental aspects of energy generation, nuclear engineering, 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.

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 of Study." Suggested courses to be taken in satisfaction of the requirements in mathematics, science, and engineering fundamentals are available from the office of the Dean of Engineering. Free elective units may be used in any way the student desires, including additional studies in civil engineering. Because the undergraduate engineering curriculum is designed to insure breadth of study, students who intend to enter the professional practice of civil engineering should obtain their professional education at the graduate level.

UNDERGRADUATE HONORS PROGRAM

The proposed program will lead 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 (LGI) of at least 3.5 for coursework at Stanford, and must maintain this through graduation. The thesis will be supervised by a Civil Engineering Department faculty advisor, but must also involve input from the School of Engineering Writing Program via Engineering 102S or equivalent. The student is also encouraged to present his 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: Construction Engineering and Management, Earthquake Engineering, Energy and Environmental Planning, Environmental Engineering, Environmental Engineering and Science, Geotechnical Engineering, Industrial Construction, Land Use Planning, Nuclear Civil Engineering, Nuclear Environmental Engineering, 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 having undergraduate degrees in civil engineering normally can satisfy requirements for the M.S. degree with three quarters of graduate work of satisfactory quality. Students with undergraduate degrees in other fields may need longer residence for the M.S. degree in order to make up specified basic undergraduate civil engineering subjects. The specific requirements differ depending upon the M.S. degree sought. For example, in environmental engineering and science, students with undergraduate degrees in science or other fields of engineering generally can complete course requirements within three quarters. Students desiring to do so may take an additional 45 units of course work to qualify for a second M.S. degree in Civil Engineering in an area other than that of the first degree, providing they also fulfill the specific requirements for the second degree.

A minimum 2.7 letter grade indicator (LGI) and a program of at least 45 quarter units are required for candidates to be recommended for the M.S. degree. The program of study must be approved by the faculty of the department and shall include at least 40 units of courses in engineering, mathematics, science, and related fields unless it can be shown that other work is pertinent to the student's objectives.

ENGINEER

A minimum of six quarters (90 units) of graduate work including a thesis (12 to 15 units) is
required for the degree of Engineer in Civil Engineering. (Thesis research in absentia is not permitted.) This degree is recommended for all students desiring more graduate education than is provided by the master's degree, especially for those planning a career in professional practice. The student normally should start his thesis in the first quarter of graduate work beyond the M.S. degree. Programs leading to the degree of Engineer are offered in the fields of specialization mentioned above. A minimum "B" average (3.0 LGI) is required for candidates to be recommended for the degree. The program of study must be approved by the faculty of the department.

DOCTOR OF PHILOSOPHY

The degree of Doctor of Philosophy is offered under the general regulations of the University as set forth in the section "Degrees" in this bulletin. This degree is recommended for those who expect to engage in a professional career in research, teaching, or technical work of an advanced nature in planning, design, and analysis. The Ph.D. program is rigorous and should be undertaken only by students with ability for independent work. It requires a minimum of three years (nine quarters) of graduate study, at least two years of which must be at Stanford. Experience has shown that few students complete the Ph.D. within the minimum residence period. Prospective doctoral students should anticipate the possibility of at least one extra year. All candidates for the Ph.D. degree are required to complete the equivalent of one-quarter time, 50 percent time, as a teaching assistant. Further information about Ph.D. requirements and regulations will be found in the department handout entitled "Information and a Typical Timetable for the Ph.D. Degree."

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

The program of study will be arranged by the prospective candidate at the beginning of the second year with the advice of a faculty committee whose members are nearest in the field of interest to that of the student. The chairman of the committee will serve as the student's problem advisor until such time as a member of the faculty has agreed to direct the dissertation research. Insofar as possible the program of study is adapted to the interests and needs of the student within the framework of the requirements of the Department and the University. In the second year of graduate study the student is expected to pass the Departmental General Qualifying Examination to be admitted to candidacy.

FINANCIAL ASSISTANCE

The department maintains a large and continuing program of financial aid for graduate students. Fellowship or scholarship awards for the academic year range from $2,000 to over $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-third time work as teaching aides during the academic year. Research assistantships are also available. Engineer and Ph.D. candidates may be able to use research results as a basis for 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.

ADMISSIONS

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 for which they are admitted and to the Program described above to which they are admitted. If students wish to shift from one program to another after being accepted, an application for transfer must be filed with the department, and they will be advised if the transfer is possible. If, after enrollment at Stanford, students wish to continue toward a degree beyond the one for which they were originally admitted, a written application must be made to the Department of Civil Engineering.
UNDERGRADUATE COURSES

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

3 units, Spr (Kiremidjian) TTh 10 and W 1:15

125. Computers in Civil Engineering—Examines changing role of microcomputers and large computers in civil engineering 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. Verification of commercially available civil engineering software packages. 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, Win (Ortolano) TTh 1:15-2:30

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 (Moore) MWF 1:15

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 (Magee) Th 11
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, Aut (Barrie) TTh 1:15-2:30

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 (Note: There will be 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: 107, Engineering 60.
4 units, Aut, (Franzini) 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. One year of college mathematics and C.E. 170 are recommended, but not required. (Graduate students register for 228.)

3 units, Win (Ortolano) TTh 1:15-2:30
alternate years, given 1986-87

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

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

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 (Masters) TTh 11-12:15

177. Building Energy Laboratory — Measurement of building heat losses, infiltration, indoor air pollution, use of thermal mass. Efficiency measurements of renewable energy sources. Use of the microcomputer as a lab instrument. Prerequisite: CE176 and computer experience. Enrollment is limited.

3 units, Spr (Masters) MF 1:15 plus
one 3-hour lab weekly by arrangement

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 11-11:50

190. Geotechnical Engineering — An introduction to basic principles of soil mechanics.

CIVIL ENGINEERING

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 11-11:50
laboratory by arrangement

199. Directed Reading and Special Studies in Civil Engineering—Practice in execution of a simple 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

COURSES 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 (Skamarock) MWF 11

202. Numerical Solution of Environmental Models—Focus on numerical models for simple physical systems in water studies context. Course is 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 will be treated. The convergence consistency, and stability properties of these methods will be examined. Course will also focus briefly on quadrature and errors and error propagation in calculations. Prerequisites: knowledge of FORTRAN, some experience with partial differential equations and 201.

2 units, Win (Koseff) TTh 8

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.
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; transportation models, structural dynamics models; harmonic analysis; application of Markov chains to civil engineering problems; introduction to statistical decision theory, Bayes theorem; prior and posterior analysis; posterior analysis; utility functions; applications to civil engineering problems. Prerequisite: 203 or equivalent.

4 units, Spr (Kiremidjian) given 1986-87

210. 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 (Wiggins) MWF 11

225. Microcomputers in Urban and Environmental Planning—(Same as Urban Studies 143 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 1986-87

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 alternate years, given 1986-87

232. Mitigating Environmental Costs of High Tech Development—(Undergraduates enroll in Urban Studies 178.) Seminar examines planning and management systems to control the spillover effects of “high tech” development; e.g., measurement and mitigation of groundwater contamination from semi-conductor industries; assessment of political, and economic barriers to effective regulation and industrial organization; social accounting and corporate responsiveness. Open to juniors and seniors with consent of instructor.

4 units, Win (Daneke) Th 1:15-3:05

233. Urbanism and Planning in Latin America—(Undergraduates enroll in Urban Studies 133.) Seminar examining phenomenon and problems of rapid urban growth and decentralization in important Third World centers
including Mexico City, Sao Paulo and Rio de Janeiro. Surveys problems in housing population, social services, transportation and infrastructure. Analyzes planning strategies applied on metropolitan and national levels. Topics include economies and diseconomies of agglomeration, intersectoral competition for urban investment and planning and administrative jurisdiction.

4 units, Win (Campbell) Th 3:15-5:05

234. Land Use Planning and Control—
(Undergraduates enroll in Urban Studies 170.) 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 (Rossi) TTh 8-9:30

235. Transportation, Land Use and Energy — (Undergraduates enroll in Urban Studies 172.) Examination of the interactions between urban land use patterns, transportation networks, and energy demand; impacts of changes in transportation technology and policy on energy consumption; contrasts between the U.S. and developing countries.

3 units, Win (Mukherjee)

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: CE 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 pm

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: CE 234 or consent of instructor.

3 units, Win (Wiggins MWF 2:15-3:05

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: 145 or equivalent experience.

4 units, Aut (Paulson) Th 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 techniques including treatment of uncertainty, subnetworks, resource allocation and leveling, time/cost tradeoffs and specification requirements. Also covers basic techniques for 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 project management, marketing, and strategic planning for construction companies. Requires individual and group efforts on problems and case studies. Prerequisites: CE240, CE241 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 an extensive term project. Prerequisites: 240 and a computer
course equivalent to Computer Science 106, corequisite 241. 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.

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

245. Expert Systems in Civil Engineering—Intended as a first course lecture/seminar for graduate students interested in applications of Artificial Intelligence to Civil Engineering problems. An introduction to relevant concepts from Artificial Intelligence and Expert Systems, and illustrations of these concepts through discussion of previous development efforts, will be presented in lecture format. Students will then 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. Each student or team will make a presentation in seminar format covering their project. Course grade will be based solely on this project. Class size is limited to 20; priority will be given to civil engineering graduate students. Advanced undergraduates may be admitted to the course by permission of the instructor. Prerequisite: familiarity with microcomputers; knowledge of a programming language is desirable but not essential.

3 units, Spr (Medearis) TTh 9, plus one hour by arrangement


3 units, Spr (Fondahl) MWF 8

248. Construction Financing in Real Estate and Land Development—Study of the interrelationships between all of the variables that make up a successful real estate project; places heavy emphasis on the financial aspects involved in land acquisition, land development, construction, permanent lending, and project management. In addition, various aspects of joint venturing, including the control of functions and equity financing are discussed. Enrollment limited to 20, with priority given to students in the graduate construction program. Prerequisite: Engineering 60, IE133 or equivalent.

3 units, Spr (Medearis) TTh 8, plus one hour by arrangement

249. Labor and Industrial Relations in Construction—Study of the history, laws, institutions and social and economic forces affecting labor and industrial relations in construction; covers both union and open-shop sectors. Enrollment limited, with priority given to students in the graduate construction program.

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

250. Managing Human Resources in Construction—Study of human behavior: individual, in small groups, and in project and company organizations. Develops integrated theories of perception, motivation and learning with examples drawn from construction. Provides both independent and supervised exercises in group problem solving, using selected case material. Consists of two one-hour lecture and one two-hour group meeting each week. Co-requisites: 144 and 240. Enrollment limited to 40 students, with priority given to those from the graduate construction program.

3 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, Win (Levitt) W 9 F 9-10:50

252. Construction Methods and Estimating—Methods and equipment selection together with techniques for estimating and bidding construction works. Construction engineering topics include rock excavation, tunnel-
ing, 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

258A,B,C. Seminar in Construction Engineering and Management—Weekly evening discussions of special topics with speakers from industry and government. Normally taken by construction graduate students each quarter for three quarters. Because lecture content builds upon required construction graduate courses, credit registration is restricted to students in the graduate construction program.

258A. 1 unit, Aut (Staff) by arrangement
258B. 1 unit, Win (Staff) by arrangement
258C. 1 unit, Spr (Staff) by arrangement

259A,B,C. Construction Problems—Analysis of group selected problems in construction techniques, equipment, or management, followed by preparation of oral and/or written 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 to 3 units, Aut (Staff) by arrangement
259B. 1 to 3 units, Win (Staff) by arrangement
259C. 1 to 3 units, Spr (Staff) by arrangement

260. Engineering Hydrology—A first course in hydrology for civil engineers and other graduate students interested in water studies. An engineering analysis of watershed hydrology, emphasizing physical principles with emphasis on microcomputer solution of hydrologic problems through the watershed hydrologic cycle.

4 units, Spr (Kruger) MWF 9 and W 2:15-4:05

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 or 260 recommended 260, 262 or equivalents.

3 units, Spr (Freyberg) MWF 9

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 problems are treated. Flood wave routing in dendritic river systems and the dam-break problem will be studied using numerical methods. Prerequisite: 107, or equivalents. Knowledge of FORTRAN.

3 units, Aut (Koseff) MWF 10

263. Fluid Mechanics of Closed Conduits—Review of fundamental principles of turbulent flow and application to closed conduits; pipe systems and branching of pipes; unsteady flow in pipes; flow establishment, application of methods of characteristics to water hammer problems. Prerequisite: Engineering 21 or consent of instructor.

3 units, Spr (Hsu) MWF 10


3 units, Win (Franzini) TTh 10, Th 12

265. Topics in 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 alternate years, given 1986-87

266. Water Resources Systems Analysis—Application of mathematical optimization techniques (e.g., linear programming) to the analysis and design of water systems. Consideration is given to both quantity and quality of water.
Topics include reservoir and conduit sizing, time phasing of capacity expansions, and reservoir operations. Water quality issues are considered in the context of waste water treatment plant design and alternative schemes for the attainment of water quality standards. Course includes an introduction to multi-objective programming and the combined use of simulation and optimization. Students will use the LOTS computing facility to solve selected problems. Prerequisite: 260.

3 units, Win (Ortolano) T 3:15-4:30

267. Water Resource and Environmental Planning—Historical perspectives on environmentalism. Water quality management using charges, standards, and marketable permits. NEPA and its influence on water planning in the U.S. and abroad. Institutions for water resources development. Current issues in U.S. water policy. Course uses group discussion format. Assignments are structured to improve students communication skills. Enrollment limited to 12 students. Prerequisites: 260 or consent on instructor.

3 units, Aut (Ortolano) T 3:15-5:05

268. Professional Seminar in Environmental and Water Studies—Discussion by faculty, students and visitors of study programs, professional opportunities, and research activities in the fields of environmental engineering and water resources engineering. All candidates for the M.S. degree in environmental and water studies are required to take this course.

1 unit, Aut (Franzini) W 4:15-5:30

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 Natural Waters—Effects of organic and nutrient pollutants on the ecology and chemical quality of natural waters; modeling of chemical movement and fate in surface and groundwaters including advection, dispersion, sorption, volatization, and transformation; water quality requirements for various beneficial uses. Prerequisites: freshman chemistry and calculus.

3 units, Aut (Staff) 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. CE 273 is recommended but not required.

4 units, Win (Roberts) MWF 8, T 12:15-1:05

271B. Water Quality Control II—Aerobic and anaerobic biological unit processes for the treatment of municipal and industrial wastewaters. Prerequisites: 274 or equivalent and 271A.

3 units, Spr (McCarty) MWF 8

271C. Water Quality Control III—Analysis of advanced or specialized wastewater treatment flowsheets, including hazardous wastes on physical and chemical processes in treatment of municipal wastewater and processing of treatment residuals. 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, W 1:15-3:05 3 field trips will be scheduled

272. 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: 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 10

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, Win (Grbić-Galić) TTh 9

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, Win (Grbić-Galić) W 2:15-5:05
plus 3 hours by arrangement

275A. Water Quality Control Processes I—Laboratory and pilot plant studies of physical and chemical processes for the treatment of water and wastewaters. Prerequisites: 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 which may be taken concurrently.

3 units, Spr (McCarty) M 1:15-5:05 and Th 2:15-5:05

276. Energy and Environment—Analysis of environmental impact of energy production in the U.S.; energy demand and supply of commercial and future energy resources; economic analysis; environmental impacts and risk; analysis of fossil fuel and nuclear fuel cycles; role of conservation; specific environmental threats: air pollution, climatic change, radiation, heat, and noise.

3 units, Aut (Kruger) MWF 9

277. Nuclear Environmental Engineering—A review of nuclear methods useful in environmental studies, the conflict of energy production and environmental quality, and the problems of environmental radioactivity. Topics included are: nuclear civil engineering, survey of available nuclear methods, application in water studies, commercial nuclear power; emission of radioactive residuals; radioactive waste management, biological importance of ionizing radiation.

3 units, Win (Kruger) MWF 10

279. Environmental Engineering Seminar—Analysis of issues involved in managing toxic environmental risks. Specific topics will include discussion of traditional approaches to pollutant abatement, approaches to risk assessment, perceptions of risk and cross media implications of toxic risk management. Guest speakers, discussion groups and assigned reading.

1 unit, Spr (Leckie, Morell) 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 8:30-10,
M 2-4, computer problems sessions

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) M 2:15-4:05,
W 1:15-2:05
M 2:15-4:05, computer problems sessions

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 (Staff) 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; equivalent frame method for slab systems; yield line analysis of slabs; design of shear walls. Prerequisites: basic courses in design of steel and reinforced concrete structures.

4 units, Aut (Krawinkler) TTh 11 and W 2:15-4:05

286. Design of Structures II—General aspects of design; serviceability and failure criteria; types of loading; methods of design; structural systems for buildings; analysis and design of tier buildings for gravity loads and lateral loads; earthquake resistant design; effects of dynamic loading on strength and ductility of structural elements. Laboratory experiments on structural elements and frame models. Prerequisites: basic courses in design of steel and reinforced concrete structures.

4 units, Spr (Krawinkler) TTh 11 and W 2:15-4:05


4 units, Spr (Staff) TTh 9:00-10:50

290. Advanced Soil Mechanics — Examination of the fundamentals of soil behavior. Classification of soils; soil mineralogy; stress-strain and strength behavior of soils; soil characterization and property evaluation; site exploration; in-situ testing; seepage through soils. Prerequisite: 190 or equivalent.

3 units, Win (Staff) T 3:15-5:15

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 12:30-2:05

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 and soil-structure interaction. Prerequisites: 290, 291 and knowledge of FORTRAN.

3 units, Spr (R. B. Seed) TTh 12:30-2:05

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.)

2 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. Geotechnical Earthquake Engineering — Causes of soil failure during earthquakes; soil liquefaction; soil settlement; influence of soils on ground motion characteristics; computation of response using lumped mass, wave propagation and finite element analyses; dynamic soil-structure interaction. Prerequisite: 292A (may be taken concurrently).

2 units, Spr (R.B. Seed) TTh 11-12:15

296A. Structural Dynamics I — Vibrations and dynamic response of simple structures to periodic and arbitrary loadings; support motion; response spectra; two-degree-of-freedom systems. Prerequisites: 180 and Engineering 12.

3 units, Win (Gere) MWF 10

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 (Pinsky) T 2:15-4:05

296C. Geotechnical Earthquake Engineering — Causes of soil failure during earthquakes; soil liquefaction; soil settlement; influence of soils on ground motion characteristics; computation of response using lumped mass, wave propagation and finite element analyses; dynamic soil-structure interaction. Prerequisite: 292A (may be taken concurrently).

2 units, Spr (Krawinkler) TTh 11-12:15 lab by arrangement
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) given 86-87

298. Structural and Geotechnical Engineering Seminar—Lectures on topics of current interest. Recommended for all graduate students.
1 unit, Aut (Kiremidjian) W 4:15
Win (Cornell)
Spr (Shah)

299. Independent Study in Civil Engineering—Directed study for graduate students on subject of mutual interest to students and staff member. Student must obtain faculty sponsor.
1-3 units, any quarter by arrangement

Aut, Win, Spr (Staff) by arrangement

301. 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

303. 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 aquifer and soil properties. Prerequisites: 201, Engineering 21, Geology 230, or equivalents.
4 units, Spr (Freyberg) TWThF 1:15

304. 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 dimensionless analysis and physical models as a means to understand flow dynamics. Prerequisites: 107, 201, Computer Science 103 or 106, or equivalents and consent of instructor.
4 units, Win (Koseff) MTWF 1:15

305. 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

306. Hydrogeochemical Cycles—A study of the processes and mechanisms responsible for the natural circulation of major, minor, and trace elements through the hydrosphere, atmosphere, lithosphere, and biosphere. Emphasis will be placed on a mechanistic interpretation of global cycling of elements and man's influence on accelerating or intercepting the normal processes. Consideration will include chemical weathering processes, biotransformations of elements, residence times in various environmental compartments, and fluxes between environmental compartments. Prerequisites: 273 and 274.
2 units, Spr (Leckie) by arrangement alternate years, given 1986-87

307. Microbial Degradation of Organic Pollutants—Mechanisms, biochemistry and enzymology of microbial degradation of various synthetic organic compounds, as influenced by environmental factors, chemical structure and concentration of substrates, will be analyzed. Evolutionary and genetic explanations for existing metabolic pathways will be sought; the role of degradative plasmids and genetic manipulation in decomposition of pollutants will be described. The phenomena of biodegradability and recalcitrance, detoxification and production of more toxic compounds, activation and biomagnification will be explained. The use of microorganisms in detecting mutagenic and carcinogenic compounds, as well as comparisons of metabolic pathways of hazardous organisms in microorganisms and man, will be covered. Estimations of biodegradation potential of xenobiotic compounds and predictive models of their decomposition will be considered.
2 units, Spr (Grbic-Galic) TTh 10
alternate years, given 1986-87

308. Random Vibrations—Concept of random vibrations; description of the vibratory motion of probabilistic summary; concept of stationarity, ergodicity, correlation and autocorrelation; Fourier Analysis; spectral density function;
input/output relationship for linear systems; transmission of random vibrations. Prerequisites: post-M.S. standing.

2 units, Win (Shah) MW 11
given 1986-87

399. Advanced Engineering Problems—Individual projects on selected topics. Provides for independent graduate work under the direction of a faculty member on a subject of mutual interest. Student must find faculty sponsor. A written report is usually required.

1 to 5 units, any quarter (Staff) by arrangement


Aut, Win, Spr (Staff) by arrangement

COMPUTER SCIENCE

(The department of Computer Science was in the process of moving from the School of Humanities and Sciences to the School of Engineering at the time this bulletin was being prepared. Please see the Computer Science section under the listings for the School of Humanities and Sciences for current information about courses and degrees in Computer Science.)

ELECTRICAL ENGINEERING


Chairman: Robert L. White (on leave*)

Associate Chairmen: James B. Angell, Thomas Kailath, Gordon S. Kino, Malcolm McWhorter


Assistant Professors: Stephen P. Boyd, Mark Horowitz, Mark Linton, Brian Reid


Associate Professor (Research): Stephen Lundstrom

Courtesy Professors: Malcolm R. Beasley, William Brody, Gene H. Golub, Donald E. Knuth, David Luenberger, John McCarthy

Courtesy Associate Professor: Gio C.M. Wiederhold

Courtesy Assistant Professors: David Cheriton, Lambertus Hesselink, Keith Lantz

Consulting Professors: Charlie C. Bass, Bruce Deal, Joseph Feinstein, Owen K. Garriott, Stig B.M. Hagstrom, Franklin Kuo, Stephen Mende, Jorma Rissanen, Jerome Tieman


Consulting Assistant Professor: Norman P. 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 EE depth sequence and an overall average of "C" in all EE courses to obtain a Bachelor of Science in Electrical Engineering.

Interdisciplinary Majors providing work in
The doctoral program, requiring a minimum of applications for admission with graduate standards. The department has waived the thesis requirement. Inquiries may be addressed to the Associate Chairman, Admissions, Department of Electrical Engineering.

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). A Supplementary Information Sheet providing detailed instructions, and including a worksheet for preparing a program proposal, is 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 depth area.
2. At least one electrical engineering course numbered above 200 in each of three additional course areas, outside of the area selected under item 1, to provide breadth.
3. Enough additional units of electrical engineering courses so that items 1 through 3 total at least 21 units of graded electrical engineering courses numbered above 200, including at least 9 units of such courses numbered 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 in departments other than electrical engineering for a total of nine units.
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.

Able students without formal undergraduate preparation in electrical engineering may also be admitted for graduate study. Such students may have graduated in any field and may hold either the B.S. or A.B. degree. Each student, with the help of an advisor, prepares a program of study to meet his or her particular needs and submits it to the faculty for approval. A student with adequate preparation in mathematics
through calculus and college physics including electricity, can usually complete the M.S. degree requirements within two academic years. A student with some additional preparation in electrical engineering may be able to complete the M.S. requirements in only one academic year.

Graduate study in Electrical Engineering is demanding, and it is essential that students be adequately prepared in physics, mathematics, circuits, fields, electronics, digital systems, and laboratory work. The ability to take advantage of modern computing facilities is an essential skill for electrical engineers, and an increasing number of our courses routinely require it. Every student should acquire this skill early in the program, either by taking one of the regular computer science courses or one of the special "short courses" given by the Computation Center, or by self-study.

It is the student's responsibility, in consultation with an advisor, to determine whether the prerequisites for advanced courses have been met. Prerequisite courses ordinarily taken by undergraduates may be included as part of the graduate program of study. However, if the number of these is large, the proposed program should contain more than the typical 42 to 45 units, and the time required to meet the degree requirements may 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 from 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 less than 25 units of study in electrical engineering with about 25 units of study in industrial engineering or business. Four academic quarters are required to complete this program, which combines the technical education that is represented by the master's degree in Electrical Engineering with a substantial amount of work in industrial engineering or business.

The degree of Engineer is also offered for an administration program. Six academic quarters are required, and a thesis is to be written. Work toward this degree is usually divided about evenly between business and engineering. The thesis may be in either department, with proper approval.

Students wishing a degree with the designation "Electrical Engineering: Administration" should so indicate on the application for candidacy for the degree.

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 section “Degrees” in this bulletin. The requirements are administered by the University Committee on the Graduate Division.

Admission to the graduate school does not imply that the student is a candidate for the Doctor of Philosophy degree. Advancement to candidacy requires superior academic achievement, satisfactory performance on a qualifying examination, and sponsorship by two faculty members. Enrollment in 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 oral examination near the completion of the doctoral program; (5) a dissertation, based on research, which must be a contribution to knowledge.

About one-fourth of the program of graduate study should be in departments other than Electrical Engineering. Courses shall be selected to form an integrated program, to be approved by the department. A student wishing to fulfill the requirements for a formal minor may elect to do so.

**Ph.D. Minor**—For a minor in Electrical Engineering, the student’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. (See sections on study beyond the master’s degree below.)

**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 assistantships are awarded by individual faculty research supervisors, working in conjunction with the Committee on Graduate Admissions of the department. Research assistants are normally able to carry out their Engineer or Ph.D. thesis work and write their thesis as an integral part of their assistantships.

Applicants for all three forms of financial assistance should obtain the necessary application forms from the Office of Graduate Admission, Old Union, Stanford, CA 94305.

**OTHER ASSISTANCE PROGRAMS**

Many of the department's graduate students are supported by other programs which provide particular advantages. The Honors Cooperative Program makes it possible for academically qualified engineers and scientists in nearby companies to be part-time graduate students in Electrical Engineering while continuing nearly full time professional employment (see discus-
Further information about this program can be obtained by writing to the Committee on Graduate Admissions, Electrical Engineering Department, Stanford, CA 94305.

AREAS OF RESEARCH

Candidates for advanced degrees participate in the research activities of the department as paid research assistants or as students of individual faculty members. At any one time, certain areas of research will have more openings than others. A new applicant should express a second choice of research interest in the event that there are no vacancies in the primary area of interest. At present, faculty members and students are actively engaged in research in the areas listed below.

SPACE PHYSICS AND RADIOISCIENCE

Computer Simulation of Wave-Particle Interactions
Electromagnetic Waves and Plasmas
Electron Beam Experiments in Space
Ionospheric and Magnetospheric Physics
Planetary Exploration
Propagation Studies of Winds and Turbulence
Radio Wave Scattering
Remote Sensing of Atmospheres and Surfaces
Solar-Terrestrial Interactions
Space Engineering
(Also see Space Science and Astrophysics)
Space Plasma Physics
Space Vehicle Electrodynamics
Very Low Frequency Wave Propagation
VLF Wave-injection Experiments

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

INTEGRATED CIRCUITS

Bipolar, MOS and other silicon devices
Biomedical Applications of Custom Integrated 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

QUANTUM ELECTRONICS

Coherent UV and X-Ray Sources
Fiber Optics
Holography
Laser Applications in Physics, Chemistry, Biology, Aeronautics and Electronics
Laser Devices and Laser Physics
Nonlinear Optical Devices
Photoacoustic Phenomena
Picosecond Laser Pulses
Scanning Microscopes

MICROWAVE PHYSICS AND ELECTRONICS

Acoustic Imaging
Acoustic Microscopy
Acoustic Signal Processing
Magnetoacoustic, Acousto optic and Photoacoustic Phenomena
Microwave Acoustics
Nondestructive Testing

INFORMATION SYSTEMS

Adaptive Control
Adaptive Signal Processing
Biomedical Signal Analysis
Cryptography and Data Security
Descriptions of courses will be found in the following pages.

**COURSES FOR UNDERGRADUATE STUDENTS**

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 EE, 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 (Hellwell) 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 perturba-
tions; 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: Engrg. 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 8-9:15
Win (da Rosa) MWF 11

112. 3 units, Win (Gibbons) TTh 8-9:15
Spr (da Rosa) MWF 11

113. 3 units, Aut (da Rosa) MWF 11
Spr (Gibbons) TTh 8-9:15

121. Digital Laboratory—Introduction to digital circuits and their application. Topics include measurement technique, logic families, switching speed, Boolean algebra, state machines, digital data transmission, analog and digital converters, and digital displays. Prerequisite: Engineering 40; co-requisite: Engineering 102E.

2 units, Win (Staff) M 1:15 plus 3-hour lab weekly by arrangement
2 units, Spr (Staff) M 1:15 plus 3-hour lab weekly by arrangement

122. Analog Laboratory—Design and testing of analog circuits. Transistor amplifier with feedback; discreet components differential amplifier; op-amps and their applications; active filters and oscillators; regulated power supplies; class AB power amplifier; AM and FM communications. Co-requisite: 113.

3 units, Aut (da Rosa) TTh 9:30-10:20 plus
3-hour lab weekly by arrangement
Spr (da Rosa) MW 3:15 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

141. Electromagnetic Fundamentals—The field concept, Maxwell’s equations, basic vector analysis treatment, plane waves in simple media, computation of static and time-varying fields, dielectric and magnetic media. Prerequisites: Physics 53 and Mathematics 44.

3 units, Aut (Waterman) MWF 2:15
Win (Inan) MWF 2:15

142. Electromagnetic Waves—Continuation of 141. Emphasis on waves-plane waves in lossy, inhomogeneous and anisotropic media, and waves in simple guided systems such as transmission lines, waveguides and optical fibers. Phenomena of reflection, refraction, standing waves and polarization. Antennas and radiation of energy. Elements of radio transmission systems and radar. Prerequisite: 141 or Physics 120.

3 units, Spr (Inan) MWF 2:15

180A,B,C. Fundamentals of Computer Science — (Enroll in Computer Science 108A,B,C.)

182. Digital Computer Organization—Basic digital circuits; introduction to switching theory and logic design; computer arithmetic; memories, processors, control, input/output, and mass storage; data formats, addressing and instruction sets. Study of the logic control of a small computer. Prerequisites: 181 (or Computer Science 108C may be concurrent).

3 units, Aut (Manning) MWF 11
3 units, Win (Staff) MWF 11

183. Digital Logic Laboratory—Experiments in digital logic design using TTL integrated circuits, including SSI gates and flip-flops. MSI registers and ALU's and LSI memories 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
3 units, Win (Staff) TTh 8-9:15
plus 4 hour lab by arrangement
3 units, Spr (Staff) TTh 8-9:15
plus 4 hour lab by arrangement

190. Special Studies or Projects in Electrical Engineering—Independent work under the direction of a faculty member. Individual or team activities involving laboratory experimentation, design of devices or systems, or directed reading. Graded on a Pass/No Credit basis. by arrangement

191. Special Studies and Reports in Electrical Engineering—Independent work under the direction of a faculty member; a written report or 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.

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.

COURSES FOR UNDERGRADUATE OR GRADUATE STUDENTS

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 (Staff) Th 11
200C. 0 units, Spr (Staff) 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 anatomical 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. Prerequisites: Course presumes no biological background, but some familiarity with circuits and electrical instrumentation techniques (e.g., 113) will make it more meaningful.

3 units, Win (Thompson) MF 3:35-4:50

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 (Mekn) T 11

208. Biological Information Processing—The primary purpose of this course is to acquaint the student with the basic signal processing elements occurring in biological systems, and how these elements can be assembled to execute fairly complex signal processing. The physiological basis of the signal processing is investigated so that a good sense of the signal magnitudes, propagation delays, etc. can be obtained. The signal processing capabilities of various neural networks are examined and compared to naturally occurring systems. Examples are taken from both lower animal and human systems. Peripheral signal processing, such as occurs in auditory and optical sensory systems, is discussed, as well as regulatory systems and the central nervous system.

3 units, Spr (White) not given 1985-86

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 synapse, quantum 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 10

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 the p-n junction, metal-semiconductor contact, bipolar junction transistor, MOS capacitor, MOS and junction field-effect transistors and related devices such as CCD's and solar cells. First-order device models that reflect physical principles and are useful for integrated-circuit analysis and design. Prerequisites: 111, 112 for undergraduates, none for graduates (though equivalent of 111, 112 is recommended).

3 units, Aut (Plummer) MWF 1:15, or (Staff) TTh 2:45-4

Win (Staff) MWF 9

217. Electron and Ion Beams for Semiconductor Processing—Generation of high resolution electronic and ion beams for use in fabrication and diagnosis of solid state electronic devices. Interaction to resolution and current density. Interaction of beams with solid state targets; isotropic and anisotropic dry etching techniques; contrast mechanisms in scanning beam microscopy. Prerequisites: Physics 51, 53, 55 and 57 or equivalent.

3 units, Spr (Pease) MWF 8

221A. Linear Active Networks—The general small-signal properties of active devices and the use of the devices in amplifiers and oscillators. Various forms of two-port network parameters and their properties. The relation between these parameters and various models for active devices. Properties and design of common ac and dc amplifier and oscillator configurations. Prerequisite: an undergraduate electronics sequence.

3 units, Win (McWhorter) MWF 10

221B. Linear Active Networks—Introduction to the common network functions for approximating constant gain in a desired band (lowpass and bandpass). Implementation of these functions by active filters and LC networks. General concepts relating to effects in multiple-stage amplifiers. The origin of amplifier noise; means for maximizing the signal-to-noise ratio in single and cascaded stages. Prerequisite: 221A.

3 units, Spr (McWhorter) MWF 10

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 (Harris, J.) MWF 3:15

231. Lasers—Introduction to how lasers 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 (Stiegman) MWF 8

232. Lasers—Continuation of 231. More detailed coverage of selected topics in lasers, optics, quantum electronics. Prerequisite: 231.

3 units, Win (Siegman) MWF 9

238. Electrical and Magnetic Properties of Solids—Electrical and magnetic properties of solids from a fundamental point of view. Introduction to band theory, surface states, dielectric and ferroelectric materials, magnetic materials, ferromagnetism, and superconductivity. Emphasis on physical understanding. A large amount of material is systematized using the twin concepts of extended wavefunctions (transport, band theory, etc.) and more localized wave functions, ferroelectricity, ferromagnetism, etc.

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

239A. Solid State Theory—(Enroll in Applied Physics 239.)

239B. Solid State Theory—(Enroll in Applied Physics 240.)

241. Waves I—Introduction to a variety of waves and wave phenomena as they appear in different natural, laboratory, and application settings. Electromagnetic, acoustic, seismic, atmospheric, plasma, and water waves and their mathematical and physical correspondence in terms of Hamilton's principle. Propagation, attenuation, reflection, refraction, surface and laminar guiding, and intrinsic and structural dispersion; energy density, power flow, and
phase and group velocities. Geometrical and structural complexities are minimized in order to stress basic wave concepts common to diverse fields of application. Analysis in terms of transmission line and impedance concepts using exponential notation and vector phasors. Treatment limited to plane harmonic waves in isotropic media. Nonhomogeneous cases limited to plane interfaces and exponentially stratified media. Prerequisite: 142 or equivalent or other wave course.

3 units, Aut (Eshleman) MWF 10

242. Waves II—Continuation of 241 with emphasis on fundamental topics of importance for further study and application of microwave, optical, acoustic, or plasma phenomena. Plane, cylindrical, and spherical waves and boundary value problems; radiation, dipole and array antennas, interferometers, and reciprocity; wave guides, fiber optics, and acoustic delay lines. Uniaxial and gyrotropic anisotropic media with magnetionic plasma, and ferrite applications. Non-linear effects. Mode coupling, resonators, and gaussian wave packets. Prerequisite: 241.

3 units, Win (Eshleman) MWF 10


3 units, Win (Pantell) MWF 11

244A. Communication Engineering Telephony—Covers engineering principles used in current telephony system research and development, including telephone transmission lines, concept of traffic, traffic theory, analog and digital (PCM) transmission of telephony, and fiber optics and cable. Course reviews signaling methods, practical signaling systems in use and international standards. Review of past switch design is followed by description of current digital switch design drawing from current research and development projects. A review is given of telephone network planning and Integrated Services Data Networks. Prerequisite: senior or graduate standing in Electrical Engineering or permission of instructor.

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

244B. Communication Engineering Transmission Systems—The design of transmission systems for television, telephony and data-using satellites. Microwave repeaters, mobile radio, and broadcast. Also reviews modulation performance of FM, AM, SSB, common digital schemes and spread-spectrum. Emphasis is on link performance, capacity, 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: 241 or equivalent. Registration by consent of instructor. Enrollment limited to 15.

3 units, Spr (Kino) TTh 9:30-10:20

246. Microwave Circuit Theory—Basic concepts and theory of representing microwave, millimeter wave and high speed digital circuits by combinations of lumped circuit elements and transmission line sections. Emphasis on MIC structures (microstrip, slotline, finline, image-line) suitable for millimeter wave and picosecond range pulse circuits. Impedance matching, transitions, discontinuity effects, hybrids, power dividers, filters. Interfacing with semiconductor devices. Emphasis on physical concepts, not detailed analysis. Examples of components discussed in class. Prerequisite: 142 or approximate equivalent.

3 units, Win (Auld) MWF 2:15

249. Introduction to Space, Telecommunication and Radioscience—Experimentation in the near-earth environment using radio waves and other probes. The STAR environment: earth, ionosphere, magnetosphere, interplanetary space, planetary environments. Tools: Transmitters, antennas, receivers, sensors, radars, displays. Telecommunications. Electromagnetic waves, acoustic waves, gravity waves,
plasmas. Applications to current experimental programs. Planning and execution of experiments. Prerequisite: familiarity with electromagnetics at the level of Phys 53 and senior or graduate standing.

3 units, Aut (Bracewell) MWF 1:15

250. Communications Design Seminar—A seminar covering recent development in telecommunications research, including satellite applications, mobile radio, telephone network planning, digital switch development, voice and data modulation systems. Speakers are drawn from Stanford research laboratories and the telecommunications industries.

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


3 units, Spr (Bracewell) MWF 1:15

254. Principles of Radar Systems—Radar system analysis and design: Radar equation and system parameters, characterization of radar targets, statistical target parameters, noise in radar systems, topics in radar detection and measurement precision, ambiguity function and uncertainty theorem, waveform selection, synthetic aperture radars, radar astronomy techniques, range-Doppler mapping, special systems. Prerequisites: Senior standing or first year graduate student.

3 units, Aut (Tyler) MWF 1:15

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 (Macovski) TTh 2:45-4
Spr (Staff) MWF 1:15

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 (Staff) 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, and some aspects of hardware implementation. Prerequisites: Knowledge of z-transform theory; 263, 104, or consent of instructor. 261 is recommended.

3 units, Win (Staff) 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 E.E. and C.S. students with background in computers, signal process-
ing, 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 MOS 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 functionally simulate and test their projects and report the results. By arrangement, students may undertake more extensive work for additional credit. Lectures include simulation and testing techniques used in the laboratory and advanced topics in design. Prerequisite: Completing the 272A design project.

1 unit, Spr (Horowitz) T 1:15-2:30
plus lab by arrangement

274. The Computer as a Laboratory Instrument—Practical experience on a small, real-time digital computer system. Minicomputers, I/O programming techniques, data acquisition, computer-generated displays and some signal processing. "Hands-on" experience in these subjects is acquired by completing a series of laboratory assignments. Enrollment limited to 30 students. Prerequisite: 181 or equivalent assembly programming experience.

3 units, Aut (Staff) MWF 3:15 plus
lab by arrangement

3 units, Win (Staff) MWF 1:15 plus
lab by arrangement

3 units, Spr (Staff) MWF 11 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 Stat 116E or equivalent.

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

279. Information Transmission and Modulation—Analysis and design of communication systems; analog and digital modulation and demodulation, frequency conversion, multiplexing, noise and quantization, spectral and signal-to-noise ratio analysis. Prerequisite: 278.

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

280A, B. Computer Applications and Signal Processing—Real-time applications of mini- 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 1985-86

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 (Gill) TTh 2:45-4
plus lab by arrangement
Win (Peterson) TTh 9:30-10:45 plus
lab by arrangement

282. Computer System Architecture—Structure of systems using processors, memories, input/output (I/O) devices, and I/O interfaces as building blocks. Computer system organization and architecture — accumulator, general-register, stack machines, multiprocessors, and other organizations. Issues and tradeoffs involved in the design of computer system architectures, and, in particular, in the design of instruction sets. Prerequisites: 182. Also see Computer Science 212.

Aut (Enroll in Computer Science 212)
3 units, Spr (Staff) TTh 1:15-2:30

283. 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: 285.

3-4 units, Win (Hennessy) TTh 11-12:15

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: 285.

3-4 units, Win (Hennessy) TTh 11-12:15

285. Programming Languages—Introduction to several programming languages, such as LISP, Ada, Snobol, APL, PROLOG, and/or Simula. Comparison of issues in programming language design, and language features that result from them. Runtime representation of data and control constructs. Memory management issues, recursion, binding and allocation, scoping, parameter passing mechanisms, compilation vs. interpretation, modules and classes, abstract data types, exception handling. Several programming assignments, each in a different language, will be given; emphasis will be on proper use of the features and facilities of each language and its runtime system. Prerequisites: Computer Science 106B or 108A, knowledge of Pascal. (Also see Computer Science 242.)

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

286. Introduction to Operating Systems—Motivations, functions, and evolution. Processes and concurrent programming: mutual exclusion, synchronization, and communication. Memory management: static relocation, virtual memory, segmentation, paging, load control. I/O and file systems: file structures, naming, disk management, drivers. Overview of other issues, including scheduling, protection, user interfaces, and distributed system issues. Prerequisite: 180B or 285. (Also see Computer Science 246.)

3 units, Spr (Owicki) TTh 1:15-2:30


3 units, Win

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

3 units, Win (Allison) MWF 10 plus lab by arrangement

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

COURSES FOR GRADUATE STUDENTS

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
311. Characterization and Computer Modeling of Semiconductor Devices—Experimental and 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. Computer controlled device measurements and model parameter extraction for SPICE. This laboratory complements 216 and 312 and can be taken concurrently.

3 units, Aut (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 1:15-2:30
3 units, Spr (Plummer) TTh 9:30-10:45

314. Linear Integrated Circuits — Analysis and Design—Description and quantitative study of linear IC’s made with both bipolar and MOS technologies. Principles of biasing, common-mode rejection, low-drift, and reducing temperature dependence of amplifying circuits and such related circuits as voltage references. Applications to specific case studies, such as phase-locked oscillators, wide-band amplifiers and multipliers. Prerequisite: 216.

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

315. Design of Analog MOS Integrated Circuits—Fundamentals of analog MOS integrated circuit design. Operational amplifiers are used as an initial vehicle. The design of analog switches, sample and hold circuits, comparators and voltage references are discussed. Analog subsystems considered include D/A and A/D converters and switched capacitor filters. Prerequisite: 313 or consent of instructor.

3 units, Spr (Dutton, Wooley) TTh 9:30-10:15

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 (Dutton) 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 alternate years, given 1986-87

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, photelectric 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 Shrödinger
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—This course will deal with the various approximation schemes for determining the energy levels and other properties of real systems. These will include 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, and relativistic quantum effects. Prerequisite: 322B or Physics 231.

3 units, Spr (Pantell) alternate years, given 1986-87

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 I—(Enroll in Applied Physics 252.)

327B. Acoustic Waves in Solids II—(Enroll in Applied Physics 253.)

328A, B. Physics of Semiconductor Devices—Introduction to the physical principles underlying semiconductor device operation and the application of these principles to specific devices. Emphasis will be placed on understanding device operation, rather than circuit properties. Topics in 328A include elementary excitations in semiconductors such as phonons, photons, conduction electrons and holes, charge and heat transport, carrier trapping and recombination, effects of high doping, contacts, and the p-n junction. 328B will consider the junction transistor, surface effects, the MIS diode, and the MOSFET. Prerequisites: 216, 228 and 328A (for 328B) required; 238 recommended but not required.

3 units, Win (Swanson) MWF 3:15
Spr (Swanson) MWF 3:15

329. The Electronic Structure of Surfaces and Interfaces—This course 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; 235 or consent of instructor.

3 units, Aut (Lindau) TTh 9-9:15

331. The Science of Semiconductor Interfaces—Recent developments in experimental (see EE329) and theoretical techniques allow a scientific understanding of semiconductor surfaces and interfaces on an atomic level. Both semiconductor-insulator (e.g., oxides) and semiconductor-metal interfaces are included and correlations made between them. 3-5 and other compound semiconductors will be emphasized; however, comparison and inter-relations with Si interfaces will be made. Key concepts will be identified and the course developed around them to give unity and allow the student to
easily follow new developments as they arise. Considerable emphasis will be placed on practical applications. Prerequisite: 238 or equivalent and consent of instructor.

3 units, Spr

alternate years, given 1986-87

332. Optical Properties of Solids—Basic theory with emphasis on the relationship between electronic structure and optical properties of solids. Representative semiconductors, insulators, and metals will be discussed. Impurities and defects in solids. Surface states. Photoemission, Luminescence, applications. Prerequisite: 322A or equivalent.

3 units, Spr (Spicer) TTh 1:15-2:30

alternate years, given 1985-86

334. Superconducting Electronics—Introduction to superconducting electronics and applications. Course proceeds from a brief introduction to the phenomena of superconductivity through a discussion of Josephson junctions and superconducting quantum devices and finally to an analysis of some promising applications in computer logic and memory, magnetometry, and low noise electromagnetic detectors and mixers in the millimeter and submillimeter wave region. No formal prerequisites but an exposure to quantum mechanics and a good grounding in electromagnetic theory are desirable.

3 units, Win (Beasley) 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. Prerequisites are a good understanding of transmission lines, Smith charts, 221B. Lectures will be given by the professor and experts from H.P. (Two lectures, one lab per week.) 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 (Harris, S) 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 (Banks) TTh 2:45-4

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—Magnetonic 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, alternate years, given 1986-87

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 bio-
logical media. Prerequisite: 241 or equivalent or consent of instructor.

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

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, magnetionic 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 Probing of Atmospheric Environ-ment—Techniques for measuring the structure, content, properties, and motions of the atmosphere by remote means. Interactions between propagated waves and the atmospheric medium. Scattering, reflection, absorption and radiation of radio, optical and acoustic waves. Applications to measurement of temperature, humidity, rain, aerosols, inversion layers, waves, winds, turbulence, and pollutants. Prerequisite: 142 or 241 or Physics 121 or equivalent.

3 units, Spr, alternate years, given 1986-87

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. Time-and frequency-domain design of controllers and observers. Prerequisite: 102 or Engineering 104. Mathematics 113S or equivalent is helpful.

3 units, Aut (Staff) MWF 11
Spr (Staff) TTh 2:45-4

364. Multivariable System Theory—Structural properties, controllability, observability, canonical forms. Applications to pole-shifting, decoupling, system realization and identification. Introduction to algorithms for reliable computation of solutions to control problems. A sequel to 363 where similar problems are studied for scalar systems. Prerequisite: 363.

3 units, Win (Staff) MW 11-12:15


3 units, Spr, alternate years, given 1986-87

366. Introduction to Fourier Optics—Application of Fourier theory to the analysis and synthesis of optical imaging and optical data processing systems. Propagation and diffraction of light, Fresnel and Fraunhofer approximations, Fourier transforming properties of lenses, image formation with coherent and incoherent light, transfer functions of imaging systems, optical data processing, and holography. Prerequisite: familiarity with Fourier analysis, 261 recommended.

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, alternate years, given 1986-87

368. Digital Image Processing—This course covers various topics in the field of digital image processing, including: physical descriptions of continuous images; properties of the human visual system; sampling and quantization of images; matrix representation of image forming and image processing systems; unitary transforms; image enhancement and restoration; scene matching and recognition and applications. Demonstrations are given throughout. Prerequisites: 261, Mathematics 114S 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 telecommunications policy.

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

373. Adaptive Systems—Self-optimizing systems whose performance is improved through contact with their environments. Feedback models for least mean-square adaptation processes. Searching stochastic surfaces by steepest

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 expanding 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 (Cover) 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 channels, 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 (Cover) TTh 2:45-4


3 units, Spr, alternate years, given 1986-87


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

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 (Lundstrom) W 4:15-5:05
Win (Allison) W 4:15-5:05
Spr (Lundstrom) W 4:15-5:05

381. Logic Design—Principles and techniques of logic design. Topics include combinational circuit analysis including hazard detection, combinational circuit design including PLAs, 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.

(Also see Computer Science 211.)

3 units, Aut (Peterson) MWF 9
Win (McCloskey) TTh 2:45-4

382A. Processor Design—ALU and Its Control—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 PLAs and microprogramming control. Prerequisites: 181, 182, or equivalent.

3 units, Win (Flynn, Lundstrom) MWF 9

382B. Processor Design—Memory Hierarchy and Control Unit Design—Cache and main memory design, virtual storage system. Instruction decoding and timing. Pipelined execution
and interlocks. Instruction set characteristics, branching, supervisory state. Recommended:

382A.

3 units, Spr (Staff) MWF 10

383. Advanced Compilers—Lectures and discussion will explore implementation issues in depth. The major focus will be optimization techniques and advanced code generation. A significant project will be included. Prerequisite: 283.

3-6 units, Spr (Hennessy) TTh 9:30-10:45

384. Computer Networks: Architectures and Protocols—Objectives of computer networks; network structure and components; switching techniques (circuit-switching and packet-switching); network functions; layered network architectures (the ISO reference model); data link protocols (character-oriented protocols, bit-oriented protocols, error checking, window flow control, and multiaccess protocols); network control (datagrams, virtual circuits, routing, and congestion control); transport and session protocols (end-to-end communication, interconnection of networks); presentation layer protocols (virtual terminal and file transfer protocols). Specific examples and standard protocols 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) 3 units, Win (Tobagi) 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

385C. Introduction to CMOS Design—Seminar will discuss how to design integrated circuits using Stanford’s new 2 micron 2-level metal CMOS technology; how CMOS design differs from nMOS design, and some basic CMOS circuit forms; Stanford’s CMOS process will be described in more detail, and design rules for the process will be distributed, and finally more advanced circuit forms will be described. Each student will be responsible for taking notes for one lecture to help prepare a CMOS design guide. Prerequisite: Student must have taken 271 or equivalent.

1-3 units, Win (Horowitz) Th 1:15-2:30

386. Advanced Operating Systems—(Enroll in Computer Science 346.) In-depth treatment of selected topics in operating system design. Emphasis will be on topics not covered in 286, such as naming and binding, protection, reliability, distributed system issues, user interfaces, construction strategies, modeling and performance evaluation, system management, and portability. Significant project will be included. Prerequisite: 286.

3-6 units, Win

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

389. Programming Language Design—Exposure to the problems of programming language design and their known solutions will be undertaken. Topics may include formal semantics, implementation considerations, extensibility, very high level languages, evaluation of language designs, and other timely topics. The innovative features of a variety of modern programming languages will be discussed. Prerequisite: 285.

3 units, Aut, alternate years, given 1986-87

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, photolithography, 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 performance. 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 Techniques**—Theory of ion implantation and related processes, with applications to the study of solid-state materials and the fabrication of solid-state devices. Prerequisite: consent of instructor.

1-3 units, *Spr, alternate years, given 1986-87*

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 currently) 314 or equivalents.

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

428A.B. **Physics of Advanced Electronic Devices**—A two-quarter course intended for second and third year graduate students specializing in solid state electronics and integrated circuits. The focus of the course will be 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&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 (Siegmund)* *MWF 10*


477. **Information and Statistics**—(Enroll in Statistics 362.)

3 units, *alternate years, given 1986-87*

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 (Kailath)* *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 (Gray) TTh 2:45-4

482. **Advanced Computer Organization**—Topics in parallel and concurrent systems; single and multiple instruction stream systems; memory structures and control; high performance networks; algorithm; concurrency detection; applications considerations; system design and analysis. Prerequisites: 282 and 382A, or 382B as corequisite.

3 units, Spr, alternate years, given 1986-87

483. **Topics in Concurrent Programming**—Current research topics in the exploitation of concurrency in computations for multiprocessors, distributed systems, and highly concurrent machines. Subjects that may be covered include programming language features and implementation, formal models, and the match between algorithms and architectures. Prerequisite: 286.

2-4 units, Aut, alternate years, given 1986-87

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 multi-access/broadcast protocols (used in packet-switched satellite, ground radio, and local networks): fixed assignment, random access, demand assignment, adaptive strategies, stability considerations and dynamic control. Prerequisite: 284. Knowledge of 384 is also highly recommended.

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

485. **Database System Theory**—(Enroll in Computer Science 345.) Overview of database systems; the entity—relationship model of the real world; the network data model and the DBTG proposal; the hierarchical model; the relational model, relational algebra and calculus; query languages based on algebra and calculus, such as ISBL, QUEL, SQL, and Query-by-Example; functional dependencies and their influence on database design; multivalued dependencies; query optimization; concurrent operations on the database; query optimization and concurrency control for distributed database systems. Prerequisites: A familiarity with file organization, as in 287, and with predicate calculus, as in Computer Science 257A, will be assumed.

3 units, Spr

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 (Lundstrom) TTh 11-12:15

487. **Digital Signal Processing Architecture & Circuits**—The architecture, system design and hardware implementation of real time signal processors and digital filters. Signal processing operations including the Discrete Fourier Transform, Discrete Convolution, Cosine transform, Hadamard transform and the estimation of power spectra. Design of Finite Impulse Response and Infinite Impulse Response implementations of low pass, high pass, bandpass and all-pass filters. Applications in speech processing, image processing, communication, sonar and radar signal processing. Possibilities for LSI implementation of signal processing and digital filter computation structures will be investigated. Prerequisites: 381, 382A. 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, alternate years, given 1986-87


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

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.
Chairman: David G. Luenberger  
Professors: Donald A. Dunn, Willis W. Harman, Ronald A. Howard, David G. Luenberger, James L. Sweeney  
Associate Professors: Edison T.S. Tse, John P. Weyant  
Assistant Professors: Samuel S. Chiu, Ross D. Shachter, Ennio Stacchetti  
Lecturers: Paul I. McEntire, George R. Murray, Patricia A. Owen, Gerd D. Wallenstein  
Consulting Professors: Kamal Golabi, Robert E. Larson, James E. Matheson, Richard D. Smallwood  
Consulting Associate Professors: Carson E. Agnew, Edward G. Cazalet, Peter A. Morris, D. Warner North  
Consulting Assistant Professors: Charles D. Feinstein, Samuel Holtzman

OFFERINGS AND FACILITIES

The Department of Engineering-Economic Systems is dedicated to preparing individuals for careers dealing with the planning, operation, analysis, and control of complex technological and economic systems through programs of study, internship, and research on the graduate level. EES emphasizes mathematical modeling and other analytical approaches to problems, but also devotes careful attention to nonquantitative aspects of problem formulation, solution, and implementation.

The formal coursework provides the basic framework of professional training and emphasizes the system analysis techniques that have application in the planning and operation of the complex systems required by modern society. A unique feature of the doctoral program is the internship, a period of experience in government or industry that allows a student to gain first-hand experience in the limitations of existing methodology. The internship experience often provides the basis for formulating meaningful doctoral research problems.

BACKGROUND REQUIRED

Students admitted for graduate study in Engineering-Economic Systems must have a background of undergraduate work that indicates a level of mathematical maturity customarily found in an intensive undergraduate engineering or physical science program. A full year's college-level calculus course, and several courses applying calculus, constitute an absolute minimum of preparation. Undergraduate course work in economics is not required, but will prove helpful in graduate study in this field. The department's core courses require a fair degree of mathematical maturity. Incoming students who feel they are not adequately prepared for a rigorous analytical methodology should take recommended courses in the Department of Mathematics prior to taking the core courses.

GRADUATE PROGRAMS

There are three programs of study, all at the graduate level, leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy in Engineering-Economic Systems.

Study programs should be selected to give a broad coverage as well as work in depth in one or more specific areas. System analysis is a young discipline that draws many of its models and methods from mathematics, physical science, and social science. Future developments in system analysis will often be an outgrowth of concepts born in these foundation fields. The student's course program should include a selection of foundation material from the offerings of other departments so that the student will have the breadth to contribute to the growth of his or her profession both now and for the years to come.

MASTER OF SCIENCE

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 Engineering-Economic Systems faculty.

The degree of Master of Science requires a minimum of one academic year of study beyond the B.S. degree. University regulations governing the degree of Master of Science are described in the "Degrees" section of this bulletin. The department does not have a thesis requirement for the master's degree. In addition to meeting University requirements, M.S. programs must contain a total of 45 units of course work. This total must include at least 36 units of regular lecture courses, 24 units of which must be courses in Engineering-Economic Systems with letter grades. Included in these courses must be at least five of the department's core courses. An M.S. program must also contain at least 3 units of project work. (See "Courses" below for a list of courses that meet
this requirement.) Finally, a letter grade average of 2.75 must be achieved on the course program.

Up to 18 units of a student’s program for the M.S. degree may be taken outside the department. However, most M.S. programs include more EES units than the minimum required. A typical program for a student whose M.S. is a terminal degree would include 18 units of EES core courses (201A, 212A, 221, 231, and 241); a 4-unit project course such as 236 or 206; two or three other EES courses; and courses from other departments such as Industrial Engineering 133, Statistics 219/220, Operations Research 245 or 251. Students who view the M.S. as an intermediate degree would substitute additional EES core courses (e.g. 201B or 212B), mathematics courses (e.g. Mathematics 114 and 115), or other courses in their planned area of interest. Although not a requirement, students without prior experience in computer programming should take a course in this subject (such as Computer Science 106) early in their M.S. program.

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.

Requirements may be summarized as follows: (1) The successful completion of an approved academic program consisting of a 3.1 letter grade indicator at the end of the first year; 45 units beyond an M.S. degree (which may or may not be in E.E.S.); completion of all E.E.S. core courses during either the M.S. or Engineer degree program; and a 3.1 or better letter grade average on the courses taken. (2) Approval of a thesis proposal by the thesis supervisor. Such a proposal may be based on a successful tutorial project. (3) Satisfactory oral presentation of the thesis to the thesis adviser and one other faculty member appointed by the department. (4) Completion and approval of the engineer’s thesis by the thesis supervisor.

Permission to study beyond the Master of Science degree must be obtained from the appropriate department committee. The decision of the committee is based on its evaluation of the applicant’s academic record, performance in independent work, and potential for advanced study, and on the ability of the faculty to support and supervise such study.

DOCTOR OF PHILOSOPHY

The degree of Doctor of Philosophy requires a minimum of three academic years of study beyond the B.S. degree. A complete statement regarding University regulations governing the degree of Doctor of Philosophy will be found in the "Degrees" section of this bulletin. The requirements are administered by the University Committee on Graduate Studies.

Admission to the graduate school does not imply that the student is a candidate for the Doctor of Philosophy degree. Only after the Application for Doctoral Candidacy has received official departmental and University approval does the student become a candidate for the degree.

All students who have not already earned a master's degree must receive the Master of Science degree in the required engineering-economic systems as a prerequisite to candidacy for the Ph.D. Not later than the first Autumn Quarter after receiving the Master of Science degree the student should submit an application to participate in the department qualifying procedure.

Requirements may be summarized as follows: The student is to complete successfully (1) a minimum of three years of residence with graduate standing, (2) department qualifying procedure, (3) an approved program of courses, (4) a 3.5 average letter grade average on the core courses (see "Courses" below), (5) an oral examination near the completion of the doctoral program, (6) a dissertation, based on research, which must be a contribution to knowledge. The department does not have a foreign language requirement.

Examples of student programs for the Ph.D. which emphasize different foundation disciplines are as follows:

1. A quantitative system analysis program which emphasized mathematics might include the following mathematics courses: 113, 114, 115, 116, 117, 205A, B, C, 261A, B, C.

2. A program which emphasized economics might include the following economics courses: 155, 202, 203, 204, 210, 237, 238, 272, 273, 280, 281, 282.

Similar programs with an emphasis in other specific areas such as political science or sociology can be developed with the aid of an adviser. In most such cases it is possible to obtain a minor in the student’s additional area of special interest.

In some cases a student may wish to emphasize an interdisciplinary area such as communications which might involve taking courses in a number of other departments. Individual programs can be developed with the aid of an adviser to meet particular student interests, but an attempt should be made to develop substantial depth in at least one area outside the EES department during the course of the Ph.D. program.

Ph.D. Minor—Doctoral students throughout the University may complete a minor in Engi-
neering-Economic Systems by taking 21 units of courses selected from the list below. The selection must be approved by the student’s department adviser and by the Engineering-Economic Systems faculty. The primary aim of this minor is to develop system analysis and decision-analysis capabilities for graduate students who anticipate careers associated with system problems.

INTERNSHIPS

Since most large-scale system problems cannot be made available within a university, some internships are available to help the student develop the ability to solve system problems by working on real problems.

Problems of broad scope requiring a system viewpoint and thus suitable for the internship experience are found in large industrial firms; in companies and research groups concerned with the design, operation, and planning of complex projects and systems; on Congressional staffs; 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. While interning, the student lives on location and works as an employee responsible to the company or agency concerned. The Engineering-Economic Systems faculty help locate and screen suitable internship opportunities in a variety of areas.

The student’s internship work is mainly directed toward the successful solution of a real problem. Consequently, the student gains an appreciation for the approximations and compromises with rigor that characterize applied work in the field. Internships are not required, but many students elect to participate in an internship. Over 186 EES students have been on internships to date.

RESEARCH AND APPLICATIONS

It is important for students to receive experience in the application of system concepts in at least one specific problem area. This experience can be gained through the internship program, through applied research projects, and through special courses that concentrate on the application of system concepts to specific areas.

The major research programs of the department are listed below. Regular and consulting faculty who are active in these programs are indicated.

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.

DECISION ANALYSIS

(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, and (4) 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, Shachter, 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 storage theory, to explain the storage policies for commodities such as wheat, and (5) a study of futures markets using the concept of "rational expectations."

BUSINESS SYSTEMS
(Howard, Larson, Luenberger)

The business systems program is a new program responding to the fact that more EES graduates now either 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. Recent research projects include options pricing, dynamic financial equilibrium, optimal portfolio theory, design of contracts, and project evaluation. Graduates from this program have obtained teaching positions in business schools or challenging positions in industry.

ORGANIZATIONAL ECONOMICS
(Chiu, Dunn, Shachter, 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. Which method of combining and using information in decision making is best depends on 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
(Sweeney, Weyant)

The energy modeling activity centers around the Energy Modeling Forum (EMF) and involves the analysis and application of formal models in the study of energy policy issues. Sponsored by the Electric Power Research Institute, the Department of Energy, and several industrial affiliates, the EMF is based at Stanford with Professor Sweeney as Director and Professor Weyant as Executive Director. A national activity, the EMF seeks to improve the application of energy models for policy and planning purposes and to improve communication between energy model builders and users. Ad hoc working groups, typically consisting of 40 energy experts with an equal number of modelers and model users (assisted by EES students serving as research assistants), are the foundation of EMF studies. Each group is organized around a single topic to which several existing energy models can be applied.
The current EMF study focuses upon the demand for energy by industry.

Current dissertation work 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, Schachter, 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 multiformity, both with respect to the types of mathematics employed and in the areas of application. The Stanford program emphasizes the development of new techniques through involvement in a variety of practical problems. Faculty and students in the program have developed effective analytical approaches to problems such as: the design of a national housing allowance experiment; planning of electric power expansion; analysis of U.S. agricultural policy; the theory of instruction; land-use planning; word processing system evaluation; market forecasting systems; water resource planning; and surveillance strategies for air defense. Students have often been employed by local firms while working on these problems.

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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. In the recent past students have typically received $1100 per month during the period of their internships. The critical period financially for most students has been the first year to year-and-a-half of graduate work. A financial commitment of about $19,500 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 $590 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:
- 206, 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

31. Introduction to Decision Analysis — Everyone makes decisions, but few people think about how they do it. Yet, psychological research shows that in many simple decision situations people make decisions that upon close examination they regard as wrong. Decision analysis is a rationale for decision-making that allows people to covert the opaque decision situations that confuse them into a clear basis for action by using transparent logical steps. The course presents 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


3 units, Aut, Sum (Staff) MW 11-12:15, 10-11:15

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 that are discussed in some detail include: cohort population models, social structures, migration models, national economics, price cycles, cultural media dynamics, Peter Principle of organizational hierarchies, Richardson's theory of arms races, Homans-Simon model of group interaction, population growth. Prerequisite: Mathematics 113 or equivalent.

4 units, Win (Chiu) 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 transference, the spread of epidemics, optimal resource allocation.

4 units, Spr (Tse) TTh 1:15-2:30

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. Discussion of implementation difficulties. Examples of applications: evaluation of technologies for vehicle location, routing and control, controlling randomness in mass transit systems, design of dial-a-ride transportation systems, operation and control of police patrol dispatch strategies. Prerequisite: 221 or equivalent.

3 units, Spr (Chiu) MW 12:45-2

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, transformation techniques, named distributions, and computer simulation. Most enrolling students have had previous probability courses, but they share a desire to learn how to apply probability concepts to problems of uncertainty. The course objective is to provide students with the same understanding and competence in analysis of probabilistic problems that they already possess in dealing with deterministic problems. Prerequisite: working knowledge of calculus.

5 units, Aut (Chiu) MW 11:12:15


3 units, Win (Shachter) MW 9:30-10:45

OPTIMIZATION


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


4 units, Spr (Shachter) MW 9:30-10:45

248. Dynamic Programming—The discrete-time dynamic optimization problem. Bellman's principle of optimality. The basic computational procedure. Advanced computational procedures, including successive approximations, approximations in policy space, dynamic programming with shift vectors, and state increment dynamic programming. Dynamic programming for continuous time systems and the calculus of variations. Linear systems. Dynamic programming for stochastic and adaptive systems. Applications in system expansion planning, operations research, process control, power systems, environmental systems, and trajectory optimization.

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

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; discounted 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
alternate years, given 1986-87

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 covered include: properties of convex sets and functions, conjugacy, conjugate duality, multifunctions, monotone operators, and generalized equations. Applications include: duality in economics (Hotelling’s lemma, Shephard’s lemma, and Slutsky’s equations), 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, Arowe-Debreu models). A general Newton type algorithm to solve generalized equations is also presented. The course is intended for a broad audience. Prerequisites: multivariate calculus and linear algebra; exposure to at least one of the application areas mentioned above will be assumed.

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

263. Principles of Optimization—The main objective of this course is to demonstrate that a rather large segment of the field of optimization can be effectively unified by a few geometric principles of linear vector space theory. Introduction to functional analysis; linear vector spaces, normed spaces, Banach space, Hilbert space. Projection theorem in Hilbert spaces with applications to least-square estimation and minimum norm control. Dual spaces and linear functionals, the Hahn-Banach theorem. Convex optimization, duality theory, Kuhn-Tucker theorem with applications to production planning, resource extraction. Prerequisite: 201B or Mathematics 113, Mathematics 115.

3 units, Aut (Tse) MW 9:30-10:45

ECONOMICS

155. Economics of Natural Resources—(Enroll in Economics 155.)
5 units, Spr (Sweeney)

212A,B. Economic Analysis—Analytic modeling of economic phenomena; methodologies for modeling choices of individual agents, for modeling the interactions among choice-making agents, and for analyzing normative economic models. Models of individual agents include theories of consumers and of firms. Models of interactions include theories of competitive and noncompetitive markets and general equilibrium theories. Normative economic models include those which focus on the conditions for economic efficiency, the mechanisms by which markets may fail to be efficient, and planning rules for improving resource allocation.

First quarter attention devoted to basic theory in a deterministic and static setting. Second quarter focuses on extensions of basic theory to uncertain and/or dynamic environments. Focuses on issues of implementation including model building techniques, project evaluation principles, and private or public project evaluation procedures. Prerequisite: EES 241 or equivalent. Prior work in microeconomics at the level of Economics 51/151 is helpful but not required.

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
DECISION ANALYSIS

231. Decision Analysis—Development of a normative rationale for individual and group action in the face of uncertainty, complexity, and dynamism. Presentation of the procedures necessary to reduce the rationale to practice. Encoding of information and preferences. Discussion of utility measures of risk preference and discounting measures of time preference. Analysis of problems using decision trees that include risk and time preference. Determination of the economic value of perfect and imperfect information on one or several variables in a decision problem. Design of economic information-gathering experiments. Presentation of examples that range over the fields of business, engineering, law, and medicine. Applications drawn from private and public sectors of the economy. Prerequisite: Knowledge of basic probability (221 or equivalent).

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 dynamic processes. Content will vary with current research interests. Prerequisite: 231.

3 units, Spr (Luenberger) T 2:45-5:15

233. Strategic Decision Analysis—Extension of concepts of decision analysis to decision problems that are not yet suitable for decision analysis, either because they are still vague concerns or because their scope extends across customary fields of activity of the individual or the organization. Presentation and examination of formal approaches to the identification, formulation, and resolution of strategic decision problems. Discussion of responsibilities of the analyst for the creation and evaluation of the decision basis. Development of procedures for treating the complex dependency relations often present in strategic decision problems. Prerequisite: 231.

4 units, Spr (Matheson) TTh 11-12:15
235. **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. The purpose of this course is to sensitize the individual to ethical issues and to provide him or her with the means to form ethical judgments. The course especially questions the desirability of physical coercion 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. Technical questions such as the bearing of risk and the desirability of physical coercion will be carefully examined. 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

**APPLICATIONS AND RESEARCH**

206. **Decision System Project Course**—Class will work together to study recurring decision problem and build prototype system to assist in solution. Emphasis on developing methodology to inform decision-maker, using techniques from core courses. Design and implementation focus on data representation and interactions among different subsystems created by class. Possible generalization of tools for use in future quarters. Prerequisites: four EES core courses or consent of the instructor.

4 units, Sum (Shachter) TTh 9-10:50

283. **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 successful 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. Topics addressed include: natural rights theory, the non-aggression principle, property rights and homesteading, contracts, defense, and legal remedies; spontaneous order and the free market; the state and interventionism, the hypothesis of reverse results, class theories of the state, historical fallacies; applications to various topics, including help for the needy, victimless crimes, environmental protection, and monopoly and anti-trust; transition strategies to a voluntary society.

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

**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
Programs of Study

Industrial Engineering is concerned with how best to organize people, information, money, and materials to produce and distribute services and products. Depending on the degree level, students are prepared to design, manage, perform research on, or teach about productive systems which may be in private industry, federal, state or local government, or in public, quasi-public, or non-profit institutions.

Engineering Management is concerned with the knowledge and processes required to manage technically based enterprises.

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 group projects comprise an important part of the course. In these projects, the student has the opportunity to formulate and solve problems and implement solutions for firms and organizations in the surrounding community.

Many students completing the bachelor’s program will wish to pursue graduate study in industrial engineering, in other professional schools—law, medicine, or business—or in fields related to industrial engineering such as economics, statistics, or operations research.

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 20 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 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 and engineering management.

The hardware and engineering-design aspects of the program include:
- Visual Thinking
- Engineering Design
- Manufacturing Engineering
- Computer-Aided Design
- Microprocessor Applications
- Introduction to Robotics and Manipulation

The engineering management subjects include:
- Engineering Economy
- Industrial Accounting
- Statistics and Quality Control
- Organizational Behavior and Management
- Analysis of Production Systems
- Manufacturing Strategy

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 (ME 210) revolving around an actual engineering design project.

Beyond the required core, the curriculum allows for elective courses chosen from a broad set of relevant electives providing additional training in both the engineering management perspective, engineering-design hardware, and aspects of computer science. Here a student may follow his or her individual interests and tailor the program to meet individual needs.

The requirements for the MSMSE program
The Engineer degree is designed for students desiring the maximum academic preparation for a career of professional practice in the activities and areas described previously. The Engineer degree requires two years of academic work beyond the bachelor's degree. Normally a program of study for the Engineer degree will include the courses required for the M.S. plus approximately 30 units of additional courses of a more advanced level and a thesis. Up to 15 units may be allowed for the thesis. The purpose of the thesis is to prove the professional competence of the candidate and not necessarily to make an original contribution to knowledge.

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 half-time service as a teaching assistant is required. The completion of an acceptable dissertation may occupy most of the candidate's third year of study.

The program of study will be arranged by the candidate with the advice of a Faculty Committee of three, appointed 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.

A limited number of fellowships and assistantships up to $16,000 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.

Undergraduate Courses

60. Engineering Economy—(Enroll in Engineering 60.)
ing information for decision making is stressed. Students who have taken or are taking another University course in elementary accounting should not enroll.

3 units, Aut (Staff) MWF 1:15
Spr (Staff) MWF 11

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.

3 units, Spr (Jucker) 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, 235, 260, E40.

3 units, Win (Jucker) 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, 235, 260, E40.

3 units, Win (Adler, Paté-Cornell, Rosenbloom) 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, 235, 260, E40.

3 units, Win (Brandeau, Hausman, Lee, Silver) 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

COURSES PRIMARILY FOR GRADUATE STUDENTS

201. Problem Solving—(Same as Engineering 190.) An investigation of problem solving with particular emphasis on problem definition, creativity, and interpersonal and organizational factors that influence thinking. Common blocks to problem solving will be explored and methods of dealing with them will be presented. The advantages of integrating various problem solving strategies will be stressed through use of reading, abstracted problem situations, and projects. Open to undergraduates and graduates in any field.

3 units, Spr (Adams) MW 2:15-4:05

203. Organizational Behavior and Management—Organization theory; concepts and functions of management; behavior of the individual, the work group, and the organization. Substantial emphasis on case and related discussion. Enrollment limited and restricted to graduate students.

3 units, Aut (Jucker) TTh 11-12:30

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.

3 units, Win (Sutton) MWF 10-11:15

216. Airline Management—This course is designed to be an action-oriented curriculum concerned with functional airline management in five basic fields: marketing, finance, administration, operations, and planning. Airline management problems and techniques will be studied both academically and on airline field trips. There will be extensive use of case studies and project studies with airline executives. not given 1985-86

234. Research and Development Management—The economics of R&D and functions of R&D in the business enterprise, including R&D 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 1985-86

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, Win (Hodder) MWF 9

236. Project Management Systems—Study of project formulation, definition, and organization. Types of projects; documenting ideas; research and development; proposal preparation; contract provisions; cost estimates; contract negotiations; performance; administration; evaluation. Involves actual field work. Prerequisites: 144 and Statistics 116 or equivalents; graduate standing or consent of instructor.

not given 1985-86

237. The Firm in the International Economy—(Same as Economics 167.) The response of firms to international economic forces. Exposure to exchange rate movements, trade barriers, and international taxation. Implications for accounting, financial and production practices. Prerequisites: 235 (required) and Economics 165 (recommended). Enrollment limited and at discretion of instructor (preference given to students with recommended prerequisite).

not given 1985-86

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; 100/203 recommended. Open to seniors and graduate students only. Enrollment is at the discretion of instructor.

not given 1985-86

244. Environmental Health Risk Assessment—(Same as Civil Engineering 272.) 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 (Pate-Cornell, Ricci) TTh 11:11:50

260. Analysis of Production Systems I—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 optimal lot sizes, and optimal timing and sizing of production capacity expansion, and introduction to inventory control. Prerequisites: 121 (recommended); Operations Research 152, Engineering 60, Statistics 116 (required).

3 units, Aut (Carlson) TTh 9:30-10:45

Win (Brandeau) TTh 9:30-10:45

261. Analysis of Production Systems II—Scheduling and control of production—inventory systems. Demand forecasting, inventory control, production scheduling, aggregate production and work force planning, materials requirements planning and integrated systems. Prerequisites: 260 and Operations Research 153.

3 units, Spr (Lee) MW 10-11:15

262. Analysis of Production Systems III—Design and operation of production—inventory systems. Production scheduling, capacity planning, plant location, sequencing, assembly line balancing, multigal optimization. The reading material will be drawn primarily from journal articles. Prerequisite: 260.

3 units, Spr (Brandeau) TTh 9:30-10:45
264. Economic Analysis of Quality Control — Introduction to the economic design of quality control procedures and the analysis of the relationship between quality control and the other functions of the firm. Emphasis will be on techniques and approaches to modeling these design and management problems. Topics include: quality control and corporate strategy, marketing, warranty and service provision; economic design of process control and acceptance sampling; and the analysis of quality, learning, inventory, and productivity. Prerequisites: Operations Research 152 and Operations Research 153 or equivalents.
3 units, Spr (Lee) TTh 11-12:15

268. Manufacturing Strategy — Development and implementation of the manufacturing functional strategy. Emphasis placed on the integration of manufacturing strategy with the business and corporate strategies of a manufacturing-based firm. Topics include: types of manufacturing technologies and their characteristics, quality management, capacity planning and facilities choice, the organization and control of operations, and determining manufacturing's role in corporate strategy. Enrollment limited and at the discretion of the instructor. Prerequisite: 260.
3 units, Spr (Ferdows) MW 8:30-9:45

269. Industrial Management — Introduction to marketing and manufacturing policy for industrial products. The course focuses on real life industrial settings in which an executive is faced with important create, make, or market decisions. Some of the major topics addressed are: plant location, processing technology, vertical integration, technology selection, product design, pricing, channels of distribution, sales organization, promotion, communication and response to competitive actions. Throughout the course, the interaction of functional policies and overall corporate strategy is stressed. Cases are used extensively. Open to graduate students only. Enrollment limited and at the discretion of the instructor. Prerequisites: 100 or 203, 133, 242, and 235.
4 units, Win (Staff) MF 10-11:45

270. Managing Technology for Competitive Advantage — (Same as Graduate School of Business 359.) Key issues of technology management at the firm level will be addressed. The first portion of the course establishes essential concepts for understanding the management tasks in a technology-intensive environment. Building blocks in three specific areas are addressed: product design and product-line configuration, process development, and delivery of the product/service to the marketplace. The second part of the course looks at the implementation of the role selected for technology within the firm. Particularly important are the 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 11-12:30

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 (Banfe) MF 3:15-5:05

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, Spr (Adler) TTh 11-12:15

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, Win, Spr (Paté-Cornell) Th 4:15-5:30

291. Industrial Engineering Problems — 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.
   *3 units, Spr (Sutton) M 2:30-5*

330. Doctoral Seminar in Financial Decisions—Topics from current published literature and working papers. Content varies with faculty and student research interests. Open to doctoral students with research interest in the application of financial and economic theory to industrial engineering problems.
   *3 units, Win (Hodder) TTh 9:30-10:45*

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, Aut (Hausman) MW 1:15-2:30*

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 (Rosenbloom) W 2:45-5:15*

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*

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**MATERIALS SCIENCE AND ENGINEERING**

Emeritus: (Professor) 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: Robert I. Jaffee, Helmut R. Poppa, Arden Sher, John Stringer

Consulting Associate Professor: Jeffrey Wadsorth

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**OFFERINGS**

Materials Science and Engineering is concerned with the relation between the structure and properties of materials, factors which control the internal structure of solids, and processes for altering the structure and properties of solids. It brings together in a unified discipline the developments in physical metallurgy, ceramics, and the physics and chemistry of solids. The undergraduate program of the department, described under the School of Engineering, provides training for the physical metallurgist or materials engineer and also preparatory training for graduate work in materials science. Able students are encouraged to take at least one year graduate study to extend their coursework and to obtain training in research. Coterminal degree programs are encouraged both for undergraduate majors in Materials Science and Engineering and for undergraduate majors in related disciplines. Graduate programs lead to the degrees of Master of Science, Engineer, and Doctor of Philosophy.

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**FACILITIES FOR INSTRUCTION AND RESEARCH**

The Department of Materials Science and Engineering occupies an area of 30,000 square
feet in the Thomas F. Peterson Engineering Laboratory building. The laboratory includes modern facilities for teaching and research in physical metallurgy and materials science. Heat-treating furnaces and furnaces for crystal growing are available. Mechanical testing equipment includes hardness measuring devices, variable strain rate machines for mechanical deformation studies, creep machines and equipment for dynamic elastic modulus and internal friction measurements. For studying the structure of solids there are laboratories for optical scanning and transmission electron microscopy. Facilities for X-ray diffraction and fluorescence, and electrical, magnetic and optical measurements are also available.

The department, together with Chemical Engineering and Electrical Engineering, participates in an Institute for Surface and Microstructural Research, a collaborative research effort between Stanford University and the Materials and Physical Sciences Branch of the NASA Ames Research Center.

The 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 itemized below:

1. Materials Science
   This program should be taken by those who wish to pursue a Ph.D. degree in Materials Science and Engineering.
   a) All courses in the 180 series (18 units) except for students who have had equivalent courses at other universities.
   b) A minimum of 12 units of advanced course work (beyond the 180 series) in the department (excluding the 202 laboratory series, attendance-only seminars and research and special problems).
   c) The entire 45-unit master's program should represent an integrated technical program. Approval of the program by the student's advisor is reviewed by the Advanced Degree Committee prior to admission to candidacy.

   (A minimum of 6 units and not more than 12 units of 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.)

2. Materials Engineering
   Additional programs may be designed for those students who wish to obtain a working knowledge of materials science and engineering applied to materials technology. These programs are 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>
<tr>
<td>M.S.&amp;E. 205</td>
<td>Strength and Microstructure</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 238</td>
<td>Fracture of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 249</td>
<td>Time-dependent Plasticity</td>
<td>3</td>
</tr>
<tr>
<td>Mech. Engr. 238A, B</td>
<td>Theory of Elasticity</td>
<td>6</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>45</td>
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ELECTRICAL, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S.&amp;E. 188</td>
<td>Electrical, Optical, and Magnetic Properties of Materials</td>
<td>4</td>
</tr>
<tr>
<td>M.S.&amp;E. 210</td>
<td>Semiconductor Materials Processing</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 215</td>
<td>Photovoltaic Solar Energy Conversion</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 222</td>
<td>Statistical Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>Elec. Engr. 322A, B</td>
<td>Quantum Mechanics</td>
<td>6</td>
</tr>
<tr>
<td>M.S.&amp;E. 233</td>
<td>Quantum Theory of Energy States in Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 234</td>
<td>Electronic Transport in Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.&amp;E. 235</td>
<td>Photoelectric Properties of Solids</td>
<td>3</td>
</tr>
<tr>
<td>Elec. Engr. 332</td>
<td>Optical Properties of Solids</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
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<td>14</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>45</td>
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</table>

ENGINEER

The University's basic requirements for the degree of Engineer are outlined in the "Degrees" section in this bulletin. The following are departmental requirements:

1. Completion of the substantial equivalent of the requirements for the Master of Science degree in Materials Science and Engineering.
2. Completion of an acceptable thesis and 15 units of approved advanced course work beyond the requirements of the Master of Science degree.
3. A program of study should be submitted to the department for approval prior to the end of the third quarter at Stanford.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the Ph.D. degree are outlined in the "Degrees" section in this bulletin. The following are departmental requirements:

1. Complete the substantial equivalent of the requirements for the Master of Science degree in Materials Science and Engineering.
2. Pass a departmental oral qualifying examination one year after admission.
3. Graduate students working toward the Ph.D. degree must submit a program of study to the department prior to the end of the student's third quarter at Stanford. The program should contain at least 72 course units beyond the B.S. degree and should include the following:
   a) All courses in the 180 series or their equivalent. These must be taken on a letter grade basis.
   b) Completion of 6 units of Materials Science and Engineering 202A, B, and C (Materials Science Laboratory), except for students who have had equivalent experience.
   c) A minimum of 36 units of advanced course work which, when taken as a group, comprise a coherent and well-designed program leading to proficiency in a certain area of materials science and engineering. These courses are to be taken for a letter grade and must include a minimum of 21 units of graduate courses within the materials science and engineering department.
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 to 3 units, any quarter (Staff), by arrangement
150. Atomic Arrangements in Solids—(For undergraduates, see 180 for description.)
5 units, Aut (Bravman) MTThF 10, M 2:15-5:15

151. Thermodynamics and Phase Equilibria—
(For undergraduates, see 181 for description.)
5 units, Aut (Stevenson) MTWTh 9, M 3:15

152. Rate Processes in Materials—(For undergraduates, see 182 for description.)
4 units, Spr (Shyne) MTWF 9

155. Mechanical Behavior of Solids—(For undergraduates, see 185 for description.)
4 units, Win (Nix) MWF 9

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, Win (Bravman) T 4
161. 2 units, Aut (Shyne) T 1:15
162. 2 units, Spr (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 structure and mechanical properties; description of elastic, anelastic, and plastic properties of materials; study of the relations between stress, strain, strain rate and temperature for plastically deformable solids; application of dislocation theory to the study of strengthening mechanisms in crystalline solids; description of the phenomena of creep, fracture and fatigue and discussion of their controlling mechanisms.
3 units, Win (Nix) MWF 9

188. Electrical, Optical and Magnetic Properties of Materials—An introduction to electronic properties. Includes properties of waves, free electron model, energy bands, optical refraction and absorption, electrical conductivity, scattering processes, Hall and thermoelectric effects, junctions, and magnetic materials. Prerequisite: Engineering 52. Physics 57 recommended.
4 units, Win (Bube) TTh 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 (Tilkr) TTh 11-12:15

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 crystallizers, ingots, casting and welding, amorphous materials, purification of materials, and frozen foods, biological tissues and organs. Prerequisite: MSE 201A.
3 units, Win (Tilkr) TTh 11-12:15

202A,B,C. Experimental Methods in Materials Science—Laboratory course involving experimental techniques in different areas of materials science. Typical experiments are listed below: 202A: Experiments on the thermodynamics and kinetics of materials including phase diagram determination, diffusion, oxidation, phase transformations. 202B: Structural characterization by optical microscopy, scanning electron microscopy, x-ray diffraction and electron diffraction. 202C: Experiments on the mechanical, electrical, optical and magnetic properties of solids. Prerequisites: previous
concurrent registration in the Materials Science and Engineering 180 series or their equivalent.

2 units, Aut (Shyne) T 1:15
Win (Braoman) T 4
Spr (Staff) M 4:15


3 units, Spr (Barnett) MWF 9, given 1986-87

904. 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

905. 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

907. 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 9-10:15


3 units, Aut (Barnett) given 1986-87

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

213. Structural Materials for Nuclear Power Systems—Fundamental material responses of the major load-bearing components of fission and fusion reactors to their thermal, irradiation, and chemical environments. Examples of components and design-limiting behavior: creep, swelling, and stress-corrosion cracking of fuel element cladding; radiation embrittlement of pressure vessels; corrosion and stress-corrosion cracking of piping, heat exchangers, and turbines; blistering and fatigue of fusion first wall materials. Prerequisite: Familiarity with mechanical behavior of materials.

3 units, Win (Roberts) TTh 10-11:15
given 1986-87

215. Photovoltaic Solar Energy Conversion—This course discusses the fundamental of solar cells as well as pertinent disciplines including electronic properties of materials, semiconductor junction theory, and crystal and film growth. The Si single crystal, AlGaAs/GaAs heterojunction, and Cu2S/CdS thin film cells are described in detail as examples of the basic types of solar cells. Prerequisites: 188 (may be
concurrent) and Electrical Engineering 112 or equivalent or by permission.

3 units, Spr (Fahrenbruch) TTh 2:30-3:45

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, Win (Stevenson) TTh 11:20-12:35

plus lab by arrangement

230. Materials Science Colloquium.

1 unit, Aut, Win, Spr (Fiegelson, Sherby, Bravman) F 3:30

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: Engineering 50 and Materials Science and Engineering 181 or equivalent.

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

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: 180 or Electrical Engineering 322A.

3 units, Spr (Bates) TTh 1:15-2:30

234. Electronic Transport in Solids—Time dependent wave mechanics and wave packets. Electrical conductivity, mobility and scattering processes. Interpretation of the Boltzmann equation for galvanomagnetic, thermal, and thermoelectric processes in metals and semiconductors. Localized levels and Fermi level analysis of semiconductors. Prerequisite: 233 or Electrical Engineering 322B.

3 units, Aut (Bube) MWF 2:15

235. Photoelectronic Properties of Solids—Selected topics in photoelectronic properties of solids, including photodetconductive, 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

given 1986-87

236. Modern Imaging Techniques in Materials Science—Currently important methods of directly examining the microstructure of materials are surveyed. The following topics are covered: optical microscopy, scanning electron microscopy, field-ion microscopy, transmission electron microscopy, X-ray topography and scanning transmission electron microscopy. Emphasis is placed on the electron-optical techniques. Prerequisite: 180.

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

given 1986-87


3 units, Win (Barnett) MWF 9

given 1986-87

238. Fracture of Solids—The stress fields about elastic cracks developed from both a conventional elastic and a dislocational approach. Energy of deformation and the Griffith-Irwin brittle fracture criterion, and the extensions to incorporate small-scale plastic yielding. Fracture toughness testing. Microscopic mechanisms of crack nucleation and propagation; mechanisms of ductile fracture. Prerequisites: 185, 203

3 units, Spr (Nix) MWF 11

243. Transmission Electron Microscopy—Image formation and interpretation is covered in detail. The contrast phenomena associated with perfect and imperfect crystals are discussed both from a physical point of view and from a formal treatment of electron diffraction theory. The importance of electron diffraction to systematic analysis is emphasized and recent imaging developments are described. Prerequisite: 190.

3 units, Win (Sinclair) TTh 2:30-3:45

244. Failure Analysis—Techniques and methods used in the analysis of failures in the field of materials science and engineering. Laboratory work includes optical and electron fractography, localized chemical analysis, individual failure analyses, and a mock product liability trial. Lectures include failure in structural and electronic materials by ductile and brittle fracture, fatigue, corrosion, stress-corrosion cracking, surface damage, etc. Selected case studies.

3 units, Spr (Miller) TTh 11, M 1:15-4
247. Mechanisms of Fatigue — A study of the mechanisms of fatigue of metals. Topics include a phenomenological description of cyclic deformation and fatigue life rules, dislocation processes in cyclic deformation including persistent slip band formation, nucleation of fatigue cracks and stage I growth, continuum or stage II crack growth, threshold effects and high temperature fatigue.

3 units, Aut (Nix) by arrangement

249. Time-Dependent Plasticity—Theories and mechanisms of creep. Temperature and strain rate effects on plastic flow of solids. Relation of high temperature strength and ductility of materials to structure. Prerequisite: 185 or 205 or Engineering 50.

3 units, Spr (Sherby) TTh 1:15-2:30

250. Life Prediction in Engineering Structures — Modelling of deformation and fracture in metals and alloys, emphasizing methods for quantitative predicting failure of structural materials under complex histories and environments. Specific topics include the modelling of creep and plastic deformation (constitutive equations), fatigue crack initiation and propagation, stress corrosion cracking, and ductile 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, Spr (Marshall) by arrangement

255. Thin Film and Interface Microanalysis—This course deals with both 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). Generic processes such as sputtering and high-vacuum generation will also be covered. Prerequisite: 188 or equivalent.

3 units, Spr (Bravman) MW 2:15-3:30

257. Fatigue of Metal Structures—(Enroll in Mechanical Engineering 245.)
MECHANICAL ENGINEERING

Chairman: Charles H. Kruger
Associate Chairman: Thomas J. Connolly
Division Chairman: Thomas J. R. Hughes (Applied Mechanics), Robert J. Moffat (Thermosciences) (The Design Division operates without a chairman.)
Laboratory Directors: David Beach (M.E. Student Shops), Daniel B. DeBra (Guidance and Control), 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, Rolf A. Faste, Larry J. Leifer, Drew V. Nelson
Assistant Professors: John K. Eaton, Helen L. Reed
Acting Associate Professor: David M. Kelley
Acting Assistant Professor: George Kychakoff
Professors (Research): Dean R. Chapman, Elliott Levinthal, Sidney A. Self, Felix E. Zajac
Associate Professors: David W. Beach (Teaching), Dennis R. Carter (Research)
Courtesy Professors: Robert A. Chase, Robert L. Street, George Springer
Courtesy Associate Professor: Leslie J. Dorman
Courtesy Assistant Professor: John J. Csongradi

Affiliated Faculty: John V. Breakwell (Dynamics), James M. Gere (Structures), Matthew S. Kahn (Art), Greg Lynch (Art)
Consulting Professors: Floyd L. Culler, Anthony Leonard, Chauncey Starr, 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 typically enter various 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 mechanics. The Design Division emphasizes the design process and is specifically concerned with manufacturing technology, automatic controls, analytical and numerical design methods, optimization, design aesthetics, human factors, biomechanics, computer-aided design, microcomputers in design, and systems design. The Design Division also offers undergraduate and graduate programs in Product Design (jointly with the Art Department). The Thermosciences Division offers courses and specialized work in the areas of applied thermodynamics, energy sys-
tems, nuclear energy, pollution control, combustion, fluid mechanics, heat transfer, and plasma sciences.

Many faculty members of the three divisions are involved in advanced mathematical analyses, and the department as a whole provides a number of basic and advanced courses in applied mathematics.

**FACILITIES**

All three divisions of the department maintain modern laboratories which are used for both undergraduate and graduate instruction and graduate research work.

The Division of Applied Mechanics provides facilities for laboratory work in experimental mechanics and experimental stress analysis. Additional facilities, including an MTS electro-hydraulic materials test system are available through the School of Engineering Structures and Solid Mechanics Research Laboratory. Laboratories for biological experimentation are available through the School of Medicine and the Palo Alto Veterans Administration Hospital. Individual accommodation is provided for the work of each research student. Weekly seminar meetings acquaint the students with a great variety of subjects in their field, and give opportunity to practice speaking on a selected topic.

Various research projects are conducted in Applied Mechanics. Qualified students participate in these as research assistants, engaged in thesis research, in close working association with the faculty director and fellow students. The projects include original 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 maintains machine, foundry, welding, wood and plastic shops. Laboratory space is available for use in instruction, for construction of projects, and for graduate research work in various disciplines of interest to the Design Division faculty. The School of Engineering Structures Laboratory is used extensively for experimental work in structural mechanics and biomechanics. A Smart Product Design Laboratory supports microprocessor application projects. The Center for Design Research provides an excellent facility for CAE/CAD/CAM research development and education. Resources include an IBM 4391-II, 16 high-performance graphic workstations and a wide variety of peripheral devices. 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 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, data acquisition and graphics. 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, magneto-hydrodynamics (MHD) for energy conversation, 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. In addition, the Thermosciences Division has a small Environmental Measurements Laboratory which includes a variety of instrumentation for environmental measurements pertinent to energy systems, and a Thermosciences Measurements Center, which houses information on all aspects of measurements. A wide variety of instrumentation, extensive shop facilities, utilities, and research space are all available within and shared by these laboratories.

The Guidance and Control Laboratory, a joint activity with the Departments of Aeronautics and Astronautics and Mechanical Engineering, specializes in the construction of electromechanical systems and instrumentation, particularly where high precision is a factor.
Work in this laboratory ranges from robotics for manufacturing to feedback control of carburetors for automotive emission control. The faculty and staff of this laboratory work in close cooperation with both the Design and Thermosciences Divisions on device development projects of mutual interest.

A wide range of computation facilities are available to department students. Three of the department’s laboratories are equipped with superminicomputers, three DEC VAXes and a Prime. Numerous smaller minicomputers and microcomputers are used in the research and teaching laboratories. A microcomputer applications development laboratory equipped with several development systems is also available. Free computation is available on the DEC-20 LOTS system while larger computations are possible on the IBM 3033 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 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 gas-dynamics, fluid mechanics and heat transfer.

Graduate students participating in research are provided with office space in the laboratory buildings, and have access to substantial staff support from their research group.

The Thermosciences Division faculty is deeply involved with activities of Stanford’s Institute for Energy Studies. The institute sponsors seminars, research, and other activities throughout the University, and acts as a focal point for energy at Stanford. The institute’s Energy Information Center, a special library, is located adjacent to the Thermosciences Laboratories.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

Students desiring to specialize in mechanical engineering during their undergraduate period may do so by following the curriculum outlined earlier under School of Engineering. The university’s basic requirements for the bachelor’s degree are discussed in the “Degrees” section of this bulletin.

A program for Product Design is offered by the Design Division and leads to the degree of Bachelor of Science in General Engineering. It is recommended, however, that this should not be considered a terminal degree and that all students who elect this program continue on through the master’s degree in this field.

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 average set by the School of Engineering (2.0 in engineering breadth and depth courses). All courses in the mechanical engineering depth sequence must be taken for letter grades.

COTERMINAL B.S./M.S. PROGRAM

Stanford undergraduates who wish to continue their studies through the Master of Science degree under the coterminous 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.

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, magneto-hydrodynamics, biomechanics, systems engineering, to name a few. No mechanical engineer is expected to have a mastery of this entire spectrum.

The master's degree program requires 45 units of course work taken as a graduate student. At least 36 of these units must be taken at Stanford; any units transferred from other universities (up to 9 are allowed) must be graduate level courses taken while registered as a graduate student, and may not be applied toward fulfillment of item "2" below. No thesis is required. However, students who desire some research experience during the master's year may participate in research through Mechanical Engineering 290, 291, and 292.

The departmental requirements which must be met for the degree of Master of Science are:

1. **Mathematical Competence** in two of the following areas: partial differential equations, linear algebra, complex variables, or numerical analysis, as demonstrated by completion of two appropriate courses from the following list: Mechanical Engineering 200-209; Mathematics 106, 113, 131, 132; Computer Science 137A, B. (Requirement—6 units.)

   Students who completed comparable graduate-level courses as undergraduates and who can demonstrate their competence to the satisfaction of the instructors of the Stanford courses may be exempted from this requirement by their advisors, and place the units in the approved elective category.

2. **18 units** of graduate-level courses in Mechanical Engineering consisting of:
   a) **A Specialty in Mechanical Engineering:** A set of graduate-level courses in mechanical engineering to provide depth in one area. These sets have been approved by the faculty as providing depth in specific areas as well as a significant component of applications of the material in the context of engineering synthesis. Lists of approved depth packages are available from the Department Office. The currently approved depth packages involve 3 to 4 courses.
   b) **Breadth in Mechanical Engineering:**
      1) At least one additional approved mechanical engineering course numbered 210-285 in each of two additional depth areas outside of the depth area selected in item "2a."
      2) Additional graduate-level courses, if necessary, in mechanical engineering to bring the total number of graduate course units in mechanical engineering to 18.

   Courses 200-209, 280, and 286-301 may not be counted in these categories.

3. **Approved electives,** to bring the total number of units 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 Mechanical Engineering 291, 292, and no more than 3 units may come from the other courses numbered M.E. 290-299 or other seminars. A student planning to go on for a Ph.D. degree should discuss with his or her faculty advisor the desirability of taking 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, 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 prepare 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 258A,B, 261, etc.). Choice of math courses, theoretical and experimental dynamics courses, and electives most suitable for the CFD program should be selected in consultation with the student's advisor.

MASTER OF SCIENCE IN 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 degrees from other schools usually spend an additional year taking prerequisite undergraduate product design courses. The requirements for this degree are:

**Course No.**  **Subject**  **Units**
*M.E. 211A,B,C. Product Design*  12  
**Master's Project**  6  
*M.E. 214. Philosophy of Design*  3  
*M.E. 221. Human Factors*  3  
**Approved Electives**  15  
**Free Electives**  6  

Total  45

**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  

**Engineering Design**  
M.E. 210A,B,C. Engineering Design  
M.E. 214. Philosophy of Design  
M.E. 216. Optimal Design  
M.E. 223. Design and Analysis of Dynamic Systems  

**Biomedical Design**  
M.E. 280. Biomechanics Seminar  
M.E. 281. Orthopedic Biomechanics  
M.E. 282. Neuromuscular Biomechanics  
M.E. 284. Dynamics of Viscous Fluids and Suspensions  
M.E. 285. Biomechanical Fluid Mechanics  

**Computer Based Design**  
M.E. 212A. Introductory Computational Geometry  
M.E. 212B. Advanced Computational Geometry  
M.E. 218A,B. Smart Product Design  
Elec. Engr. 280A,B. Computer Applications and Signal Processing Laboratory  

**Visual Design**  
Art 261. Advanced Graphics Design  
Art 268. Design Synthesis  
Art 269. Advanced Creative Studies  

Admission requirements and grade point average graduation requirements are the same as for the mechanical engineering master's degree described above. If possible, applicants should also submit evidence of design ability (e.g., photos or slides of several design projects).

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.

**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.
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.

**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 thesis requirement for the degree of Engineer is satisfied mainly by documenting the M.E. 211A, B, C master's project.

The total of 90 units can normally be completed in two academic years. Students deficient in prerequisite areas may take more time. Students who fulfill requirements for this program are awarded the M.S. in Engineering (Product Design) and Degree of Engineer in Mechanical Engineering (Product Design) simultaneously at its completion.

Admission to the program follows the same requirements as for the master's degree in Product Design.

DOCTOR OF PHILOSOPHY

The basic University requirements are discussed in the "Degrees" section of this bulletin. The Ph.D. degree is intended primarily for students who desire to pursue a career in research, advanced development, or teaching; for this type of work a broad background in mathematics and the engineering sciences, together with intensive study and research experience in a specialized area, are the necessary requisites.

The department 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 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 qualify-
ing 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.

FRESHMAN LEVEL COURSES

The following courses offered by the faculty of the department are suitable for freshmen.

Course No.  Subject
M.E. 31. Social Aspects of Nuclear Power
M.E. 101. Visual Thinking
M.E. 103. Manufacturing Technology

COURSES 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 registration day or the first day of University instruction, is essential in order that the laboratory schedule may be prepared. Enrollment later than the first week will not be permitted under any circumstances.

30. Engineering Thermodynamics—(Enroll in Engineering 30.)

31. Social Aspects of Nuclear Power—Course will present an overview of nuclear power industry, with aim of examining bases of public controversy surrounding nuclear power generation. Technical presentation is descriptive rather than analytical. Course includes: projected nuclear power demands (are they reasonable?); principles of nuclear reactor design (how a reactor supplies energy); different reactor types; breeding; the nuclear fuel cycle; radiological and environmental concerns; reactor safety; nuclear safeguards; and other topics as time permits. Open to any student who has had high school physics or chemistry. Engineering students desiring a more analytical treatment of nuclear reactor technology should take Engineering 176 instead.

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

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


3 units, Aut (Faste, Boyle)
lec and lab
Sec. 1 MW 1:15-3:05
Sec. 2 MW 3:15-5:05
3 units, 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. Enrollment Priorities: (1) sophomore and junior M.E. majors; (2) other engineering majors taking 103 for breadth; (3) non-engineering majors; (4) others.

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 p.m.

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 (Staff) TTh 1:15-3:05

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) TTh 1:15-3:05

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 (Staff) TTh 1:15-3:05

115A. Human Values in Design—Active encounter with human values in design. Lectures survey central philosophy of product design program, with emphasis upon the relation between technical and human values, the creative process, and design methodology. Laboratory exercises include the development of simple product concepts visualized in rapidly executed three-dimensional mockups. Prerequisite: 101.

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

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 11-1:05


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 lecturers, 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; lab one afternoon by arrangement

131B. Heat Transfer — Continuation of 131A. 5 units, Win (Moffat) MWF 10 plus one lec hour and lab one afternoon by arrangement

131C. Thermosciences — Continuation of 131B.
5 units, Spr (Bowman) MWF 10; lab one afternoon by arrangement

137. Air Pollution—Sources and effects of urban air pollution. Photochemical smog. Chemistry of pollutants in the atmosphere. Interaction between meteorology and pollution, pollution control; devices and legislation.
3 units, Spr (Sher) MWF 11

138. Noise Pollution—(Enroll in Aeronautics and Astronautics 138.)

161. Mechanical Vibrations—Mathematical modeling of vibrating systems. Experimental determination of coefficients. Systems with one and with more degrees of freedom. Damping, Natural Modes. Prerequisites: Engineering 12 or equivalent, Mathematics 43 or equivalent.
3 units, Aut (Staff) T 10-12, Th 10-11

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 1986-87

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 to 5 units, any quarter (Staff) by arrangement

MEZZANINE
LEVEL COURSES

The following courses are especially suitable both for advanced undergraduates and for graduates, and may be used to satisfy the M.S. requirement, item 3, approved electives.

Course No. Subject
M.E. 105. Control System Analysis and Design (Enroll in Engineering 105)
M.E. 113. Engineering Design
M.E. 137. Air Pollution
M.E. 138. Noise Pollution (Enroll in Aeronautics and Astronautics 138)
M.E. 161. Mechanical Vibrations
M.E. 176. Nuclear Energy (Enroll in Engineering 176)
M.E. 190. Energy and Society
M.E. 250. Introduction to Heat Transfer
M.E. 255. Gasdynamics

COURSES PRIMARILY
FOR GRADUATES

ENGINEERING MATHEMATICS

jcal solutions. Applications to the solution of engineering problems. Prerequisites: knowledge of advanced calculus and ordinary differential equations.

3 units, Aut (Reed) MWF 11


3 units, Win (Staff) MWF 9


3 units, Spr (Ferziger) MWF 9

201. Applications of Complex Variables—The theory of analytic functions, with applications to the evaluation of definite integrals by contour integration, the solution of physical problems by conformal mapping, and the solution of partial differential equations by means of integral transforms. A knowledge of the algebra of complex numbers and the derivative of a complex function is assumed.

3 units, Aut (Van Dyke) MWF 11

202. Stochastic Equations and Waves in Random Media — (Enroll in Mathematics 233.)

203. Perturbation and Asymptotic Methods with Applications—(Enroll in Mathematics 270.)


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 with Applications—(Enroll in Aeronautics and Astronautics 192.)

209A. Linear Transforms and Their Applications to Engineering Problems I—(Enroll in Aeronautics and Astronautics 291A.)

209B. Linear Transforms and Their Applications to Engineering Problems II—(Enroll in Aeronautics and Astronautics 291B.)

DESIGN AND CONTROLS

210A.B.C. Engineering Design—Experience in the formulation, design, and analysis of real engineering projects, 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 ME210 and ME218, Smart Project Design. Projects will be carried through construction and testing of a prototype, and first design revision. Instruction includes design methodology, project planning, safety, liability, and patenting. Students must enroll for all three courses. Provides experience
in technical presentations—both oral and written. 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)
Th 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. Introductory Computational Geometry
—Principles of solid geometry and pictorial sketching pertinent to computer-aided design of mechanical parts and visual interpretation of computer generated drawings. Computerized drafting, Wireframes: perspective, visual paradox, and animation. Boundary representation: surface normal, topological consistency, hidden surfaces, 3D translation and rotation. Constructive solid geometry: regular sets and regularized boolean operations. Intersections and mass properties. Lecture demonstrations and lab assignments use microcomputers and CADAM; no coding assignments. Prerequisites: Vector analysis; 200A or Mathematics 113. Engineering drawing and ability to program in a high-level language such as PASCAL recommended.

3 units, Spr (Wilde) MWF 1:15-2:05

212B. Advanced Computational Geometry
—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 and CADAM/CATIA. Prerequisites: 200A, 212A, 200B and C and ability to program in a high-level language such as PASCAL recommended.

3 units, Aut (Wilde) MWF 9

213. Manufacturing and Design—Course offers experience which links design and fundamental manufacturing processes. Introductory labs provide hands-on experience with machining, casting and welding; 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—This course is intended to be an intensive personal experience in which the participants’ career objectives and psychologial 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

216. Modelling for Global Optimization—How to model for compact, rapid, and correct computer-aided optimization of realistic (non-convex) systems. Constraint and objective function formulation. Parameters vs. decision variables. Model completeness; predicting critical
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), assembly language programming in a high-level language environment, real-time task control, and electronics for electro-mechanical systems. Assignments stress balanced hardware and software design practice. Grading is based on laboratory assignments in which each student: 1) builds several microprocessor interface circuits; 2) writes microcomputer control programs for each interface; 3) creates stand-alone products using a small target system; and 4) writes a comprehensive laboratory report for each assignment. Computer Science 111/Electrical Engineering 181 or their equivalents are highly recommended. A laboratory fee is required. Enrollment is limited. Graduate students in mechanical engineering have first priority.

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 stand-alone (embedded) micro-computer based projects.

3 units, Spr (Leifer) TTh 1:15-2:45

219. 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 transformation, manipulator solutions, workspace, path selection, control and dynamics, application, locomotion. 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

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 studies of various 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 displacement and motions, the theory of higher plane curves, higher-order path-curvature analysis, circle and center-point theory.

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

223. Design and Analysis of Dynamic Systems — Modeling, analysis and synthesis of practical devices, operating open loop, in which dynamic response is a dominant consideration. Representations of dynamic systems including mass distribution, flexibility and friction effects. Mathematical description of actuators including hydraulic, pneumatic, springs, electro-magnetic, electro-hydraulic and cam-driven systems; dynamic significance of kinematics properties of coupling between actuator and driven systems. Design criteria. Prerequisite: 161 or permission of instructor.

3 units, Spr (Barkan) MWF 9

224A. Introduction to Robotics and Computer Vision — (Enroll in Computer Science 327B.)
224B. Advanced Robotics—(Enroll in Computer Science 327C.)

225. Control System Design and Simulation—(Enroll in Engineering 206.)

226A. Digital Control I—(Enroll in Engineering 207.)

226B. Digital Control II—(Enroll in Engineering 208.)

227A. Optimal Control of Dynamic Systems—(Enroll in Aeronautics and Astronautics 278A.)

227B. Optimal Estimation and Control Logic in the Presence of Noise—(Enroll in Aeronautics and Astronautics 278B.)

227C. Differential Games—(Enroll in Aeronautics and Astronautics 278C.)

228. On-Off Control Logic—(Enroll in Engineering 209.)

229. Fluid Power Control—Hydraulic and pneumatic components and systems. Valves, fluid transmission lines, actuators, fluids, power supplies. Compressibility, leakage. System modeling, stability, compensation. Prerequisite: Engineering 105. 3 units, Spr (DeBra) MWF 9, alternate years, given 1986-87

230. Advanced Kinematics—Discussion of kinematics from both the mathematical and engineering viewpoints. Introduction to algebraic geometry. Application of matrix, tensor, and dual-quatennion 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

231A. Dynamics — Partial differentiation of vector functions in a reference frame. Configuration constraints. Generalized speeds. Motion constraints. Partial angular velocities and partial linear velocities. Inertia scalars, vectors, matrices, and dyadics; principal moments of inertia. 3 units, Win (Kane) TTh 9:30-10:45

231B. Dynamics — Generalized active forces. Contributing and noncontributing interaction forces. Generalized inertia forces. Relationship between generalized active forces and potential energy; generalized inertia forces and kinetic energy. Prerequisite: 231A. 3 units, Win (Kane) TTh 9:30-10:45


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) TTh 3:15-4:30 alternate years, given 1986-87

232B. Spacecraft Attitude Dynamics II—(Same as Aeronautics and Astronautics 243B.) Force functions. Generalized active forces, potential energy, generalized inertia forces, formulation of dynamical equations of motion of complex spacecraft. Linearized dynamical equations. Discrete multi-degree-of-freedom systems. Lumped mass models of spacecraft. Spacecraft with continuous elastic components; use of the finite element method in the simulation of spacecraft motions. 3 units, Spr (Kane) TTh 3:15-4:30 alternate years, given 1986-87

233. Nonlinear Oscillations—Derivation and classification of nonlinear differential equations governing various phenomena of mechanics. Phase plane trajectories and integrals of the equations of motion of autonomous systems. Response curves and stability criteria for forced oscillations of systems with nonlinear characteristics. Systems with several degrees of freedom. Large nonlinearities, chaotic behavior. 3 units, Win (Breakwell) W 2:15-4:05 plus one hour by arrangement


235A. Finite Element Analysis — Emphasis on fundamental concepts and techniques of "primal" finite element methods. Method of weighted residuals, Galerkin’s method, and variational equations. Linear elliptic boundary value problems in one, two, and three space

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


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


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


3 units, Aut (Herrmann) TTh 11-2:15 alternate years, given 1986-87

236B. Wave Propagation — (Same as Mathematics 274.) The following concepts will be 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 will made to electromagnetic, acoustic, elastic and other types of waves. 236A is not a prerequisite for this self-contained course.

3 units, Win (Keller) TTh 2:15-3:30 alternate years, given 1986-87

237. Free and Forced Motion of Structures— (Enroll in Aeronautics and Astronautics 244A.)


3 units, Aut (Herrmann) MWF 10


3 units, Win (Barnett) MWF 10

238C. Theory of Elasticity — Continuation of 238B. Westergaard solutions for plane crack (in terms of complex potentials). Derivation of the asymptotic stresses at crack tip. Strain energy and material conservation laws in linear elasticity. Their relation to path-independent integrals of fracture mechanics: J, I, M. Three-dimensional problems in terms of displacement potentials such as Boussinesq-Papkovich-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 (Herrmann) MWF 11

3 units, Spr (Steele) TTh 1:15-2:30

242A. Introduction to Nonlinear Continuum Mechanics — (Same as Mathematics 275.) Definitions of general states of stress and deformation of continua, including rate-of-deformation and spin (vorticity). General balance principles; thermodynamical foundations and entropy. Discussion of constitutive equations and influence of material symmetries. Applications of the theory with particular reference to finite elasticity. Introduction to the theory of imperfect continua (containing defects) and the role of the material momentum tensor. Discussion of new material conservation laws and their relevance to path-independent integrals of fracture mechanics. Prerequisite: 238A or equivalent.
3 units, Spr (Staff) TTh 11-12:15

alternate years, given 1986-87

242B. Introduction to Nonlinear Continuum Mechanics—Application of theory of continua to nonlinear viscoelastic materials. Thermodynamic effects including thermoeelastic coupling for nonlinear elasticity at finite strain. Prerequisite: 242A.
3 units, Aut (Staff) TTh 11-12:15

3 units, Spr (Springer)

3 units, Spr (Herrmann) TTh 11-12:15, alternate years, given 1986-87

245. Structural Fatigue—The mechanism of fatigue and occurrences of fatigue in service.
Methods for predicting fatigue life and for protecting against premature fatigue failure. Use of elastic stress and inelastic strain analyses to predict crack initiation life. Use of linear elastic fracture mechanics to predict crack propagation life. Effects of notches, manufacturing processes, load sequence, irregular loading, multi-axial loading, and environment 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, Win (Staff) MWF 2:15

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, Spr (Nelson) W 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—This is a course designed for graduate students who seek a one-quarter introduction to heat transfer. The course covers the fundamentals of conduction, convection, and radiative heat transfer, with applications in engineering analysis. Students who have had an adequate undergraduate preparation in heat transfer, should take Mechanical Engineering 253 and 252A,B instead. Prerequisites: graduate standing. Some computer skills are desirable.

4 units, Aut (Fersziger) 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 (Eaton) 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 (Staff) MWF 11

252A. Convective Heat and Mass Transfer—Prediction of heat, mass, and momentum transfer in channel flows and boundary layers. Differential equation methods for fully developed and entry length laminar tube flows. Similarity solutions for laminar heat transfer with blowing and suction. Superposition methods for non-uniform boundary conditions. Development of the integral equations of the boundary layer; approximate and semi-empirical methods of solution. Introduction to mass transfer. Prerequisite: at least one survey course in heat transfer and one in fluid mechanics, i.e. 250 and 251A or equivalent.

3 units, Win (Kays) MWF 10

252B. Convective Heat and Mass Transfer—Heat exchanger analysis and design. Theory of compact heat exchangers. Turbulent heat transfer in internal flows and boundary layers. Prerequisite: 252A.

4 units, Spr (Kays) MWF 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 Mechanical Engineering 252A,B to obtain depth in convective heat and mass transfer. Prerequisites: Graduate standing; an undergraduate course in heat transfer; some computer skills are desirable.

3 units, Aut (Self) MWF 9

254. Computers and Instrumentation in the Fluid Mechanics Laboratory—Use of laboratory computers including (a) interfacing of ana-
log and digital instruments, (b) experimental control, (c) sampling strategies, and (d) data reduction techniques. Instrumentation including hot-wire, laser and pulsed-wire anemometers. Prerequisite: previous experience with computer programming.

4 units, Spr (Eaton) MTWF 10

plus one 4-hour lab


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 (Johnston) TTh 8:35-9:50


2 units, Spr (Self) by arrangement

alternate years, given 1986-87


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

258B. Fluid Dynamics—Continuation of 258A including effect of viscosity, compressibility, turbulence, and free surfaces. Stokes and Oseen's approximations for low Reynolds number flow. Separation and transition to turbulence. Irrotational potential flow theory for an ideal inviscid fluid. Mathematical analysis of selected two- and three-dimensional flows and wave motions and with application to surface waves, acoustics, aerodynamics of wings and bodies at subsonic, transonic, and supersonic speeds, and selected geophysical and astrophysical phenomena.

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: 258B or equivalent.

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

alternate years, given 1986-87

261A. Introduction to Turbulence — The objective of this course is to introduce the student to the basic physical properties of turbulent flows. Topics covered will 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 (Reynolds) MWF 3:15
261B. Analytical Methods for Turbulent Flows — This 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, Spr (Staff) MWF 2:15
alternate years, given 1986-87

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. Hypervelocity Aerothermodynamics and Atmospheric Entry— (Enroll in Aeronautics and Astronautics 212.)

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: ME262A or equivalent.
3 units, Win (Hanson) MWF 9

265. Special Topics in High-Temperature Gasdynamics—Detailed study of selected topics in high-temperature gasdynamics, such as molecular spectroscopy, chemical kinetics of high-temperature gases or advanced kinetic theory.
3 units, Win (Hanson) MWF 9
alternate years, given 1986-87

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 (Kychakoff) MWF 11

268. Experimental Methods in the Thermosciences—Planning experimental programs, uncertainty analysis and the selection of instrumentation systems. Steady-state measurements of heat flux, temperature, pressure, and flow rate. Mean-velocity and mean-temperature measurements in boundary layers. Advanced laboratory problems in heat transfer and fluid dynamics. 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

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 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;
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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 (Staff) 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 (Staff) MWF 1:15 plus one hour by arrangement, not given 1985-86

275. Solar Energy—The Sun as a source of energy, economic value of solar energy, solar position calculations. Radiative properties of materials, materials for solar applications. Heat transfer aspects of solar collection: radiation, conduction, convection. Applications to water and space heating, air-conditioning and other uses. High performance solar devices; concentrators, special surfaces, electrical power plants. Solar conversion by biological systems, solar cells. This course will normally include a project—a solar device to be built by the student. Prerequisite: 131B or equivalent.

3 units, Spr (Whitehouse) MWF 11

276. Nuclear Energy—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 (Sher) MWF 1:15


3 units, Aut (Sher) MWF 10

277B. Nuclear Engineering—Heat removal from nuclear reactors, nuclear power plants. Light water reactors and fast breeders. Reactor safety. The nuclear fuel cycle. Prerequisite: 277A or consent of instructor.

3 units, Win (Sher) TTh 10-11:15

279. Controlled Thermonuclear Fusion—The fusion reaction. Fundamentals of plasma physics as applied to plasma creation and containment in a fusion device. Experimental devices; pinch, mirror, stellerator, Tokamak. Concepts of fusion reactors and fusion-electric generators. Prerequisite: consent of instructor.

3 units, Spr (Staff) by arrangement not given 1985-86

BIOMECHANICS

281. Orthopaedic Biomechanics—Engineering mechanics applied to the human musculoskeletal system. Material and structural characteristics of bones, ligaments, muscle/tendon and synovial joints. 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.

3 units, Spr (Carter) MWF 4:15-5:05

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. Prerequisites: 200A, 231A, 231B, or equivalents.

3 units, Spr (Zajac) TTh 4:15-5:30 alternate years, given 1986-87

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 and Science—(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

294. Design Colloquium — Invited speakers address issues of interest to designers. Brief presentation followed by open discussion.

1 unit, Aut (Staff) F 3:15-4:05
Win (Staff) F 3:15-4:05
Spr (Beach) 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 (Steele) Th 4:15-5:30

297. Energy Policy Seminar—Weekly presentations and discussions on energy policy with emphasis on technological aspects. The status of various national programs for the advancement of energy technology will be reviewed. Views on the political, social and economic aspects of projects to which engineers devote their efforts will be presented. Prerequisite: graduate standing in engineering.

1 unit, Aut, Win, Spr (Connolly) M 4:15-5:30
alternate years, given 1986-87

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

OPERATIONS RESEARCH

Chairman: Arthur F. Veinott, Jr.
Associate Chairman: Frederick S. Hillier

Professor (Research): Walter Murray
Consulting Professor: Alan J. Hoffman

Affiliated Associate Professor: Charles P. Bonini
Senior Research Associates: Philip E. Gill, Michael A. Saunders, John P. Weyant, Margaret H. Wright

Research Associate: Dorothy B. Sheffield, John C. Stone

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, queuing, 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, and microcomputers.

INTRODUCTORY COURSES

The department offers introductory courses for both undergraduate and graduate students. The courses are given at several levels and in a variety of combinations to accommodate the needs of different students.

Operations Research 50 is designed for students who wish to become familiar with the basic terminology and ideas of operations research without using any mathematics beyond high school algebra. Applications are given to important socio-economic problems.

Operations Research 152 is an introduction to linear, nonlinear, and dynamic programming for students familiar with calculus. Operations Research 151 is similar except that it also assumes a knowledge of the elements of matrix algebra, includes a discussion of game theory, and gives less emphasis to nonlinear and dynamic programming. Operations Research 153 is an introduction to stochastic processes and models in operations research for students with a knowledge of calculus and undergraduate level probability theory. Operations Research 154 is a condensation of Operations Research 152 and 153 for students with similar backgrounds.

Operations Research 240 is a first course in linear programming having matrix algebra as a corequisite. Operations Research 250 is a sequel which discusses nonlinear and dynamic programming as well as game theory. Operations Research 251 is an introduction to stochastic models in operations research for students acquainted with the elements of stochastic processes. Operations Research 240 and 250 provide a more extensive and higher-level presentation of topics of 151 and 152. Operations Research 251 bears a similar relationship to 153.

Students with a good mathematical background and an interest in an advanced introduction to the various fields of operations research may wish to consider one or more of Operations Research 340A, B, C, 342, 347, 349, 351, 356, 359A, B.

UNDERGRADUATE PROGRAM

BACHELOR OF SCIENCE IN MATHEMATICAL AND COMPUTATIONAL SCIENCE

Although the department does not have an undergraduate degree program in Operations Research, it does participate with the Departments of Computer Science, Mathematics, and Statistics in a program leading to a Bachelor of Science in Mathematical and Computational Science. See "Mathematical and Computational Science" section of this bulletin.

GRADUATE PROGRAMS

MASTER OF SCIENCE

The program leading to a Master of Science in Operations Research is designed to prepare individuals for high-level professional work applying operations research. Thus, the emphasis is on providing a solid foundation for a lifelong professional career involving the formulation, analysis, and use of operations research models of complex systems problems in business or government.

In addition to the University's basic requirements for the master's degree discussed in the "Degrees" section in this bulletin, a candidate is expected to complete an approved course program of 45 units. This program normally can be completed in one academic year (three academic quarters) of full-time work. A number of operations research practitioners in local industry also attend part-time, taking one or two daytime classes per quarter, under the Honors Cooperative Program. Each student will normally fulfill the following requirements for the Master of Science degree:

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

*Comp. Sci. 135 (or 137A) 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.
Stat. 203. Introduction to Regression Models and the Analysis of Variance 3
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 10
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, and
2. the development of the mathematical theory necessary for the study of these models.

Examples of the disciplines studied include energy and economic modeling, mathematical programming, dynamic programming, stochastic systems, stochastic processes, network and combinatorial theory, reliability, queueing theory, inventory theory, and game theory.

Candidates for the Ph.D. in Operations Research will normally meet the course requirements shown below.

1. Prerequisites: Mathematics 113, 115, 116; Statistics 116, 119, 120; Computer Science 106. Engineering-Economic Systems 212A. Students lacking background in some of these areas can include appropriate courses in their program at Stanford.

2. Requirements in Operations Research: 340A,B,C, 342, 347, 349, 351, 356, 359A,B; and three other 300-level, quarter courses in the department totaling nine or more units (excluding 399 and courses requiring enrollment in other departments).

3. Requirements in other departments: Statistics 217, 218, and three 200-level, 3 or more unit, quarter lecture courses in either Computer Science, Economics, Mathematics, or Statistics (only doctoral courses in Statistics).

In addition to the course requirements, a doctoral candidate must fulfill several University requirements, as described in the "Degrees" section in this bulletin. These include passing a University oral examination and completion of a dissertation which represents an original contribution to knowledge expressed in a satisfactory form. The department also requires that candidates successfully complete written comprehensive examinations on the content of Operations Research 340A, B, C, 342, 347, 351, 356, and 359A,B, and have a reading knowledge of at least one foreign language (French, German, or Russian).

A student performing satisfactorily in the Ph.D. program normally would be eligible to receive a Master of Science in Operations Research, if desired, after completing 45 units of course work.
Ph.D. MINOR IN OPERATIONS RESEARCH

Doctoral students in other departments may obtain a minor in Operations Research by completing 15 units of 200 or higher-level courses in the department with an average grade of 3.0 or higher. The courses will normally include Operations Research 240, 250, 251, and 257 or approved substitutes.

FELLOWSHIPS AND ASSISTANTSHIPS

Financial aid is available on a competitive basis for qualified doctoral candidates. This includes a number of fellowships as well as some research assistantships supported by departmental research grants and contracts. Although these research assistants work closely with the faculty on their research projects, they usually are able to take close to a full course load. Supplementary financial aid can sometimes be obtained by grading, assisting in special projects, or University loans.

All applicants for financial assistance are required to take the Aptitude Test and the Advanced Test (in a field of the applicant’s choosing) of the Graduate Record Examination.

Applications for fellowships and assistantships should be made to the Graduate Admissions Office by March 1.

COURSES PRIMARILY FOR UNDERGRADUATES

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, urban planning, and criminal justice systems. Intended for students in the social sciences or pre-engineering desiring a broad introduction to the potential role of operations research in modern society. (Graduate students register for 150.) Prerequisite: high school algebra. (DR:8)

3 units, Win (Manne) MWF 10
Spr (Staff) MWF 10

150. Models and Applications of Operations Research in Society—Lectures same as 50, but a term paper is required.

3 units, Win (Manne) MWF 10
Spr (Staff) MWF 10

151. 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, 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, Win (Veinott) 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
Spr (Hillier) MWF 1-2:05


4 units, Win (Iglehart) 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, Spr (Staff) TTh 3:15-5:30

180. Applications of Operations Research—Graduate students register for 280. Applications of operations research to important problems arising in business, industry, government, and society will be discussed. Case studies involving formulation, analysis, data collection, technical writing, public speaking and discussion. Prerequisites: 151 or 152, or both 240 and 250, 153 or 251 (concurrently) or equivalent.

3 units, Spr (Manne) MW 9:30-10:45

COURSES PRIMARILY FOR MASTER'S CANDIDATES

These courses are oriented toward applications. Operations Research 240, 250, 251, 257, and 280 form a basic one-year core program aimed at students who desire a professional career involving application of operations re-
search in business, government, or industry. Operations Research 245 and 246 are useful supplementary electives.

240. Linear Programming—This course 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 1:15-3


3 units, Win (Hoffman) MW 8:30-9:45

246. Mathematical Programming Computation—(Doctoral students register for 346.) Course presents 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. Gain practical experience with techniques that increase speed, stability, and accuracy of computation. Prerequisites: 250 or 340C, and Computer Science 106 or equivalent, or consent of instructor.

3 units, Sum (Staff) TTh 3:15-5

250. Deterministic Models in Operations Research—Formulation, solution, and analysis of mathematical programming models in operations research, including those of network flow theory, dynamic programming, inventory theory, integer programming, quadratic and nonlinear programming, and game theory. Prerequisite: 240.

3 units, 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. Course content stresses formulation, solution, and analysis of stochastic models in operations research. Topics covered include queueing theory, inventory theory, Markov decision processes, and dynamic programming. Prerequisite: Statistics 217.

3 units, Spr (Staff) TTh 4:30-5:45
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 8-9:15

280. Applications of Operations Research—(Same as 180.)

3 units, Spr (Manne) MW 9:30-10:45

290. Colloquium—Presentation of current research in operations research.

1 unit, Aut, Win, Spr (Staff) W 4:30-5:30

299. Independent Study—Intensive study of literature of special topics. any quarter (Staff) by arrangement

COURSES PRIMARILY FOR DOCTORAL STUDENTS

These advanced courses are concerned with the development of the mathematical theory of operations research and sophisticated applications thereof.


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

via linear complementary theory and its pivotal methods. Prerequisites: 340A and Mathematics 115 or consent of instructor.

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


3 units, Spr (Eaves) TTh 1:15-2:30

341. Topics in Mathematical Programming—A seminar type course with presentations by students and invited speakers. General topics covered include: Structured linear programs, generalized upper bounding (GUB), generalized linear programming, decomposition principle, basis factorization, convex programming, stochastic programming, continuous programming, multi-commodity problems, large-scale networks, integer programming. In addition, one or two research topics will be selected from the following typical list: Linkage of models and submodels (for example, of different sectors of the economy); development of end conditions in finite-horizon models; experimentation with different strategies for choosing the entering and exiting variables in large linear programs, development of new algorithms for large, structured optimization problems. Corequisite: 340B.

3 units, Win (Dantzig) by arrangement

342. 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: 340A or consent of instructor.

1 unit, Aut (Hillier) F 9

344. Methods of Nonlinear Programming Seminar—Motivation and analysis of procedures for solving nonlinear programming problems in finite-dimensional spaces. One-dimensional zero-finding minimization. Descent algorithms for n-dimensional minimization (convergence analysis, steplength criteria). Newton-type, quasi-Newton, and conjugate gradient methods for unconstrained optimization including linear and quadratic programming. Algorithms for nonlinearly-constrained optimization, including penalty and barrier function methods, reduced and projected gradient methods, augmented and projected Lagrangian methods. Some use of the computer will be required. Prerequisite: 340C or consent of instructor.

3 units, Spr (Murray) given 1986-87

345. Network Optimization—(Same as 245.)

3 units, Win (Hoffman) MW 8:30-9:45

346. Mathematical Programming Computation—(Same as 246.)

3 units, Sum (Staff) TTh 3:15-5


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


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


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

356. Inventory Theory—Methods for qualitative characterization and efficient computation of optimal solutions of structured nonlinear and dynamic programs. Lattice programming, substructures and complements in network flows, invariant network flows, minimum concave-cost flows in networks, stochastic comparison of distributions. Application to selection of optimal inventory policies for single and multi-item dynamic inventory models with convex or concave cost functions and known or uncertain requirements. Myopic policies. Multi-echelon models. Heuristics with high-guaranteed effec-
tiveness. Prerequisites: Lagrangian duality theory and Statistics 116.

3 units, Aut (Veinott) 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 (Staff) TTh 8-9:15

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

3 units, Aut (Iglehart) TTh 9-10:15

363. Theory of Information and Organization—(Same as Economics 282.) This course will examine the role of information in the design of various economic organizations, including teams and markets, among others; problems of coordination and incentives under incomplete information: search, signaling, and related phenomena.
5 units, Win (Arrow) given 1986-87

366A,B. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 386A,B, Psychology 283A,B, Business 494A,B.) Seminar aims to study 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. Seminar will meet once every two or three weeks throughout the academic year.
A. 1-2 units, Aut (Arrow, Tversky, Wilson) by arrangement
B. 1-2 units, Win (Arrow, Tversky, Wilson) by arrangement

367. Welfare Economics—(Same as Economics 280.) The course will cover the normative and descriptive theory of social choice. Alternative axiomatizations of social choice, with special reference to interpersonal comparisons of utility; possibility and impossibility theorems. Measurement of inequality from a social choice viewpoint. Individual rights and social choice. Strategic considerations in social choice procedures; the Gibbard-Satterthwaite theorem on manipulability; demand revelation.
5 units, Aut

4 units, Spr (Wilson) by arrangement

376. Solving Nonlinear Equations Parametrically—A unified and comprehensive view of a new and powerful deformation method for solving nonlinear equations based on complementary pivot theory. Constructive proof of Brouwer's fixed point theorem. Applications to optimization and to computation of equilibrium points in economics and game theory.
3 units, Aut (Eaves) by arrangement

390A,B. Advanced Topics in Operations Research—Two seminars will be offered, topics to be announced. Prerequisite: consent of instructor.
390A. 3 units, Sum (Staff) by arrangement
390B. 3 units, Sum (Staff) by arrangement

any quarter (Staff) by arrangement
ORGANIZATIONS

The School of Humanities and Sciences includes the Departments of: Anthropology; Athletics; Physical Education, and Recreation; Applied Physics; Art; Asian Languages; Biological Sciences; Chemistry; Classics; Communication; Computer Science; 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.

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.

STATEMENT OF PURPOSE

African and Afro-American Studies at Stanford is the systematic investigation of the history, culture, and circumstances of peoples of African descent. This investigation examines the interrelationships, the parallelisms and divergencies between the Black experience in the New World Diaspora - U.S.A., Latin-America,
the Caribbean—as well as the linkages between the New World experiences and that of the place of origin, Africa. At the same time however, investigation places a central focus on the United States Afro-American experience in its complex and contradictory relation to the mainstream American (United States) experience. The scholarly investigation therefore encompasses what might be called two area studies—that of the Diaspora and Africa and that of American Studies. Yet, in this latter context Afro-American Studies cannot represent itself as merely an additional component to that of the mainstream studies; rather it seeks to introduce a tension, a dynamic which can lead to the reinterpretation not only of the Black, but of the American experience as a whole. From this comes its challenge and theoretical excitement. The investigation will be carried out from the perspective both of the specialized disciplines and of interdisciplinary approaches. Even with the former, the comparative element will be frequently stressed. Thus the study of literature for example, will deal with specialized in-depth studies of significant Black writers from Phyllis Wheatley to Richard Wright, to contemporary writers like Amiri Baraka, and Alice Walker, as well as with the critical tradition in which they are placed; yet it will also deal with the relation of these writers both to the American (U.S.A.) literary system and to the Western literary system; and with the parallelisms and divergencies in theme and treatment with the other writers of Africa and the Black Diaspora.

In anthropology, it is the study of cultures, values and social relations of the world’s Black communities and how they have been viewed by W. E. B. DuBois, E. Franklin Frazier, or St. Clair Drake. In political science, it is the study of African & Afro-American liberation movements, African political systems and development, and leaders such as Frederick Douglass, Martin Luther King, Jr., Malcolm X, and Amilcar Cabral. In history, it is the study of the ancient African cultures, slavery, colonialism and struggles for independence both in Africa and the Americas. In psychology, it is the study of the psychological dimensions of racism and the psychological experience of Blackness in a race-conscious environment.

The sociology of knowledge suggests that one’s exposure to information is in part a function of several factors, such as time and geography, or status and position in society. Consistent with this perspective, this program of study is an eclectic concentration in which major disciplines intersect with the experiences, aspirations and world views of people of African descent. It recognizes the need for continued teaching and research in these content areas, which have often been neglected by Western education.

Because of this, scholarly investigation will focus from an interdisciplinary perspective on an analysis of the frames of reference through which the Black experience has been represented and explored in mainstream scholarship. The duality of the Black experience—Black and American—affords new insights into the ongoing definitions of a universally applicable sociology of knowledge. The original scholarship in the Black experience has much to gain from interdisciplinary approaches. The program hopes to develop this kind of approach concomitant with the theoretical development of its offerings.

UNDERGRADUATE PROGRAM

The Program in African and Afro-American Studies offers the Bachelor of Arts degree only. It is designed to provide the student with an interdisciplinary approach to the history, culture and experience of peoples of African origin. Its primary thrust is to help students develop literary and analytic skills while providing an intellectual framework which satisfies the traditional expectations of a liberal education. The course of study focuses on sub-Saharan Africa and those societies in the Western hemisphere where peoples of African heritage are a significant element in the population.

The undergraduate program is especially attractive to students choosing to double major in African and Afro-American Studies and a traditional discipline. It is also beneficial to non-majors interested in augmenting their coursework through classes exploring topics on African and Afro-American culture.

Opportunities for training and education beyond the A.B. parallel those open to any student majoring in a humanities or social science discipline. Graduates of the program typically pursue advanced degrees in humanities and social science disciplines, or professional schools.

The program does not offer a graduate degree in African and Afro-American Studies. However, interested students admitted to other graduate degree programs should contact the Committee on African Studies for information on combining an African Studies minor with their program.

REQUIREMENTS FOR THE MAJOR

The major in African and Afro-American Studies requires 50 units of credit for the A.B.
degree. Majors are required to take the introductory course (105), an African history course, and an Afro-American history course. Also, \textit{twenty} units must be satisfied in a concentration area, either in one department or interdepartmentally. Majors may also satisfy the concentration requirement with study in an African language. The precise content of each student's program will be worked out in consultation with the program advisor. Information on study in Africa is available through the Overseas Studies Office and Bechtel International Center.

**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 produce a document or project demonstrating a 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 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 course of study.

**PROGRAM OFFERINGS**

*Satisfies major requirements.

**AFRICAN AND AFRO-AMERICAN STUDIES**

- 59 A,B,C. Dance Theater Production.  
  1-5 units, Aut, Win, Spr (Osumare)

- 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: 1) 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. The course also considers why particular ideas developed at particular times and examines the relationship between African and Afro-American Studies and other academic disciplines. No prerequisite. (DR.5*)  
  5 units, (Aut (Gibbs, Staff) MWF 11

- 113. Western Culture and the Black Diaspora—The Semiotics of Self and Other—This seminar will use narrative analyses of selected texts in order to examine the significations accorded Africa, the "Negro" and the Black Diaspora in the signification system of Western culture. It will analyze the deconstruction of these significations both by some schools of modern Western scholarship and by counter-discourse of emancipatory movements in the Diaspora itself. (DR.5*)  
  5 units, (Wynter) given 1986-87

- 114. Africa and the Black Diaspora: An Introduction to its Literature, Thought and Cultural Worlds—Provides 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)

- 115. Ancient African History: The Truth Revealed—Explores the African origins of humanity, emphasizing ancient African societies and civilizations, specifically those of Ethiopia, Egypt, and West Africa. Discusses relationships between African science, technology and religion. (DR.5*)  
  4 units, Aut (Staff)

- 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 110.) Examines 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 — This seminar will examine the use made of the
analogy of gender — i.e., biological difference — to code socially produced differences as natural difference. It will focus 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." It will further examine 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)
alternate years, given 1986-87

165. Afro-Hispanic Culture and Literature—As an outgrowth of 104, Africa and the Black Diaspora, this course will concentrate on those Spanish-speaking countries with a sizeable Black population, particularly Colombia and Cuba. Students will also be introduced to other, less-known Afro-Hispanic cultures. Emphasis will be 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 studies.

5 units, Spr (Wynter)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought and Cultural Worlds — (Same as Spanish and Portuguese 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, Spr (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)

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)

DEPARTMENT OFFERINGS

See respective department listings for course descriptions and (DR) information.

ANTHROPOLOGY

15/116. Anthropological Perspectives on American Culture.
3-5 units, Spr (G. and L. Spindler)

5 units, Spr (Donham)

5 units (Yanagisako)

AFRICAN AND
AFRO-AMERICAN STUDIES

ATHLETICS

73. Jazz Dance III.
1 unit, Aut, Win, Spr (Osumare)

73A. Jazz Dance IV.
1 unit, Aut, Win, Spr (Osumare)

DRAMA

5. Introduction to Black American Drama.
5 units, Spr (Richards)

1-3 units, Aut, Win, Spr (Staff)

1-5 units, Aut, Win, Spr (Staff)

150. Contemporary Black Playwrights.
5 units, Win (Richards)

ECONOMICS

118. Economics of Development.
5 units, Aut (Ray)

122. Theory of Capitalist Development.
5 units, Win (Blecker)

EDUCATION

175X. Women and Development in Africa.
4 units, Spr (Samoff)

195. An Introduction to Africa Through Film: Tarzan, Terrs, and Liberation.
given 1985-86 (Samoff)

201. History of Education in the United States.
3 units, Win (Lazerson)

217S. Teaching A Global Perspective: Cross-Culture Approaches.
4 units, Spr (Grossman)

395. Education and Radical Change: African Experiences—(Same as Political Science 221S.)
4 units, Spr (Samoff)

ENGLISH

161A. The Afro-American Novel.
5 units, Aut (Drake)

161F. The Harlem Renaissance.
5 units, Aut (Drake)

FOOD RESEARCH INSTITUTE

103. The World Food Economy—(Same as Economics 106.)
3 units, Spr (Johnston)

131. 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 and Sociology 153.)
5 units, Spr (Arthur)

166. International Trade Policy.
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)

FRENCH

196/296. Literature of Decolonization. 4 units, Win (Giraud)

HISTORY

21. The World Outside the West: Change and Tradition Before the Age of European Imperialism.
5 units, Win (Fox, Roberts, Van Slyke)

22. The World Outside the West in the Age of European Imperialism.—(Same as Political Science 22.)
5 units, Spr (Duus, Abernethy, Collier)

148. Introduction to African History.
5 units, Aut (Jackson)

148C. Africa in the 20th Century.
4-5 units, Spr (Roberts)

248S/448A. State and Society in Colonial Africa.
5 units, Win (Roberts)

348C. Problems in West African Economy.
5 units, Aut (Roberts)

349. History and Anthropology.
5 units, Aut (Jackson, Rosaldo)

LATIN AMERICAN STUDIES

80. Culture and Society in Latin America.
5 units, Spr (Durham, Wirth)

LINGUISTICS

73. Black English.
4 units, Spr (Rickford)

150. Introduction to Social Linguistics.
5 units (Rickford)
alternate years, given 1986-87

155. Introduction to Multi-Lingualism.
4 units, Spr (Ferguson)

270. The Structure of Hausa.
4 units (Leben) given 1986-87

602A,B,C. Beginning Hausa.
4 units, Aut, Win, Spr (Leben)

606A,B,C. Beginning Swahili.
5 units, Aut, Win, Spr (Staff)

5 units, Aut, Win, Spr (Staff)

608A,B,C. Beginning Amharic.
5 units, Aut, Win, Spr (Staff)

616A,B,C. Beginning Setswanna.
5 units, Aut, Win, Spr (Staff)

PSYCHOLOGY

127. Afro-American Psychology.
3 units, Spr (Hudson)

169. The Politics of Madness.
3 units, Spr (Landrine)

POLITICAL SCIENCE

22. The World Outside the West in the Age of European Imperialism.
5 units, Win (Abernethy, G. Collier, Duus)

25. Colonialism and Nationalism in the Third World.
5 units, Spr (Abernethy)

118B. Southern Africa: Race, Class and Political Change.
5 units, Spr (Abernethy)

118J. Africa: Development and Dependence.
5 units, Aut (Samoff)

132D. Colonialism and Radical Change.
5 units, Win (Abernethy)

221. Education and Political Change.
5 units, Win (Samoff)

221S. Education and Radical Change—(Same as Education 39S.)
5 units, Spr (Samoff)

SOCIOLOGY

145. Race and Ethnic Relations.
3-5 units, Win (Staff)
American Studies

Administrative Committee: (Chairman) Jack N. Rakove (History), Joseph Corn (VTSS) Program Coordinator, Wanda Corn (Art), Albert J. Celpi (English, Coe Professor of American Literature), Hubert R. Marshall (Political Science)

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 program of study must include a "statement of purpose" which outlines the student's particular goals and areas of concern and indicates how the proposed courses comprise a coherent plan towards those ends.

- Each major must also include in the program of study: (1) the introductory course, American Studies 50, to be taken as soon as possible after declaring the major; (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.

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 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, Aut (Hellenbrand) MTWTh 9

AMERICAN THOUGHT AND IMAGINATION

4 units (W. Corn) given 1986-87

Art 130A. American Art and Culture in the Gilded Age.
5 units (W. Corn) given 1986-87

4 units, Win (W. Corn)

Art 130D. American Art after World War II.
4 units, Spr (W. Corn)

4 units (Turner) given 1986-87

Art 231B. Colloquium on the History of American Art History.
4 units, Win (W. Corn)
Art 233. Colloquium on the History of Photography.  
4 units (W. Corn)

Drama 5. Introduction to Black American Drama.  
4 units, Spr (Richards)

Drama 65. American Musical Theater.  
4 units, Aut (Eddelman)

5 units, Aut (Richards)

5 units, Win (Islas)

5 units, Aut (Fields)

English 100G. Psychological Themes in American Fiction, Poe to Hawkes.  
5 units, Spr (Moser)

English 120. The American Historical Novel.  
5 units, Spr (Dekker)

English 122. American Literature, 1855-1917.  
5 units, Win (Moser)

English 123. American Literature, 1917-Present.  
5 units, Spr (Fields)

5 units, Aut (Skenazy)

English 161A. The Afro-American Novel.  
5 units, Aut (Drake)

English 161F. The Harlem Renaissance.  
5 units, Aut (Drake)

English 162A. Chicano Literature.  
5 units, Spr (McKenna)

English 179D. Conrad and Faulkner.  
5 units, Spr (Moser)

English 239. American Short Fiction.  
5 units, Win (Fields)

English 256. Emerson, Whitman, Dickinson.  
5 units, Win (A. Gelpi)

English 266. The American Enlightenment.  
5 units, Aut (Hellenbrand)

English 284. Hawthorne and James.  
5 units, Win (Dekker)

Philosophy 105. American Pragmatism.  
4 units, Win (Pruitt)

Philosophy 176. Representation, Invention, and the Ordinary World.  
4 units, Aut (Pruitt)

AMERICAN SOCIAL ORGANIZATION AND BEHAVIOR

American Studies 51. American Culture Since the 1850s—(Same as History 151A.) Historical and interdisciplinary perspectives on American life and character from the mid-19th century to the present. Topics range from race relations and class conflict to music, movies, and popular culture.  
5 units, Win (Gillam) MTWTh 11

American Studies 171. The Development of American Law—(Same as Political Science 183F.) The growth and development of American legal institutions with particular attention to crime and punishment, slavery and race relations, the role of law in developing the economy, and the place of lawyers in American society, from colonial times to the present.  
5 units, Aut (Friedman) given 1986-87

5 units, Aut (Wright)

5 units, Sum (G. Spindler)

Anthropology 116. Anthropological Perspectives on American Culture.  
5 units, Win (G., L. Spindler)

History 52S. Undergraduate Seminar: The Making of the Constitution.  
5 units, Win (Rakove)

History 161. American Intellectuals and Afro-American Life, 1890-Present.  
5 units, Spr (W. Jackson)

History 163. The Crisis of American Thought, 1890-Present.  
5 units, Aut (Gillam)

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 (Kennedy)

History 269S. Undergraduate Seminar: U.S. Foreign Policy in the World War II Era.  
5 units, Win (Kennedy)

History 272. Undergraduate Colloquium: Medicine, Expertise, and Democracy.  
5 units, Spr (Gillam)

5 units, Spr (Staff)

Sociology 130. American Society in Film and Literature.  
3-5 units, Win (Zelditch)
American Studies 171. The Development of American Law—(Same as Political Science 183F.) See description under Social Organization and Behavior. 5 units (Friedman) given 1986-87

American Studies 176. Law in Radically Different Cultures—(Same as Anthropology 157, Law 316, Political Science 182L, 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 28. Students must register for both quarters.
2 units, Win plus 3 units, Spr (Merryman) M/W/Th 2:15

American Studies 179. Introduction to American Law—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)

Communications 140. History of American Journalism.
4 units, Win (Lewenstein)

History 158. History of Education in the United States
3 units, Spr (Tyack)

History 158B. American Education and Public Policy—(Same as Political Science 186K.)
3 units, Aut (Tyack)

Political Science 1. Major Issues of American Public Policy.
5 units, Aut, Win (Marshall)

Political Science 10. American National Government.
5 units, Win (Manley)

Political Science 128. Political Elites.
5 units, Spr (Eulau)

Political Science 145J. American Foreign Policy.
5 units, Aut (Goldstein)

Political Science 167A,B. American Political Thought.
5 units, Win, Spr (Eulau)

Political Science 175. Politics and Public Policy.
5 units, Spr (Manley)

Political Science 181. Conservatism and Constitutionalism.
5 units, Spr (Horn)

Political Science 183K. Criminal Law and the Criminal System.
5 units, Win (Kaplan)

Political Science 186K. American Education and Public Policy—(Same as History 158B.)
3 units, Aut (Tyack)

5 units, Win (Kirst)

Political Science 192R. Seminar: The Politics of Policy Toward Unemployment.
5 units, Win (Brody)

5 units, Aut (Ferejohn)

Sociology 105. Poverty and Public Policy in America.
3-5 units, Spr (Staff)

VTSS 101. Technology and Science in Contemporary Society.
4 units, Win (Staff)

CORE SEMINARS

American Studies 201. The South Since 1880—Perennial questions of southern identity, distinctiveness, and continuity versus change from a variety of disciplines. Guest speakers from law, literature, economics, religious studies, political science, art, music, sociology and psychology will focus on Southern topics which lend themselves to interdepartmental study.
5 units, Spr (Sosna) T/Th 2:15-4:05

5 units, Spr (Ilas, McKenna)

American Studies 206. The Automobile and American Culture—Origins, development and consequences of our romance with the automobile: technical evolution, development of the industry, conflicts between safety and styling, workers and assembly lines, legal aspects of mass automobility, car cultures, the impact of cars on cities and suburbs. Approach will be essentially historical but will also utilize materials from literature, film, the arts, and the social sciences.
5 units, Spr (J. Corn) given 1986-87
American Studies 208. The American Character.
5 units (Staff) to be arranged

American Studies 217. Material Culture—A study of three-dimensional and two-dimensional objects, including structures and buildings, arts and crafts. Machines and machine-made things reveal attitudes, values and beliefs embodied in and reflected by the production, use, collection and preservation of artifacts.
5 units (J. Corn) given 1986-87

American Studies 220. Photographs as Historical Documents—(Same as Art 231A.) Methods, problems and practice of "reading" photographs as historical evidence. Consideration given to the history of photography and theories of photograph interpretation, followed by development of an individual research project and writing of major essay.
5 units, Spr (J. Corn and W. Corn)
TTh 1:15-3:05

American Studies 221. The Machine in American Culture—Examination of technology as a cultural phenomenon in 19th and 20th century America, dealing with themes such as: technology as a secular religion, ideologies on anti-technology and technological utopianism, technology-centered rituals and celebrations, cultures surrounding particular technologies, and technology in popular culture.
5 units, Aut (J. Corn)

American Studies 222. Core Seminar: America in Vietnam—(Same as History 264.)
5 units, Spr (Rakove)

American Studies 223. Language and Social Issues in America—(Same as Linguistics 50.)

American Studies 225. Power and Imagination in the 1940s—(Same as History 51S.) Historical and interdisciplinary perspectives on American life and character from the mid-19th century to the present. Topics range from race relations and class conflict to music, movies, and popular culture.
5 units, Win (Gillam)

HONORS PROJECT

American Studies 250. Honors Project—Prerequisite: consent of the chairman of American Studies.
5-15 units, any quarter (Staff)
The Honors Program in Anthropology is open to all majors who have a 3.5 letter-grade equivalent in anthropology courses. Candidates of sophomore or junior standing should apply for admission no later than the end of the fourth week of the Spring Quarter. The application must include a transcript, a short paper, and a letter of recommendation from the professor who will supervise the honors project. Students who cannot meet all of these requirements but wish to be considered for admission to the Honors Program should petition the Committee on Undergraduate Studies for special consideration.

The Major in Social Science also requires a written application. The student must submit a tentative list of courses and a brief statement that presents an intellectual rationale for the proposed program of study. Applications for this major must be received no later than the beginning of the Winter Quarter of the student’s junior year. The Major in Social Science allows a candidate to combine a concentration in anthropology with, a selection of courses from history, sociology, economics, political science, and psychology. Students who want a program that combines anthropology courses with courses from some other field (e.g., classics) are advised to arrange for a special major with the Dean of Undergraduate Studies.

All majors in the Department of Anthropology must fulfill the following requirements:

1. Competence in a foreign language. Such competence is usually demonstrated by completing a course on the second-year level, but the requirement may be met by special examination, presentation of superior foreign language placement scores, or certification in writing from an appropriate department.

2. A passing grade in Anthropology 90. This course is required of all Anthropology majors and should be taken before the end of the junior year. It introduces students to anthropology 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**—Forty-five units in anthropology or 40 units in anthropology and 5 units in either sociology or psychology. The units in anthropology must include at least one course in four of the following topical categories: (a) Area Studies (8, 102-118, 121); (b) Social and Cultural Anthropology (1, 6, 11-22, 128-168, 219-244, 246-276); (c) Linguistic Anthropology (4, 5, 75, 172-178, 245); (d) Archeological Anthropology (3, 81, 91, 183-189); (e) Biological Anthropology (2, 6, 181, 182).

**Honors Program in Anthropology**—The candidate must complete all of the requirements for the Major in Anthropology and submit an honors thesis no later than four weeks prior to the end of the quarter in which graduation is anticipated. The thesis will be read by the candidate’s advisor and a second reader appointed by the Committee on Undergraduate Studies. An honors candidate may enroll in Anthropology 95 for as many as 15 units but may not count more than 5 of these units in fulfilling the 45 unit requirement.

**Major in Social Sciences**—Thirty units in Anthropology and 20 units in related social science fields. The 50 units must form a coherent program of study and must be approved by the student’s academic advisor.

All units required for these programs must be passed with a grade of “C” or better, and not more than 5 of the required 45 units may be taken for a Pass/No Credit grade.

Undergraduate majors who have completed the prerequisites are encouraged to enroll in 100- or 200-level seminars. They may also take part in field work on local archeological sites, obtain training in museum methods by means of research with Stanford collections, and apply for funds to support summer field research in archeology and social anthropology. In addition, they are encouraged to take part in departmental activities and to attend the department’s colloquia (Mondays) and noon-hour films (Fridays). 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 consist of residence at Stanford University as a graduate student for at least three quarters. Students must take a minimum of 45 quarter units in anthropology with a grade of B or better in each course. They must have at least 15 additional units of anthropology, taken at Stanford or elsewhere, constituting a minimum total of 60 units in anthropology. Within the 45 units taken at Stanford, students must take one quarter (5 units) of the History of Anthropological Theory plus one additional course from those designated as “core courses” by the faculty. The remaining units may be made up of courses selected in consultation with the faculty advisor to meet the needs and interests of the student. A field or library research paper read and approved by at least two departmental faculty members must be presented. Full-time students entering the program with appropriate background in anthropology can complete the A.M. program in one calendar year. Others may require a longer time. To provide a meaningful A.M. program within a one-year period, advance planning of coursework with an advisor is required.

DOCTOR OF PHILOSOPHY

Prospective graduate students should apply formally through the Graduate Admissions Office, which will transmit their records to the department for consideration when application requirements have been completed. Applicants for admissions must file a report of their scores on the Graduate Record Examination and submit a sample of their writing. Successful applicants for the Ph.D. Program may enter only at the beginning of the Autumn Quarter. The final date for applications is January 1. The Ph.D. Program consists of a number of required courses and examinations which also allow students to develop a flexible program designed to reflect their special interests under the supervision of a faculty committee chosen by them. Students are encouraged to plan a program that will enable them to complete all work for the Ph.D. in five years.

The requirements for the Ph.D. degree include:
1. Pass within the first two years, at an acceptable graduate level, four of the courses designated as “core courses” by the faculty.
2. Submit an acceptable, substantial research paper in the Spring Quarter of the first year.
3. Serve as a teaching assistant for two courses, usually during the second year of graduate study. An approved internship may be substituted for part of this requirement.
4. By the end of the second year pass, at a satisfactory graduate level, four courses distributed in at least two of the following areas: archeology, biological anthropology, linguistics, statistics.
5. Pass, by the end of the second year of graduate study, an examination in a foreign language in which there exists a substantial body of literature relevant to the student’s program of study.
6. Pass a special examination (written and oral), normally given during the Spring Quarter of the third year, covering the candidate’s major topic of specialization and one major ethnological area of the world. The oral part of this examination is normally taken as the University oral.
7. Prepare a dissertation proposal to be approved by the student’s dissertation committee before undertaking doctoral research.
8. Present an approved dissertation based upon independent research.

Ph.D. MINOR IN ANTHROPOLOGY

The requirements for a minor in Anthropology consist of 30 units of anthropology taken at Stanford with a grade of B or better in each course. All students must have a departmental advisor and should develop a coherent course of study related to their particular interests. The course of study approved by the advisor must be filed with the Committee on Higher Degrees 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 financial 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. Program must file a request for financial aid when applying to the program if they wish to be considered for support. No financial support is available to students enrolled only for the A.M. degree.
TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the School of Education section of this bulletin or address the inquiry to the Credential Administrator, School of Education.

COURSES FOR UNDERGRADUATES

GENERAL COURSES

These courses are open to all students. Each is introductory in the sense that prior knowledge is not assumed. The numbers are only labels; they say nothing about the level of the course. Students who want a general introduction to human behavior and culture are advised to take Anthropology 1; those who are interested in introductory courses focused on specific areas of anthropological inquiry should choose from among the courses numbered 2 through 16. A student who wants a comprehensive introduction to all four subfields of anthropology should take Anthropology 1, 2, 3, and 4.

1. Social and Cultural Anthropology—(Upper division students register for 101). A general introduction to anthropological perspectives on human behavior, thought, and institutions. Through lectures and films the course examines a wide range of human societies and introduces the assumptions and concepts anthropologists employ in examining the relationship between human nature, society, and culture. (DR:4*) or (DR:5*)

5 units, Aut (Rosaldo) Spr (G. and L. Spindler)

2. Biology and Culture in Human Evolution—(Upper division students register for 182.) Lecture course on the interplay of genes and culture in the evolution of human diversity. Compares major theories relating human biology and culture and evaluates them in light of data from contemporary populations and the hominid fossil record. Topics include genetic evolution, human origins, the emergence of culture, gene-culture interactions, sickle cell disease, color terms, incest avoidance, human aggression, and Kuru. May be taken as an introduction to anthropology and human biology. No prerequisites.

3 or 5 units, Win (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 55.) 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 (Fox) alternate years, given 1986-87

5. Biology and Evolution of Language—(Same as Human Biology 113 and Linguistics 5.) Lecture course 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. No prerequisites. (DR:4)

5 units, Aut (Fox)

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.

5 units, Spr (Johanson)

8. Introduction to China—The course 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 1985-86

11. Sex Roles and Society—The purpose of this course is to develop 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 (Herdt)

12. Sex and Gender—An introductory course of lectures on the cross-cultural study of sex and gender. Focuses on the cultural and psychological development of gender identity in non-western societies. Part one surveys the psychobiological basis of sexual behavior and reproduction in lower mammals and humans from an evolutionary perspective. Part two examines
the interplay between socialization, cultural ideology, and gender roles. Part three concentrates on the formation of gender identity (masculinity and femininity) and its consequences for normal eroticism and perversion. (DR:4*) not given 1985-86

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 1985-86

15. Anthropological Perspectives on American Culture—(Upper division students register for 116.) Areas of convergence and divergence in values, life styles, and psychocultural attributes are analyzed for mainstream, minority, and variant cultural patterns in United States society. Processes of boundary maintenance and identity reference are discussed. Current social movements are placed in the perspective of counter-culturalism, marginality, and cultural change. Field studies of relevant phenomena will be encouraged. (DR:5) 3-5 units, Spr (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. Specific topics include: early long-distance voyaging, fishing as an ecological adaptation; maritime economics and national development.

5 units (Frake) alternate years, given 1986-87

17. Culture and Astronomy—A cross-cultural and historical examination of a variety of astronomical systems, cultural practices, and empirical reality. Comparison of ancient Maya calendrical astronomy, Pacific Islanders' navigational astronomy, and ancient and Medieval Western astronomy.

5 units (Fox, Frake) alternate years, given 1986-87

21. The World Outside the West: Change and Tradition Before the Age of European Imperialism—(Same as History 21, Political Science 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. No prerequisites. (DR:5*; also DR:3 when taken in sequence with Anthropology 22.)

5 units, Aut (Fox, Roberts, Staff)

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 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. Prerequisite: Anthropology 21/History 21. (DR:5*; also DR:3 when taken in sequence with Anthropology 21.)

5 units, Win (Collier, Abernethy, Staff)

SPECIAL UNDERGRADUATE COURSES

69. Practicum in Ethnographic Futures Research—(See 269.)

75. First-Year Classical Nahuatl—Introduction to the language of the Aztecs of colonial Mexico. For beginners.

5 units, Aut, Win, Spr (Fox)

90. Theory in Social Anthropology—Anthropological interpretations of other societies have always contained assumptions about ourselves and about "Western" societies. The object of this course is to highlight that interplay and, specifically, to consider how underlying assumptions and implicit categories have influenced the presentation of data in a set of major anthropological monographs. The course will concentrate on Karl Marx, Emile Durkheim, and Max Weber, along with a particular anthropological analysis of a nonwestern society.

5 units, Spr (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. Anthropology 191 is recommended as preparation for this course, but is not a strict prerequisite.

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-his-
tories, ethnohistory, and use of documentary materials. Also explores strategies of successful entry into the community, research ethics, interpersonal dynamics, and the reflexive aspects of fieldwork. Prerequisite: introductory course in anthropology or consent of instructor. 5 units, Spr (Siegel)

94. Post-Field Research Seminar—Provides training and experience in coding, processing, and analyzing quantitative and qualitative research data. Participants are expected to complete a full-scale report on a body of field data that will normally have been collected during the preceding summer. 5 units, Aut (Befu)

95. Honors Program—Directed independent study and honors thesis work for students admitted to this program. any quarter (Staff) by arrangement

96. Directed Individual Study—For undergraduate students with special needs, and showing capacity to do independent work. Prerequisite: 1 or consent of instructor. any quarter (Staff) by arrangement

COURSES FOR UNDERGRADUATES AND GRADUATES

AREA STUDIES

100. Culture, Politics, and Society in Latin America—(Same as Latin American Studies 80 and History 80.) An interdisciplinary course which surveys the interaction of Amerindian, African, and European cultures in the creation of New World societies from 1500 to the present. Basic introduction to the Latin American courses within several departments. (DR:5*) 5 units, Spr (Collier, Wirth)

101. (See 1.)

102. Native Peoples of North America—Lecture course on the cultures of the many indigenous peoples who made North America their home before European conquest. Through lectures, readings and films, the course will cover the pre-contact situation, post-contact changes (including governmental policies), influences of Native culture on American society and culture, and the contemporary situation of native peoples. A good antidote to TV and movie Western stereotypes. (DR:5*) 5 units, Win (Barnett)

103. Peoples of Mesoamerica—Survey of the Mayas, the Aztecs and their prehistoric neighbors, of how they fared under Spanish colonial rule, and of what their descendants are like today. (May be taken in sequence with Anthropology 104.) 3-5 units (Fox) not given 1985-86

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 (Fox) not given 1985-86

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. No prerequisite. (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, Aut (Siegel)

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, Aut (Donham)

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. 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.

4 units, Spr (Samoff)

112. Peoples and Cultures of New Guinea—A course of lectures and films introducing the history, politics, economy, ritual, and sex roles of the indigenous peoples of island New Guinea.

5 units (Herdt) not given 1985-86

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 1985-86

115. Peoples of Island Southeast Asia—Shows how the contemporary culture unity and diversity within the Southeast Asian region may be accounted for in terms of the interaction between indigenous societies and a succession of outside colonizing influences. Among topics discussed are: prehistory, the process and impact of colonization, the contrast between hill and valley peoples, subsistence modes, social organization, religion, and aesthetics. (DR:5*)

5 units, Spr (Rosaldo)

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, Aut (Skinner)

118. Communist Chinese Society—Analyze 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, Win (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 1985-86

122. Ecology, Industrialization, and Culture in Japan—Social and cultural ramifications of environmental destruction in Japan resulting from industrialization will be explored. Modes of coping with the impact of industrialization—social, political, legal, etc.—will be analyzed in relation to Japan’s cultural premises and traditional social structure and values.

5 units (Befu) not given 1985-86

125. Japanese Culture Through Novels and Films—(Same as Asian Language 125). Explorations of Japanese social structure (family, socialization, community, work, etc.) and cultural values through novels (in translation) by leading writers (Mishima, Natsume, Takizaki, etc.) and feature length films by well known directors (Kurosawa, Ozu, etc.). The course will focus on the individual in the social and cultural setting of modern, changing Japan.

5 units (Befu) not given 1985-86

127. Peoples and Cultural Adaptation in Mediterranean Europe—The study of agrarian societies and cultures of Mediterranean Europe, with special emphasis on Italy, Greece, Spain and Portugal. Focus will be on ecology, land tenure and production, family and kinship, (beliefs and values). Consideration will be given to the relations between local communities and national and international forces that have historically shaped their adaptations.

5 units, Win (Siegel)

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. Pre-requisite: Anthropology 1 is recommended.

5 units, Spr (Gibbs)

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 will consider 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, Win (Siegel)
131. Cultural Evolution—Analysis of the origin of human culture using evidence from primate ethology, 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 1985-86

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 with emphasis on the 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, Lusignan, McWhorter, Siegel)
Lectures W 7:30-9:30 p.m.
Workshops by arrangement

137. Applied Anthropology—(See 237.) (Same as VTSS 150.)

138. Education and Sociocultural Change—(See 238.)

139. Seminar in Cultural Identity—Seminar investigating the nature of ethnicity, the mechanisms of ethnic boundary maintenance, and the role of ethnic groups in social, cultural, and ecological systems.

5 units, (Frake) not given 1985-86

141. Feminist Theory in Anthropology—(Graduate students register for 241.) A seminar examining ten years of feminist scholarship in anthropology. Topics include the debate over whether sexual asymmetry is universal; the utility of analytic dichotomies such as 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, Aut (J. Collier)

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, Spr (J. Collier)

145. Women in Cities: A Cross-Cultural Perspective — (Same as Feminist Studies 142.) A series of hypotheses about women’s experiences in cities, which have emerged primarily from research in North America and Western Europe, will be critically evaluated in light of research on women in Latin American, Asian, and African cities. Topics to be covered include women and migration, changing forms of the sexual division of labor, changing family and kinship structures, women’s access to ‘public’ space in cities, unionism, and political activism.

5 units, Aut (Yanagisako)

146. Urban Problems in Anthropological Perspective—A series of issues derived from current urban problems are examined from the cross-cultural perspective of anthropology. Topics include the social consequences of crowding, rural-urban migration, pre-industrial urbanism, changing family and kinship structures, urban ethnic communities and inter-ethnic relations, urban poverty and stratification, and crime.

5 units, not given 1983-86

147. Peasant Migration and Social Change—Rural-to-urban migration as indicator and consequence of social change. Examine models of migration processes; impact of policies in sending and receiving notions; motives and adaptive strategies of migrants; significance of emigration for peasant villages. Case studies from Africa, Latin America, Asia, and Europe.

3 units, Aut (Siegel)
148. Cultural Approaches to Alternative Futures—(Same as Education 287.) Seminar exploring alternative middle-range futures—of a community, a society, or the world—from an anthropological perspective. Stresses developing ability to read the futures literature critically, using explicit models and systematic data, while at the same time developing imaginative scenario-building skills. Emphasizes the change-driving power of the telemicroelectronic and biotechnical revolutions. Considers global ecological and energy constraints, and sociopolitical imperatives. Examines particular Western and non-Western cultures in terms of their adaptive capacity or vulnerability. Addresses implications for the policy-maker, planner, and educator. (DR:5) 3-5 units (Textor) not given 1985-86

150. Advanced Cognitive Anthropology—Course is concerned with how people give meaning to behavior and other events they experience. The point of view is from the anthropological side of the intersection of anthropology, linguistics, cognitive psychology, and sociology thus presenting a cross-cultural perspective on the relations among knowledge, language, and social behavior. 5 units (Frake) not given 1985-86

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 topics such as 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 1985-86

153. Religion—Interpretation of myths, symbols, and rituals, in sacrifice, magic, and witchcraft; stress on non-Western case studies rather than survey. (DR:3) 5 units (Rosaldo) not given 1985-86

154. The Anthropology of Play—(Same as Education 192.) Introductory course of lectures on anthropological perspectives on play. First half surveys the social psychological literature, for understanding the role of play in shaping cognitive development, images of adult roles, and developmental performance. An historical examination of play will identify concepts of childhood and societal correlates of varying definitions and norms of play. Second half examines play in crosscultural contexts and focus on paradigms of pretense. Final section reviews educational and social policy issues in the uses of play. 3-5 units (Heath) not given 1985-86

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 1985-86

157. Law in Radically Different Cultures—(Same as American Studies 176, Political Science 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 (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social, and cultural factors which contributed to the development of different attitudes and practices regarding law. Open to law students, graduate students in other departments and to juniors and seniors. The course covers Winter and Spring Quarters, starting January 28. Students must register for both quarters. 2 units, Win plus 3 units, Spr (Gibbs, Staff)

164. Ecological Anthropology—(Same as Human Biology 134.) Seminar on the cultural adaptations of human populations to their environments. Evaluates major theories relating cultures and ecosystems in light of examples from diverse habitats (arctic, desert, tropical rainforest, ocean islands, mountain tops, etc.). Topics include adaptation and cultural change, optimal foraging theory, resource management, social demography and population dynamics, resource competition, warfare, and social stratification. Prerequisite: Anthropology 1, the Human Biology Core, or consent of instructor. 5 units (Durham) alternate years, given 1986-87

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 to be surveyed 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)

3 units (Herdt) not given 1985-86

166. Culture and Madness—Introduction to anthropological perspectives on the theme of "madness" in cultural ideology and individual experience within tribal, peasant, and western cultures. Case studies are used to examine the role of sociocultural factors in psychiatric illnesses, diagnosis and healing in the following areas: symbolic group therapy, healing cults, shamanism and trance states, primitive psychosis and patterns of deviance, anxiety and the schizophrenias of western civilization. Models of madness are viewed in the cultural context of definitions of normal and abnormal behavior, the medical model of disease and social policies about psychiatric treatment. Prerequisite: Anthropology 1 and Psychology 1, or the instructor's consent.

3 units (Herdt) not given 1985-86

167. Ethnography of Communications: Research Methods—(Same as Education 337.) 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 (determinative unit of study, defining speech community, will be examined. Case studies will include: (1) selected speech events for interpreting value orientation to language and social roles (2) oralliterate continuum models, and (3) use of cognitive style theories for understanding cross-continuum models, and (3) use of cognitive style theories for understanding cross-cultural dimensions of first and second language acquisition.

4-5 units (Heath) not given 1985-86

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

176. Indigenous Languages of North and South America—(Same as Linguistics 90.) Survey of American Indian languages, their history, classification, structure, and possible Old World relationships. The relationship between American Indian languages and the development of anthropological and linguistic theory. Native American writing systems. Problems of language, culture and world view.

5 units (Fox) alternate years, given 1986-87

177. Mayan Hieroglyphic Writing—Lecture course on principles of archaeological decipherment as applied to the writing of the ancient Maya, with attention to the origins and functions of writing in Mesoamerica. No prerequisites.

5 units, Spr (Fox)

178. Historical Linguistics and Culture History—(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 linguistics course.

4 units, Win (Fox, Frake, Rickford)

alternate years, given 1986-87

179. Mayan Hieroglyphic Writing—Lecture course on principles of archaeological decipherment as applied to the writing of the ancient Maya, with attention to the origins and functions of writing in Mesoamerica. No prerequisites.

5 units, Spr (Fox)

174. Universals and Typology of Language—(Same as Linguistics 100) Characteristics of human language, as suggested by structural comparisons of the world's languages. Basic grammatical categories, preferred sound systems; methods of description and classification. Implications of cross-linguistic comparisons for language history, language learning, and language disorder. Prerequisite: an introductory linguistics course.

5 units, Win (Fox, Frake, Rickford)

alternate years, given 1986-87

178. Historical Linguistics and Culture History—(Same as Linguistics 150.) Lecture course on basic principles of historical linguistics, with attention to cultural inferences from language distribution and classification, 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.

4 units, Win (Fox, Frake, Rickford)

alternate years, given 1986-87

ARCHEOLOGY AND BIOLOGICAL ANTHROPOLOGY

181. Research Seminar in Coevolution—(Same as Human Biology 114.) Seminar of the interactions of genes and culture in the evolution of human diversity. Reviews major new works relating biology and culture (e.g., sociobiology, dual inheritance theory, cultural transmission, etc.) with special emphasis on theory and supporting examples. Teams of students conduct original research projects and report to the class. Prerequisites: Anthropology 2 or the Human Biology Core, and a course in statistics.

4 units (Durham) not given 1985-86
182. Biology and Culture in Human Evolution—(See 2.) Intended for upper division and graduate students only. Prerequisites: Anthropology 90 or consent of instructor.
3 or 5 units, Win (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 will be 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 will focus on the interaction between early technology and social structure, values, and institutions.
3 or 5 units, Spr (Rick, Runnels)

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, Spr (J. Rick)

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.
not given 1985-86

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 pro-
vided 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, Win (J. Rick)

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.
3-5 units, Win, Spr (P. Ritter)

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 telemicroelectronic, biotechnical, or other technological innovation, an ecological system break, or a fundamental shift in political or managerial control) where such change is judged likely to produce profound sociocultural change. The student, working alone or with a team, selects a problem, formulates it in social science terms, and receives training and systematic 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, policy, and education. Previous interviewing or social science background helpful but not essential. Open to graduate students, seniors, and juniors. Enrollment limited to 20.
3-5 units, Win (Textor)

192B. Ethnographic Monitoring of Rapid Change II—(Same as Education 254B.) Continuation of Education 254A Anthropology 192A) for the student requiring additional time, training, or guidance to complete a paper, prepare it for publication, develop it into a dissertation proposal, etc.
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
COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

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.) Purposes of seminar are to develop 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, 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, Spr (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 1985-86

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 (Siegel) not given 1985-86

237. Applied Anthropology—(Undergraduates register for 137. Same as VTSS 153.) Anthropologists are called upon to apply their knowledge and skills to a variety of problems, including: 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. The course addresses itself to the substance of such programs; the utility of anthropological theory and techniques in solving contemporary problems; and the ethics of professional practice. Field research cannot be conducted today without attention to the desires and needs of the study population, and therefore students with strong research but not applied interests also will find this course of use.
5 units, Spr (Barnett)

238. Education and Sociocultural Change—(Same as Education 306C.) (Undergraduates register for 138.) 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.
3-5 units, Spr (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 kinship.
5 units, Aut (Skinner)

243. Social Organization—Examination of theories and findings in the area of culturally defined interpersonal relations, focusing on kinship, and local group organization. Prerequisite: graduate status in anthropology or consent of instructor.
5 units, (Befu) not given 1985-86

244. Family and Kinship Organization—Seminar on the major issues anthropologists have confronted in the comparative study of family and kinship. Competing theoretical frameworks will be evaluated through an examination of such topics as descent, marriage, gender, domestic groups, and kinship change. Prerequisite: graduate standing in Anthropology or consent of instructor.
5 units (Yanagisako) not given 1985-86

245. 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 (Traugott)

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, Aut (Jackson, Rosaldo)

250. Nutritional Problems of Developing Nations—(Same as Food Research 250.) The various malnutrition syndromes common in developing countries will be described, with emphasis upon protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations will be reviewed. Detailed consideration will be given to effects of malnutrition throughout the life cycle, from fetal growth to fertility, with assessment of societal cost of malnutrition and its effects on learning, productivity, and other aspects of national development. Open to graduate students and seniors in Human Biology and Anthropology. Prerequisite: Food Research 119 or its equivalent is strongly recommended; open to graduate students and seniors in Human Biology and Anthropology.

5 units, Win (Martorell)

251. Ritual and Mind—A seminar devoted to understanding contemporary theories of ritual symbolism and individual experience. Topics to be studied: social learning, psychodynamic, semiotic, and hermeneutic theories of ritual; cognitive versus affective processes in ritual symbolism; social and personal identity; public and private symbols; interpretive approaches to textual analysis.

not given 1985-86

253. Religion—Readings in classical social theory (Weber, Durkheim, Freud) on the nature of religion with special emphasis on their importance for a theory of culture. Theory will be complemented by ethnography and contemporary works which continue, and further interpretation of such phenomena as religious sects, worship, rites of passage, magic, shamanism and dreaming. Prerequisite: consent of instructor.

5 units (Rosaldo) not given 1985-86

254. Stories and Culture — This course considers both the use of narrative in understanding, social practices, and problems in studying the text and context of storytelling.

5 units (Rosaldo) not given 1985-86

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, Aut (J. Collier)

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. This seminar will consider, among others, the works of Pierre Bourdieu, Anthony Giddens, Raymond Williams, E.P. Thompson and Fredic Jameson.

5 units, Win (Donham)

260. Topics in Urban Anthropology—Seminar devoted to key issues in anthropological research on urbanism, urban communities, and urban-rural integration.

5 units, Win (Yanagisako)

262. Economic Anthropology—Seminar on the dominant issues in current attempts to analyze the economic organization of noncapitalist societies. Special attention devoted to competing theoretical approaches — particularly neoclassical, substantivist, and Marxist — to such topics as the social organization or production, the circulation of goods and services, the generation and maintenance of economic inequality, and the encapsulation of local economic units within larger social systems.

5 units, Spr (Donham)

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, Win (Skinner)

264. Advanced Ecological Anthropology—Seminar on the role of ecological models in the analysis of contemporary cultural diversity. Uses major monographs of the subfield 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: foraging patterns of hunter-gatherers, ritual regulation in highland New Guinea, kinship and land texture in Southern Mexico, demographic change in the Swiss Alps, and peasant ecology of Central America. Prerequisite: Anthropology 164 or graduate standing.

5 units, Aut (Durham)

265. Advanced Psychological Anthropology—Analysis of selected psychocultural processes, including attention to group and individual
adaptations to rapid cultural change and urbanization. Prerequisite: consent of instructor.

5 units, Win (Herdt)

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. The patterning of education in cross-cultural perspective, sequences 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.

3-5 units, Spr (G. and L. Spindler)

267. Seminar in Fieldwork and Ethnography—Advanced seminar on the qualitative methods of anthropological fieldwork and the processes of doing and writing ethnography. Briefly surveys the intellectual history of theories and methods of fieldwork and ethnographic interpretation. Covers various qualitative techniques, and types of interviewing. Interpretive, ethical, and interpersonal aspects of ethnographic research and reporting are discussed and compared in both simple and complex societies.

5 units, Spr (Herdt)

268. Family Ecology—Each student follows a family during the quarter, interviewing, observing, and studying them at their home and in a clinical setting. The seminar provides the student with interview and observation skills and sensitizes students to others and their reactions. Field work focuses on meaning of illness from patient's point of view and role, responsibility, and impact of professional intervention.

5 units (Barnett, Grobstein)

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-directive, semi-structured, open-ended, interactive, recursive technique for eliciting from a sample of interviewees their middle-range perceived and preferred sociocultural scenarios for a given social population. EFR is (1) an auxiliary technique for research on sociocultural change; (2) a means of augmenting conventional policymaking and planning approaches; and (3) an educational technique for both interviewer and interviewee. Instruction includes ways of combining EFR with conventional ethnography and other research methodologies. No prerequisites, but 148 is recommended.

3-5 units (Textor) not given 1985-86

270. Seminar in Clinical Processes—(Same as Psychology 271.) This seminar includes practicum training in clinical interviewing and case observation. It is affiliated with a psychiatric ward at the VA Hospital, where each student will conduct interviews and coordinate findings. In weekly case presentations, the seminar will focus on aspects of case formulation as well as on the goals and theories of interviewing. Students should enroll concurrently in Psychology 216. Prerequisite: Consent of the instructors.

3 units, Spr (Horowitz, Herdt)

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: 168 or consent of instructor.

5 units, Win (Barnett)

275. Demographic Anthropology—Proseminar devoted to an examination of population dynamics in human societies. Includes a critical review of theories concerning the interaction between population processes and the political economy and a comparative analysis of family demography.

5 units (Skinner) not given 1985-86

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 1985-86

277. Linguistic Anthropology—(Same as Linguistics 255.) Seminar devoted to intensive reading and discussion of major works on the relationships between language and culture. Prerequisite: an introductory course in linguistics or consent of instructor.

5 units, Win (Fox)

278. Topics in Linguistic Anthropology—(Same as Linguistics 256.) Seminar devoted to a key issue in the relationships between language and culture. Prerequisite: 277 or consent of instructor.

5 units (Fox)

alternate years, offered 1986-87

290. Anthropological Theory in Historical Context—Seminar considers a set of problems that show the interplay between theory and historical circumstances. Among topics considered are race and culture, functionalism, societies without states, family and kinship studies, material culture, feuding and forms of
warfare, structuralism, and Marxism. Prerequisite: graduate standing or consent of instructors.
5 units, Win (Rosaldo, Yanagisako)

292. Dissertation Seminar—Seminar for graduate students in the process of writing dissertation and preparing for professional employment.
5 units, Aut, Win, Spr (Donham)

294. Design of Field Research—A seminar treating research design and the research process, with special attention to the interrelation of both with theory and method. Consideration is also given to problems of preparing dissertation proposals and applications for research grants. Limited enrollment. Prerequisite: consent of instructor.
5 units, Spr (J. Collier)

296. Research Apprenticeship—Supervised work with an individual faculty member on the students' research project. May be taken for more than one quarter.
5 units, any quarter (Staff) by arrangement

297. Directed Individual Study—Provides opportunities for advanced students to explore special areas of interest.
any quarter (Staff) by arrangement

298. Teaching Apprenticeship—Supervised experience as assistant in one undergraduate course.
5 units, any quarter (Staff) by arrangement

299. Thesis—Research in connection with the master's thesis or the doctoral dissertation.
any quarter (Staff) by arrangement

APPLIED PHYSICS

Emeriti: (Professors) Marvin Chodorow, C. Chapin Cutler, W. Conyers Herring, Mitchel Weissbluth
Chairman: Malcolm R. Beasley
Assistant Professor: Aharon Kapitulnik
Professors (Research): Bertram A. Auld, George S. Brown, H. John Shaw, J. Gethyn Timothy, Helmut Wiedeman, Herman Winick (on leave 1985-86)
Affiliated Professors: Gordon S. Kino (Electrical Engineering), Anthony E. Siegman (Electrical Engineering), William E. Spicer (Electrical Engineering)
Consulting Professors: Richard G. Brewer, Lawrence Colin, Peter M. Eisenberger, Bernardo A. Huberman, Robert M. White
Marvin Chodorow Fellow: John S. Foster, III

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, superconductivity, quantum electronics, space science, astrophysics, and physics of biological macromolecules. Student research is supervised by the faculty members listed above and also by various members of other departments such as Physics, Materials Science and Electrical Engineering, who are engaged in related research fields. Research activities are carried out in the Department of Applied Physics, the Ginzton Laboratory, the Stanford Electronics Laboratories, the Center for Space Science and Astrophysics, the Center for Materials Research, and the Stanford Synchrotron Radiation Laboratory.

The number of graduate students admitted to Applied Physics is limited. Applications should be received by January 1, 1986. Graduates students may normally enter the department only at the beginning of Autumn Quarter.

GRADUATE PROGRAMS

Admission requirements for graduate work in Applied Physics include a bachelor's degree in physics or an equivalent engineering degree.
Students entering the programs from an engineering curriculum should expect to spend at least an additional quarter of study acquiring the background to meet the requirements for advanced degrees in Applied Physics.

The courses are listed under several categories: 1) General; 2) Astrophysics; 3) Condensed Matter Physics; 4) Quantum Electronics, Optics, and Acoustics. These reflect major programs for graduate study. From time to time, "Special Topics" courses are offered to emphasize new developments in the various research areas.

The University's basic requirements for the master's degree are discussed in the "Degrees" section in this bulletin. Thirty-six units, of which at least 9 units must be graduate level courses, in applied physics, physics, engineering, and mathematics are the minimum requirements 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).
   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.

For students entering with a Master of Science degree, the course work requirements (Item 1) are modified as follows:

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. 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 Seminar 3A.) (See "Freshman-Sophomore Program" section of this bulletin.)

Aut (Cutler)

10. The Nature of Things—Explores various concepts in our natural world, including the constituents of matter, the properties of waves and the technology surrounding the methods for observing the microscopic world. Use of several experiments in the classroom to illustrate the concepts under discussion. Video cameras may be used to make the experiments visible to the entire class. Opportunity provided for students to construct a microscope that actually works.

3 units, Win (Quate) MWF

20. From Klystrons to Lasers: The Stanford Connection—Explores the operational principles of laser devices at an elementary but instructive level. The laser is used as the Rosetta stone to unlock and explore science and technology that has utilized the extraordinary properties of laser light. The goal is to introduce both science and non-science students to the world of physics, chemistry, medicine and engineering through the application of modern laser sources.

3 units, Spr (Byer)

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) given 1985-86

215. Computer Methods for Physicists and Engineers—Provides a survey of numerical tools useful for graduate students. Some knowledge of FORTRAN is assumed. Polynomial fitting, least squares, fast Fourier transform, digital filtering; numerical integration; Monte Carlo methods; transcendental equations; matrix techniques; singular value decomposition; ordinary and partial differential equations; nonlinear optimization; introduction to string processing. Prerequisite: Mathematics 113 or 130 or equivalent.

3 units, Win (Doniach) given 1985-86


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

245. Wave Measurement Techniques—(Enroll in Electrical Engineering 245.)

3 units, Spr (Kino)

290. Directed Studies in Applied Physics—Special studies under the direction of a faculty member for which academic credit may properly be allowed. Such studies may include laboratory work or directed reading.

any quarter (Staff) by arrangement

300. Dissertation Research

any quarter (Staff) by arrangement

327. Introduction to Atomic Processes—Overview of atomic spectroscopy, spin orbitals, quantum defect theory, angular momentum,

3 units. Aut (Harris) alternate years, given 1986-87

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.


1 unit. Aut (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, given 1986-87

ASTROPHYSICS

Applied Physics 15 and Physics 15 (see Astronomy Course Program listing) are addressed to students not majoring in the sciences. They are taught in different quarters by different instructors but are closely related in topic. Students are advised against taking more than one of the courses.

15. The Nature of the Universe—Course is intended to familiarize undergraduates, without scientific background, with the structure, origin and evolution of our universe. Describes our growing knowledge of the objects which make up the universe: galaxies, stars, planets, etc. Discussion of some enigmas of modern astronomy, such as quasars, X-ray sources, black holes, and pulsars. Presentation will be non-mathematical. (DR:7)

3 units. Win (Walker) TTh 2:15-3:30
plus one hour discussion by arrangement

15A. Cosmic Horizons—(Enroll in Physics 15.) Spr (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 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 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; and consent of instructor. (DR:7)

4 units. Spr (Walker) M 3:15-5, lab by arrangement

110. Introduction to Stellar and Galactic Astrophysics—Physics of the sun. Evolution and death of stars. White dwarfs, novae, planetary nebulae, supernovae, neutron stars, pulsars, binary stars, X-ray stars and black holes. Galactic structure: interstellar medium, molecular clouds, HI and HII regions, star formation and element abundances. Prerequisite: calculus and one year of college physics at the level of the Physics 50 series or equivalent.

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

111. Extragalactic Astrophysics and Cosmology—Basic observational data on distances and the distribution of matter in the universe: galaxies, clusters and superclusters of galaxies. Electromagnetic radiation from galaxies and quasars and the background radiation at radio, infrared and X-ray frequencies. Introduction to cosmology, models of the universe and their evolution. The Big Bang and the physical processes in the first three minutes. Prerequisite: calculus and one year of college physics at the level of the Physics 50 series or equivalent.

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

190A, B, C. Independent Study In Astrophysics and Honors Thesis—(Enroll in Astronomy 190A, B, C.)

Aut, Win, Spr (Staff)
356. Astrophysics Laboratory—Combined seminar and laboratory course which allows the student to investigate the fundamental observational basis of physical models of astronomical objects. The observational component of the course makes use of the 16-inch telescope at the Stanford Observatory, and ancillary photometric and spectroscopic instrumentation. Emphasis placed on spectroscopic and photometric observation of main sequence, post-main sequence, and variable stars. Limited enrollment. Prerequisite: consent of instructor.

3 units, Sum (Walker) alternate years, given 1986-87


3 units, Spr (Sturrock) MW 2:15-3:30

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)

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 quasilinear 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, Aut, Win (Sturrock) MW 2:15-3:30 alternate years, given 1986-87

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 (Petrosian) alternate years, given 1986-87

368, 369. Gravitation—(Enroll in Physics 368, 369.)

3 units, Aut, Win (Staff) alternate years, given 1985-86

350. 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, Win (Sturrock) alternate years, given 1986-87

CONDENSED MATTER PHYSICS

172. Physics of Solids—(Enroll in Physics 172.)

3 units, Spr (Kapitulnik)

238. Electric and Magnetic Properties of Solids—(Enroll in Electrical Engineering 238.)

3 units, Win (Spicer)


239. 3 units, Aut (Herring) MWF 10

240. 3 units, Win (Harrison) MWF 10


3 units, Spr (Beasley) MWF 10

271. Electronic Structure—Bond orbitals and the electronic structure of covalent solids. Unit
versal tight-binding parameters and the prediction of the bonding and dielectric properties of semiconductors. Ionic solids and the bonding and dielectric properties of insulators. Theory of silicon dioxide and related compounds and their properties. Transition metals and their compounds. Prerequisites: elementary quantum theory and preferably undergraduate solid state physics.

3 units, Spr (Harrison) MWF 9


3 units, Win (Beasley)


3 units, Aut (Fetter)


3 units, Win (Fetter) alternate years, given 1986-87

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. Percolation Theory and Fractals—Review of percolation theory as a critical phenomenon. The concept of fractals and related ideas as applied to disordered systems. Experimental realizations such as semiconductors, metal-insulator thin films, electrochemical aggregations and polymers solutions and gels will be presented and analyzed.

2 units, Aut (Kapitulnik) TTh

385B. Localization and Superconductivity in Thin Metal Films—The theory of Anderson localization as a critical phenomenon, role of dimensionality. Localization for d=2, weak localization in d=2. Localization in d>2, strong localization and hopping conductivity. Interactions effects. Superconductivity in dirty materials and the crossover to the strongly localized regime. Superconductivity below the metal insulator transition. Experimental results and possible future experiments.

2 units, Win (Kapitulnik) TTh

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) TTh 1:15

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 (Staff)

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)


3 units, Spr (Auld) alternate years, given 1986-87

324. Applications of Quantum Theory—(Enroll in Electrical Engineering 324.)

3 units, Spr, (Staff) alternate years, given 1986-87

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. Quantum Electronics Laboratory I—
Combined lecture and laboratory course emphasizing laser theory and device operation. The lasers studied include He Ne, Argon ion, Nd: YAG, CO\textsubscript{2}, and dye. The topics discussed are properties of lasers, laser theory, Gaussian beam and laser cavities, modulation and Q-switching and interferometry. Experiments are performed with emphasis on laser device properties. Limited enrollment. Prerequisites: Electrical Engineering 231 and 232 or consent of instructor.
3 units, Win (Staff)

358B. Quantum Electronics Laboratory II—
Combined lecture and laboratory course emphasizing laser interaction with matter. The lasers are considered as a source for optical experiments which include laser modulators, propagation in anisotropic crystals, harmonic generation, Raman, Brillouin and parametric scattering and acousto-optic interactions. Optical pumping atomic and molecular spectroscopy experiments using tumble dye and parametric sources are also possible. Limited enrollment. Prerequisites: 358A or Electrical Engineering 231 and 232, or consent of instructor.
3 units, Spr (Staff) given 1986-87

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 1985-86

ART

Emeriti: (Professor) Michael Sullivan (Chinese Art), (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: Wanda M. Corn
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), Matthew S. Kahn (Design), Suzanne Lewis (Medieval Art), Frank Lobdell (Painting, on leave Autumn), Dwight C. Miller (Baroque art, on leave Winter), Nathan Oliveira (Painting/Printmaking)
Associate Professors: Wanda M. Corn (American Art), Richard Randell (Sculpture), Paul V. Turner (Architectural History, on leave 1985-86)
Assistant Professors: Kristina Branch (Painting/Drawing); John-David P. LaPlante (Indian art), Greg Lynch (Design), Jody Maxmin (Ancient art), Melinda Takeuchi (Japanese art)
Senior Lecturer: Laura Volkerding (Photography)
Lecturer: Joel Leivick (Photography)
Affiliated Professor: John H. Merryman (Art and Law)

OFFERINGS AND FACILITIES

The department offers courses of study in three areas: (1) in the history of art; (2) in the practice of drawing, painting, sculpture, design, printmaking, and photography; and (3) in art education. The undergraduate program of the department is designed to introduce students to the humanistic study of the visual arts. The courses are intended to increase the students’ understanding of the meaning and purpose of the arts, of their historical development, their role in society, and their relationship to such other humanistic disciplines as literature, music, and philosophy. The work in classroom and studio is designed to intensify the students’ visual perception of the formal and expressive means of art and to encourage insight into a variety of technical processes. The collections of the Stanford Museum and the exhibitions program of the Stanford Gallery supplement the regular academic program of the department.
Undergraduates may major in Art History or the Practice of Art (Studio). A freshman or sophomore intending to major in one of these areas should consult with an adviser appointed by the department in order to plan his or her course of study.

Graduate programs are offered in Art History, Studio (including Product Design), and Art Education.

All graduate students are required, whether they are receiving financial aid or not, to take an active part in the practical work of the department/museum as part of their requirements for the degree. This work, which may include classroom duties as course assistants, is to be determined in consultation with their advisers.

During the first two years of their resident graduate work at Stanford, students are required to live in the immediate proximity of the University. Exceptions may be granted only on the basis of a petition formally submitted to the chairman of the department.

**HISTORY OF ART**

**BACHELOR OF ARTS**

The major program in the history of art must include the following:

1. 8 units from the following: Art 1, Art 2, Art 3, Art 5 and Art 10.

2. 40 units in art history courses above the 100 level, including one seminar or colloquium. To insure that majors have a broad foundation in art history, they are required to take the 40 units in art history above the 100 level in at least four of the six following areas: oriental, ancient, medieval, renaissance, baroque and modern. This distribution still permits the student to take several courses in an area of particular interest.

3. Total units: 48. 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. Recommended Courses (but which do not count toward the major): Art 40, 51 or 52 or 53 and 70.

**MASTER OF ARTS**

The Department of Art offers the Master of Arts and the Doctor of Philosophy degrees. The Master of Arts degree is normally granted as a step toward eventual fulfillment of requirements for the Doctor of Philosophy. The department does not admit students who wish to work only toward the Master of Arts degree.

The University's basic requirements for the master's degree are set forth in the "Degrees" section in this bulletin. The following are departmental requirements:

**Admission to Candidacy**—Completion of the University's requirements for a Bachelor of Arts degree in the history of art, or an approximately equivalent training, is required of students entering a program of study for the Master of Arts. After acceptance and before beginning the program, students shall take a preliminary counseling test to determine the degree of the students' previous preparation. The students will be required to remedy deficiencies indicated by this test.

**Recommendation for the Degree**—To be recommended to the University Committee on Graduate Studies for the degree of Master of Arts in the history of art, the student must have satisfied the following requirements:

1. Completion of a minimum of three full quarters of graduate work in residence or its equivalent at this University.

2. Completion of a total of at least 36 units of graduate work in the history of art in courses at the 200 level. Students will also be required to take a seminar in art historiography and methods of research.

3. Reading knowledge of two foreign languages, preferably German and French or Italian. Students of oriental art will be required to demonstrate competence in one oriental language (equivalent to three years of study) and reading knowledge of a second.

4. Submission of two from among the term papers written during the year, for consideration by the faculty.

5. Demonstration to the faculty, by 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. Immediately upon acceptance into the doctoral program, the student shall form a reading committee of at least four art historians which will take responsibility for advising and evaluating the student. The principal thesis advisor will be the committee chairman. The committee will decide whether or not the student will take examinations to test competence in the major field, and will select the type of examination if one is required.

Residence—In order to be eligible for the doctoral degree, the student must have completed three years of full-time graduate work in the history of art and must have spent at least one of them in residence at Stanford.

Collateral Studies—The student should be prepared to take 15 units in one or, at most, two supporting fields of study (such as history, literature, classics, anthropology, or philosophy), determined in consultation with the departmental advisors. 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).

Dissertation—A senior member of the department will act as the student's dissertation adviser and as chairman of her 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 Art 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 advisor 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 advisor and an approved curriculum. A student wishing to have more than 13 units applied toward the major must submit a petition to his advisor and then have his or her work reviewed by a studio committee.

MASTER OF FINE ARTS

Programs for the Master of Fine Arts degree are offered in the areas of painting, printmaking, sculpture, photography and product or graphic design.

Graduate Program in Painting, Sculpture, Printmaking, and Photography—Provides an environment sympathetic to the needs of advanced students who are ready to involve themselves fully in these areas. Participants are chosen for the program on the basis of work which shows artistic individuality, motivated by the students’ own goals and principles, and which indicates an ability to work without further need of close faculty supervision.

The Graduate Program in Design—Focuses on mature study in an area of design largely defined by the student’s own interest. Master’s projects have involved urban design, transportation, recreation, film animation, housing, seating, medical and therapeutic facilities, musical instruments, informational systems, and a great many other areas. The graduate program is structured to balance independent concentration with rich utilization of the University and the community, and personal interaction with the students and faculty of the Graduate Design Program.

Working jointly, the Departments of Art and Mechanical Engineering offer graduate degrees in the fields of product and visual design. A large new physical environment, the Design Yard, provides professional caliber studio space for each graduate student and well-equipped shops. Flexible programs may include graduate courses in fields ranging from graphic design to engineering design, typography to biotechnology, marketing to micro-computers. The program centers on a master’s project and may also include work in advanced art and design. Cross-disciplinary interaction is encouraged by a four-person graduate design faculty.

A Master of Arts degree in Design is offered to qualified students who prefer to participate in the graduate program for only one year.

Admission to candidacy for the degree of Master of Fine Arts is based on:
1. The equivalent of a Bachelor of Arts degree in art at this University.
2. A letter grade average of “B-” in at least 65 units of undergraduate work in art.
3. Formal admission to candidacy granted by the University Committee on Graduate Studies.
4. Portfolio Specifications
   a) Painting and Sculpture: six or more slides of painting or sculpture and six or more slides of drawings. 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.

Slides should be sent in the standard cardboard container received from processing (not in plastic sheets), and should be labeled with applicant’s name; size, date and medium of work; with the top of the work indicated. A stamped self-addressed container should be included for the return of portfolios. Candidates
for admission in painting and sculpture must send their slides in a Kodak Universal Carousel ready for viewing. Return postage should be included with the carousel.

5. Applications and portfolios for the studio program must be submitted by January 1. They will be reviewed in February. Students accepted are admitted for the beginning of the following Autumn Quarter. No applicants for mid-year entrance will be considered.

The requirements for the degree of Master of Fine Arts in painting, sculpture, printmaking and photography are:

1. Completion of a minimum of two years (six full quarters) of graduate work in residence or its equivalent at this University.
2. First year graduate students are required to complete nine units for the seminar, nine units of individual study with the faculty, and eighteen units of work in their chosen field. After successfully completing the first year of study, students enter their second year on terminal graduate registration and continue to participate in the seminars and study with the faculty.
3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.

The requirements for the degree of Master of Fine Arts in design are:

1. Completion of a minimum to two years (six full quarters) of graduate work in residence or its equivalent at this University.
2. First year graduate students are required to complete 54 units of coursework chosen in consultation with an advisor. At least 18 of the 54 units must be in Art 360A, B, C and Mechanical Engineering 211A, B, C.
3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.

The studio faculty reserves the right to make use of graduate painting, sculpture, lithographs and photographs in exhibitions serving the interests of the Graduate Program.

ART EDUCATION
MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered by this department and the School of Education for teachers who wish further to strengthen their academic preparation. The candidate must have a teaching credential 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 IN HISTORY OF ART
BASIC COURSES

1. Introduction to Art—A topical introduction to the history and appreciation of architecture, sculpture, and painting. (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 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 1985-86
4. Theme and Style in Japanese Art—Designed as a broad overview of Japanese artistic traditions, this course selects from the great masterpieces of Japanese art from pre-history.
the present and examines them in terms of the interplay between Japanese and Chinese cultural traditions. Material includes temples, castles, teahouses, painting, sculpture, garden design and ceramics. Undergraduate lecture; no prerequisites.

4 units (Takeuchi) not given 1985-86

5. Introduction to Ancient and Medieval Art—The formation of the Classical tradition in Ancient Greece and Rome and its transformations in the Middle Ages. (DR:2)
4 units, Win (Maxmin)

10. Introduction to Art, Renaissance to Modern: Important Events, Issues and Personalities in European Art—Main currents in the history of Western art from the Renaissance to the present. (DR:2)
4 units, Spr (Miller)

The emphasis in 20, 21 and 22 is upon the international relationships between the various kingdoms and empires of Asia. The dynamic interchange of ideas and styles begetting in turn reactions or modifications will indicate the rich inter-cultural nature of Asian Art.

There are no prerequisites for these courses. Although there is naturally an advantage to taking them in sequence, it is not required.

20. Introduction to the Art of Asia (to 600 A.D.)—India, China and Japan from the beginnings of civilization through the 6th century A.D. (DR:2*)
4 units, Aut (LaPlante)

21. Introduction to the Art of Asia (7th Century-13th Century)—The art of India, South East Asia, China and Japan from the 7th century A.D. to the Mongol invasion in the 13th century. (DR:2*)
4 units, Win (LaPlante)

22. Introduction to the Art of Asia (14th Century to the Present)—Moghuls, Mongols and Shoguns; the art of Asia from the 14th century onward. (DR:2*)
4 units, Spr (LaPlante)

65. Medieval Culture and Society—(Same as Medieval Studies 65.) (DR:2)
5 units, Win (Ferruolo, Lewis)

INTERMEDIATE COURSES

100A. Ancient Art I—Archaic and early Classical Greek Art. A selective survey of the art and architecture of Greece from Protogeometric beginnings to the height of the Early Classical period. (DR:2)
4 units, Aut (Maxmin)

100B. Ancient Art II—Classical, 4th Century and Hellenistic Art, with special emphasis given to the formation, in the 5th century, of the classical ideal, and to its development in the centuries that followed. (DR:2)
4 units, Spr (Maxmin)

100C. Ancient Art III—Roman art. A survey of the art of Rome, from the Etruscans to the Late Empire. (DR:2)
4 units, Spr (Maxmin) not given 1985-86

100D. Ancient Art IV—The art of archaic Athens, with emphasis upon the development of sculpture, vase painting and architecture in the 6th century B.C.
4 units (Maxmin) not given 1985-86

102. Ancient Art V: Greek Vase Painting—(Same as Classics 120.) An introduction to the study of Greek vases and their painters, with special attention given to the masters of Athenian black and red-figure.
4 units, Aut (Maxmin)

103. Byzantine Art and Architecture—From the founding of Constantinople (330) to the Turkish Conquest (1452), centered on patterns of imperial patronage.
4 units, Win (Lewis)

104. Early Medieval Art and Architecture—Development of formal and iconographical traditions under the patronage of major church and state institutions in Western Europe from the 4th through the 11th centuries.
4 unit (Lewis) not given 1985-86

105. Art and Architecture in Medieval France—From the First Crusade (1095) in major monastic centers, through the formation and flowering of Gothic art at Chartres, Paris, Amiens and Reims, up to the reign of Charles V (1375). (DR:2)
5 units, Aut (Lewis) given 1986-87

105A. Art and Architecture in Medieval Britain—From the Early Saxon and Celtic period through Gothic in the 13th-15th century. (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) given 1986-87

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, Spr (Lewis)

109. Medieval Russian Art and Architecture—(Same as Slavic Languages 143.) Emergence of a Muscovite Russian "national" style based on Byzantine and Kievan Rus cultures, European
and Oriental influences, native traditions and regional schools, 11th-17th centuries.

4 units, Win (J. Kollmann)

110A. Renaissance Art I. (DR:2)
4 units, Aut

110B. Renaissance Art II. (DR:2)
4 units, not given 1985-86

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 1985-86

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 (Miller) not given 1985-86

116A. Masterpieces and Monuments of the Baroque Age. (DR:2)
4 units (Miller) not given 1985-86

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, Win (Eitner)

120B. Modern Art II—Romanticism and Naturalism—Main currents in European art in the time of the Napoleonic Wars, the Restoration, and the era of middle class dominance. The later works of David, Goya, and Blake; the German romantics; Ingres, Gericault, Delacroix, and the landscape art of Turner, Constable. (DR:2)
4 units, Aut (Eitner) given 1986-87

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, Aut (Eitner)

120D. Modern Art IV—Alternatives to Impressionism—European art 1880-1900, Cezanne, Van Gogh, Seurat, Gauguin, Symbolism, Lautrec, Ensor, Munch. (DR:2)
4 units, Win (Elsen) given 1987-88

121A. Modern Art V—Twentieth Century Painting I, 1900-1920—Fauvism, Matisse, German and Austrian Expressionism, Picasso, and Cubism, Orphism, Futurism, and Abstraction.
4 units, Spr (Elsen) given 1987-88

4 units, Aut (Elsen) given 1988-89

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, Spr (Elsen) given 1986-87

123A. The First Fifty Years of Modern European Sculpture—Covers the period from the late 19th century to the end of the Second World War and includes the work of Rodin, Degas, Matisse, Maillol, Brancusi, Duchamp-Villon Picasso, Boccioni, Lipchitz, Arp, Giacometti, Gonzalez and Henry Moore.
4 units, Aut (Elsen)

Art 123B. Modern Sculpture in Europe and America, 1945-1970—A survey and analysis of the major achievements by the principal sculptors in this period: Picasso, Moore, Giacometti, Miro, Caro, David Smith, Calder, Naguchi, Segal, Oldenburg, Christo.
4 units (Elsen) not given 1985-86

124. Picasso—This course will be given either as a colloquium or lecture course depending upon enrollment.
4 units, Win (Elsen) given 1986-87

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 1985-86

125B. The Art of India.
4 units, Win (LaPlante) given 1986-87

125C. The Art and Architecture of Moghul India.
4 units (LaPlante) not given 1985-86
126A. Introduction to Chinese Art. (DR:2*)
4 units, not given 1985-86

126B. Introduction to Chinese Painting.
4 units, not given 1985-86

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 1985-86

128A. Ritual Bronzes of Ancient China.
4 units, (LaPlante) 1985-86

128B. Chinese Ceramics.
4 units (LaPlante) not given 1985-86

128C. Buddhist Art in Asia.
4 units (LaPlante) not given 1985-86

4 units (LaPlante) not given 1985-86

128E. Japanese Ceramics.
4 units, Win (LaPlante) given 1987-88

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. No prerequisites.
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. No prerequisites.
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. No prerequisites.
4 units (Takeuchi) not given 1985-86

129G. 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 1985-86

130. American Art and Culture, 1670-1860—The development of portraiture and history painting in the colonies and of landscape and genre painting in the new nation. Considers the difficulties of establishing artistic communities and patronage in a new society, on the exchange and interaction with Europe, and on the search for a uniquely American expression. Focuses on Copley, Peale, West, Trumbull, Stuart, Mount, Bingham and the Hudson River School. (DR:2)
4 units, Win (W. Corn) given 1986-87

130A. American Art and Culture in the Gilded Age—(Same as American Studies 130X.) A broad, interdisciplinary study of the art, literature, taste and cultural institutions of the late 19th century. Covering such themes as aestheticism, conspicuous consumption, the grand tour, and the expatriate experience, the course will also look at the period’s great artists, collectors and tastemakers and the symbolic importance of world fairs and expositions. (DR:2)
5 units, Spr (W. Corn) given 1986-87

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 circles around Gertrude Stein, Alfred Stieglitz and Walter Arensberg, as well as movements such as Cubism, Expressionism and Dada. (DR:2)
4 units, Win (W. Corn)

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, Win (W. Corn) not given 1985-86

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, Spr (W. Corn)

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 1985-86

174. Baroque Architecture—A survey of European architecture in the 17th and 18th centuries. The transformation of Classical forms by architects such as Bernini and Borromini in Italy, Mansart in France and Wren in England. The creation of the Rococo in French and German architecture and interior design. Baroque

4 units (Turner) not given 1985-86

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 1985-86

ADVANCED UNDERGRADUATE AND GRADUATE COURSES


4 units, Aut, Win, Spr (Maxmin)

201. Colloquium: The Development of Attic Black-Figure Painting.

4 units, Spr (Maxmin)

202. Studies on Greek Vase Painting.

4 units, Aut (Maxmin)

203. Studies on Byzantine Art and Architecture.

4 units, Win (Lewis)

204. Studies on Early Medieval Art and Architecture.

4 units (Lewis) not given 1985-86

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, Aut (Lewis)

205. Studies on Art and Architecture in Medieval France.

5 units, Aut (Lewis) given 1986-87

205A. Studies on Art and Architecture in Medieval Britain.

5 units, Aut (Lewis)

206. Seminar on the Apocalypse in Medieval Art.

4 units, Aut (Lewis)

206A. Colloquium on the Romance of the Rose: Text and Image—(Same as French 218 and Medieval Studies 165.) 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 1985-86

206B. Colloquium on Chartres Cathedral

4 units (Lewis) not given 1985-86

207. Studies on Medieval Architecture.

5 units, Spr (Lewis) given 1986-87

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 1985-86

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 1985-86

216A. Studies on Great Masterpieces and Monuments of the Baroque Age.

4 units (Miller) not given 1985-86

217. Connoisseurship in 17th Century Italian Drawings.

4 units (Miller) not given 1985-86

218. Colloquium on Art in 18th Century European Culture—A study of some of the principal artifacts of 18th century artistic culture: the Garden, the Palace, 18th century collecting, practical aesthetics and fashions of taste.

4 units (Miller) not given 1985-86

219. Colloquium on Political Ideology in 17th Century European Art in Court and Church—Monarchical eulogy and related political allegory; the art of religious propaganda of the age of the Counter-Reformation.

4 units, Spr (Miller)

219A. Colloquium on Caravaggio and the Artistic Culture of the Caravagisti.

4 units (Miller) not given 1985-86
219B. Colloquium on the History of Printmaking.
4 units (Miller) not given 1985-86

219C. Colloquium: The 17th Century School of Bologna.
4 units, Aut (Miller)

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) given 1987-88

221B. Studies on 20th Century Painting From 1920-1960.
4 units, Aut (Elsen) given 1988-89

223. Seminar on Late 19th Century Art: Rodin.
4 units, Aut (Elsen)

223A. Studies on the First 50 Years of Modern European Sculpture
4 units, Aut (Elsen)

4 units (Elsen) not given 1985-86

4 units (Elsen) not given 1985-86

223D. Colloquium: Modern Sculpture in Europe and America.
4 units (Elsen) not given 1985-86

224. Picasso.
4 units, Spr (Elsen) given 1986-87

225A. Studies on Indian Painting.
4 units (LaPlante) not given 1985-86

225B. Studies on the Art of India.
4 units, Win (LaPlante) given 1986-87

225C. Studies on the Art and Architecture of Moghul India.
4 units (LaPlante) not given 1985-86

226A. Studies on Chinese Art.
4 units, not given 1985-86

226B. Studies on Chinese Painting.
4 units, not given 1985-86

226E. Studies on Meeting of Eastern and Western Art.
4 units, not given 1985-86

227A,B. Seminar on Chinese Art.
4 units, not given 1985-86

227C. Seminar on Far Eastern Art.
4 units

228A. Studies on Ritual Bronzes of Ancient China.
4 units, Win (LaPlante)
epoch of Japanese painting. Undergraduate colloquium; no prerequisites.
4 units, Aut (Takeuchi)

230. Studies on American Art Before the Civil War, 1670-1860.
4 units, Win (W. Corn) given 1986-87

230A. Studies on American Art in the Gilded Age, 1860-1900.
4 units, Spr (W. Corn) given 1986-87

4 units, Win (W. Corn)

230C. Studies on American Art in the 1930s.
4 units (W. Corn) not given 1985-86

230D. Studies on American Art After World War II.
4 units, Spr (W. Corn)

230E. Studies on the Poet and the Artist in American Modernism.
4 units (W. Corn, A. Gelpi)
not given 1985-86

231A. Undergraduate Seminar: Photographs as Historical Documents—(Same as American Studies 220.)
5 units, Spr (J. Corn, W. Corn)

231B. 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, Win (W. Corn)

233. Colloquium on the History of Photography—Readings on the history and criticism of photography combined with a close study of works in Bay Area collections. Enrollment limited.
4 units, Aut (W. Corn)

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.
5 units, Win (Lewis) given 1986-87

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 of senior undergraduate-majors who plan to continue in art history on the graduate level may enroll with the consent of the instructor.
4 units, Aut (Ross)

4 units (Elsen) not given 1985-86

238A,B. Art and the Law—Selected problems at the intersection of law and the visual arts (painting, sculpture, and graphic art) including: the protection of national art treasures and the international traffic in them; art forgery and its control; the artist’s “droit de suite” and “droit moral” and attempts to establish their equivalent in this country; legal relations between artists, dealers, museums, collectors, and auction houses; consumer protection and counterfeit art; etc. 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, Win (Elsen) given 1986-87

any quarter (Staff) by arrangement

274. Studies on Baroque Architecture.
4 units (Turner) not given 1985-86

275A,B. Studies in Modern Architecture I, II.
4 units, Win, Spr (Turner)

4 units (Turner) not given 1985-86

277. Seminar on Modern Architecture: Le Corbusier—(Prior consent of instructor required.)
4 units (Turner) not given 1985-86

278. Seminar on American Architecture: The Design of the American College Campus—(Prior consent of instructor required.)
4 units (Turner) not given 1985-86

279. Seminar on Frank Lloyd Wright—(Prior consent of instructor required.)
4 units (Turner) not given 1985-86

280. Seminar on 20th Century Urbanism—(Same as Urban Studies 189.)
4 units, Win (Stout, Staff)

295. Teaching and Professional Work Experience. (Given for TAs in Art 1.)
4 units, Aut (Elsen)
any quarter (Staff) by arrangement

any quarter (Staff) by arrangement

RELATED COURSES
Topography and Monuments of Greece — (See Classics 108.)
City of Athens — (See Classics 109.)
Classical Athletics — (See Classics 14.)

COURSES IN PRACTICE OF ART (STUDIO)

All courses listed below in practice of art (studio) will be offered in 1985-86.
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 (Kirby, Ruiz)
15. Special Seminar in Printmaking.  
3 units, not given 1985-86
3 units, not given 1985-86
17. Special Seminar in Photography.  
3 units, Aut (Tyson)

BASIC COURSES
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. Basic Photography—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 COURSES
140. Drawing I — Fundamentals of composition in black and white. Emphasis on the visual aspects of specific objects drawn separately and in a still-life context using charcoal. This course is recommended as the beginning drawing class for studio art majors. No prerequisites.  
3 units, Aut, Win, Spr (Staff)
141. Drawing II — Intermediate/advanced drawing and composition. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.  
3 units, Aut, Win, Spr (Staff)
142. Drawing III — Advanced drawing. Emphasis on student initiative in respect to composition, color, and use of a variety of drawing materials. Work from imagination, still life, and model. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.  
3 or more units, Aut, Win, 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 the following: 40, 51 or 52 or 53, 60 or 70.

3 units, Win, Spr (Randall)

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, Aut (Kahn)

168A. Introduction to Urban Design—(Same as Urban Studies 160A.) 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 (Gast) T 2-4 and 7-9 plus two Sat workshops to be arranged

168B. Urban Design Studio—(Same as Urban Studies 160B.) 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. Prerequisites: None required, but Urban Studies 160 is advised. Enrollment limited to 14 students.

5 units, Spr (Cast) T 2-4 and 7-9 plus two Sat workshops to be arranged

170. Intermediate Photography — Students will individually pursue a topic of their own definition. Class sessions will meet for individual and group critiques, lab demonstration and discussions, some led by students.

3 units, Aut, Win, Spr (Volkerding)

172. Non-Silver Processes—This course is concerned primarily with technical procedures and will investigate the uses of primitive and hand-made 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 (Leivick)

173. Photography Abroad — Students may register for 1, 2 or 3 units of photography while enrolled in an overseas program. Additional units may be taken for lab work upon return to Stanford campus. Consent of instructor required prior to going overseas.

Aut, Win, Spr (Leivick, Volkerding)

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

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)

249. Individual Work: Lithography. Consent of the instructor required. Prerequisite: beginning lithography.  
any quarter (Oliveira) by arrangement

any quarter (Randell) by arrangement

250. Individual Work: Design.  
any quarter (Kahn, Lynch) by arrangement

261. Advanced Design I—Advanced Graphic Design—Design experiences in a wide range of media for communication utilizing a combination of typographic material and images. 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)

270. Advanced Photography.  
Aut, Win, Spr (Volkerding) by arrangement

271. Directed Advanced Photography: The View Camera, Its Uses and Techniques—This course is 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 semiotic issues will be discussed. Course work will consist primarily of visual exercises. No prerequisites.  
3 units, Aut (Bigelow)

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 COURSES

Philosophy of Design—(See Mechanical Engineering 214.)

Visual Thinking—(See Mechanical Engineering 101.)

Human Values in Design—(See Mechanical Engineering 115A.)

COURSES IN 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, Spr (Eisner)

CHINESE-JAPANESE LANGUAGE AND AREA STUDIES FACULTY

Emeriti: (Professors) S. Wing Chan, Frederic Spiegelberg

Acting Chairman: David S. Nivison

Professors: Albert E. Dien, James J. Y. Liu (on leave Autumn), David S. Nivison, Makoto Ueda, John C. Y. Wang (on leave Winter and Spring)

Associate Professors: Kung-yi Kao, Ian Levy (on leave Spring), William A. Lyell, Susan K. Matsisoff (on leave Autumn)

Assistant Professor: Thomas W. Hare

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Kinie Nishimura Nebrig, Hiroshi Sakamoto, Dorothy Shou

Professors: Masahiko Aoki (Economics), Harumi Befu (Anthropology), Albert E. Dien
(Asian Languages), Peter Duus (History), John C. Curley (Economics, on leave Autumn), Lawrence Lau (Economics), John W. Lewis (Political Science), James J. Y. Liu (Asian Languages, on leave Autumn), Jeffrey Mass (History), David S. Nivison (Asian Languages, Philosophy, and Religious Studies), G. William Skinner (Anthropology), Makoto Ueda (Asian Languages), Lyman P. Van Slyke (History, on leave 1985-86), John C. Y. Wang (Asian Languages, on leave Winter and Spring), Robert E. Ward (Political Science), Arthur P. Wolf (Anthropology, on leave 1985-86)

Associate Professors: Harold L. Kahn (History), Kung-yi Kao (Asian Languages), Ian Levy (Asian Languages, on leave Spring), William A. Lyell (Asian Languages), Susan K. Matirossoff (Asian Languages, on leave Autumn), Daniel I. Okimoto (Political Science), Lee H. Yearley (Religious Studies)

Assistant Professors: Carl W. Bielefeldt (Religious Studies, on leave 1985-86), Thomas W. Hare (Asian Languages), John D. LaPlante (Art), William J. Poser (Linguistics, on leave Spring), Terry Sicular (Food Research Institute), Melinda Takeuchi (Art)

Acting Assistant Professor: Harvey B. Aronson (Religious Studies)

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Kimie Nishimura Nebrig, Hiroshi Sakamoto and Dorothy Shou (Asian Languages)

Lecturer: Anne Klein (Religious Studies)

Mellon Fellow: Prasenjit Duara (History)

OFFERINGS

The Department of Asian Languages offers courses in the languages, cultures, and literatures of China and Japan. The department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy in Chinese or Japanese. It also gives a minor in Chinese or Japanese language and literature for the degree of Doctor of Philosophy.

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: AL 91, Cl13, AL131, 132, 133, and four other content courses dealing with China at the 100 level, as approved by the Undergraduate Advisor.

2. Concentration in Japanese: AL 92, J103, AL136, 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 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.

MASTER OF ARTS: CHINESE

The candidate must:

1. Meet the department’s requirements for the Bachelor of Arts in Chinese or their equivalent.

2. Complete the following course work: 103, 201, 202, 223, 299; four courses in Chinese numbered between 241 and 299; 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.

MASTER OF ARTS: JAPANESE

The candidate must:

1. Meet the department’s requirements for the Bachelor of Arts in Japanese or their equivalent.

2. Complete the following course work: 201, 202, 213, 248, 299; four courses in Japanese numbered between 255 and 298; and two courses in such fields as Japanese anthropology, art, history, politics, and religion, as approved by the Graduate Advisor in consultation with the student’s individual advisor. Students may be exempted from 211, 212, 213 and 246, 247, 248 by passing examinations to demonstrate that they have attained equivalent language competence. Letter grades are mandatory for all required courses.

DOCTOR OF PHILOSOPHY

The Doctor of Philosophy degree is granted in Chinese and in Japanese. Candidates for the degree are expected to acquire a thorough familiarity with Chinese or Japanese literature, an adequate command of both languages, and a comprehensive knowledge of East Asian history, social institutions, and thought. The University’s basic requirements for the doctorate are given in the “Degrees” section in this bulletin. Departmental requirements are set forth below.

Admission to Candidacy—Students admitted with A.B. only will be evaluated by the graduate faculty during the Autumn Quarter of their second year at Stanford. The evaluation will be based on written work and at least a portion of the A.M. thesis or translation. If the faculty has serious doubts about a student’s ability to work for the Ph.D., this will be conveyed to the student. During the subsequent Spring Quarter, the faculty will formally decide whether a student should be admitted to candidacy for the Ph.D. or be terminated. In the case of a student who already has an A.M. in Chinese or Japanese when admitted to the department, the evaluation will take place in the Spring Quarter of the student’s first year. If a student goes to the Taipei or Tokyo Center during his or her first two years, the department will consider requesting the Dean of Graduate Studies for approval of an exception to the rule that qualification procedure must take place during the student’s first two years. The timing of the evaluation of a student admitted with an A.M. in Asian Studies will be decided on an individual basis.

Admission to candidacy does not mean that the student has fulfilled all requirements for the degree except the dissertation, but that the departmental faculty considers the student qualified to pursue a program of study leading to the Ph.D. and that, subject to continued satisfactory progress, the student’s status in this department is secure.

A candidate must fulfill the following requirements for the Ph.D.

1. He or she must demonstrate a reading knowledge of French, German, or another European language approved by the Graduate Advisor before completing the A.M. degree.

2. He or she must complete two seminars at the 300 level. These seminars must be in different subjects.
3. He or she must pass an examination in the supporting Asian language. A candidate whose field is Chinese will be examined on his or her ability to read modern Japanese works relevant to his or her field of study. This requirement may be met by completing Japanese 103. A candidate whose field is Japanese will be examined on ability to read classical Chinese works relevant to his or her field of study. This requirement may be met either by completing Chinese 113 or by taking Japanese 250 and subsequently passing a test on the prescribed reading list in Kambun.

4. He or she must pass a set of four comprehensive written examinations. One of these will test the candidate's methodological competence in a discipline. The remaining three fields are to be chosen, with the approval of the Graduate Advisor in consultation with the student's individual advisor, from the following: Chinese literature, Chinese history, Chinese philosophy, Chinese linguistics, Chinese 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.

Minor for the Degree of Doctor of Philosophy—A student taking a minor in Asian languages shall complete at least 30 units of work within the department to be chosen in consultation with a departmental advisor. He or she must elect either Chinese 201-202 or Japanese 201-202 unless the department is satisfied that work done elsewhere has provided similar training. He or she must also pass a written examination in the Chinese or Japanese language.

Special Programs for the Degree of Doctor of Philosophy—Properly qualified students may plan special interdepartmental programs in the Asian field for the degree of Doctor of Philosophy. See the section "Graduate Division Special Programs" in this bulletin.

SPECIAL OPPORTUNITIES FOR STUDY ABROAD

Attention is called to the programs of the Inter-University Program for Chinese Language Study in Taipei and the Inter-University Center for Japanese Studies in Tokyo (both of which are administered by Stanford University). They are described elsewhere in this bulletin.

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 and 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 (Nivison) MTWTh 10
Section 1 MWF 10; Section 2 MWF 1:15

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. Traditional East Asian Civilization: Japan — An introduction to traditional Japanese culture emphasizing the relation between intellectual currents and the arts from the 8th through 18th centuries. (DR:2*)

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, Win (Ueda) TTh 1:15
114. **Haiku**—Reading and discussion of representative Japanese haiku from the 16th 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*)
4 units, Aut (Ueda) M 2:15-4:05

125. **Japanese Culture Through Novels and Films**—(Same as Anthropology 125.) Explorations of Japanese social structure (family, socialization, community, work, etc.) and cultural values through novels (in translation) by leading writers (Mishima, Natsume, Tanizaki, etc.) and feature length films by well known directors (Kurosawa, Ozu, etc.). The course will focus on the individual in the social and cultural setting of modern, changing Japan.
5 units, Spr (Befu) given 1986-87

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. (DR:2*)
4 units, Win (Staff) TTh 11

133. **Modern Chinese Literature in Translation**—Readings in representative twentieth-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'yoshū* 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 fourteenth to nineteenth centuries. Works read in translation will include masterpieces stemming from the courtly, the samurai and the urban-commoner traditions of Japan. AL136 is not a prerequisite. (DR:2*)
4 units, Win (Matisoff) TTh 12:50-2:05

138. **Modern Japanese Literature in Translation**—An introductory course in Japanese poetry, drama, and fiction since 1868. Authors considered will include Tanizaki, Kawabata, Mishima, and many others. Knowledge of pre-modern Japanese literature not required. (DR:2*)
4 units, Spr (Ueda) MWF 1:15

144. **Confucianism Since Wang Yang-ming**—(Same as Philosophy 124 and Religious Studies 254.) History of Confucian moral philosophy in China and Japan since the death of Wang Yang-ming in 1529.
4 units, Spr (Nivison) given 1986-87

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) given 1986-87

153. **Science, Technology and Material Culture in Traditional China**—(Same as History 193.) A general survey of the technological achievements and scientific undertakings of traditional China and the ideological and social factors which aided or hindered such enterprises.
5 units, Spr (Dien) TTh 2:15-4:05

154 (254). **Undergraduate Colloquium: The Middle Period in Chinese History**—(Same as History 294/394.) This course will deal with the material culture of medieval China as a source of information about central social, political and economic developments of the time. Comparative dimensions are pursued when possible, both within and beyond the bounds of Chinese history. Prerequisite: 91 or History 192A or their equivalents. (Graduate students may register under 254 in which case they will be required to do additional work.)
5 units, Win (Dien) given 1986-87

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) given 1986-87

177 (277). **Classic Japan**—This course will survey the cultural achievements of Heian (794-1185) Japan. *The Tale of Genji*, Japan's greatest work of prose fiction, will provide a central focus of attention, but students will also be introduced 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, in which case they will be required to do additional readings in Japanese.) (DR:2*)

4 units, Win (Hare) given 1986-87

179. Classical Japanese Drama—The development of Japanese drama from early religious ritual forms through nō, puppet theatre and kabuki. Readings will include works in 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 1986-87

181. Japanese Women Writers — This course examines 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 read in translation. (DR:2*)

4 units, Spr (Matisoff) given 1986-87

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 1986-87

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 Ōgai, The Setting Sun by Dazai, After the Banquet by Mishima, The Woman in the Dunes by Abe, and others.

3 units, Aut (Ueda) given 1986-87

254. Graduate Colloquium: The Middle Period in Chinese History — (See 154 and same as History 294/394 with additional work required.)

5 units, Win (Dien) given 1986-87

255A. The Nature of Literature: Japanese and Western Views—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, Win (Ueda) given 1986-87

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 (Liu) given 1986-87

COURSES IN 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 (Shou) TTh 11
28. 2 units, Win (Shou) TTh 11
29. 2 units, Spr (Shou) TTh 11

51. Chinese Calligraphy—Practice in writing Chinese characters with a brush and learning different scripts. Prerequisite: Chinese 3, 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) MW 11-12:15
212. 5 units, Win (Staff) TTh 11-12:15
213. 5 units, Spr (Staff) TTh 11-12:15

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 (Liu) MWF 11

241, 242, 243. Modern Chinese Literature—Introduction through the use of annotated texts to: short story, essay, poem, play, and novel. Prerequisite: 103 or 113.

241. Short Story. (DR:2*)
5 units, Aut (Lyell) given 1986-87

242. Essay. (DR:2*)
5 units, Win (Chuang) MWF 11

243. Novel. (DR:2*)
5 units, Aut (Lyell) MWF 9

260. Chinese Poetry (I)—Selected readings from the Shih-ching and Ch' u-tz'u with emphasis on critical analysis. Prerequisite: 223 or consent of instructor.
4 units, Aut (Liu) given 1986-87

261. Chinese Poetry (II)—Selected readings in Han, Wei, and Six Dynasties poetry (2nd century B.C.-6th century A.D.), with emphasis on critical analysis. Prerequisite: 260 or consent of instructor.
4 units, Win (Liu) given 1986-87

262. Chinese Poetry (III)—Selected readings in T'ang and Sung poetry (7th-13th centuries A.D.) with emphasis on critical analysis. Prerequisite: 261 or consent of instructor.
4 units, Spr (Liu) given 1986-87

263. Lyrics and Songs—Selected readings of lyrics (tz'u) and songs (san-ch'u), T'ang through Ming (8th-16th centuries), with emphasis on critical analysis. Prerequisite: 262 or consent of instructor.
4 units, Win (Liu) MWF 10

265. Chinese Critical Texts—Readings in traditional Chinese literary criticism. Prerequisite: 223 or consent of instructor.
4 units, Win (Liu) MWF 11

271. 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.
4 units, Aut (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, Aut (Wang) given 1986-87

291. The Structure of Modern Chinese—(Same as Linguistics 278.) Prerequisite: 23 or equivalent. Recommended: a general introductory course in linguistics.
4 units, Spr (Kao) by arrangement

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) given 1986-87
299. Master’s Thesis or Translation.
  a total of 5 units, which may be taken in one
or more quarters, Aut, Win, Spr (Staff) by
arrangement

321. Seminar on Archaic Inscriptions—Bone
and Bronze Inscriptions—Shang and Early
Chou—May be repeated for credit.
  5 units, Win (Nivison) Th 2:15-4:05

323. Chinese Philosophy of Language—(Same
as Philosophy 323.) The seminar will focus on
Hansen’s Language and Logic in Ancient China
and Graham’s Later Mohist Logic.
  5 units, Aut (Nivison) given 1986-87

331. Seminar in Confucian Ethics—(Same as
Philosophy 331 and Religious Studies 238.)
  5 units, Aut (Nivison) MW 4:15-5:30

334. Seminar in Modern Chinese Literature
—May be repeated for credit. Prerequisite: 243
or consent of instructor.
  5 units, Win (Lyell) TTh 1:15

351. Seminar in Chinese Traditional Histori-
ography—May be repeated for credit.
  5 units, Spr (Dien) W 2:15-4:05

361. Seminar in Chinese Literary Criticism—
May be repeated for credit. Prerequisite: 265 or
consent of instructor.
  5 units, Spr (Lu) T 2:15-4:05

371. Seminar in Chinese Narrative —
Thorough studies of individual texts with em-
phasis on theoretical applications. May be re-
peated for credit. Prerequisite: 272 or consent
of instructor.
  5 units, Spr (Wang) given 1986-87

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 Lan-
guage Studies in Taipei." The course is offered
on a Pass/No Credit basis.
  15 units per quarter (Staff)

COURSES IN JAPANESE

1. First-Year Modern Japanese—Conversa-
tion, grammar, reading, elementary compo-
sition. Daily sections may be set at the begin-
ing of the quarter to suit schedule requirements.
  1. 5 units, Aut (Sakamoto, Nebrig)
      Section 1 MTWThF 9
      Section 2 MTWThF 10
      Section 3 MTWThF 11
      Section 4 MTWThF 1:15

2. 5 units, Win (Sakamoto, Nebrig)
      Section 1 MTWThF 9
      Section 2 MTWThF 10
      Section 3 MTWThF 11
      Section 4 MTWThF 1:15

3. 5 units, Spr (Sakamoto, Nebrig)
      Section 1 MTWThF 9
      Section 2 MTWThF 10
      Section 3 MTWThF 11
      Section 4 MTWThF 1:15

4. Intensive First-Year Modern Japanese—
Equivalent to 1, 2, and 3 combined.
  12 units, Sum (Staff) MTWThF 8-12

21, 22, 23. Second-Year Modern Japanese —
Further instruction and practice in conversa-
tion, grammar, reading, and composition. Pre-
requisite: 3 or equivalent.
  21. 5 units, Aut (Kubota, Nebrig, Sakamoto)
      MTWThF 9
  22. 5 units, Win (Kubota, Nebrig, Sakamoto)
      MTWThF 9
  23. 5 units, Spr (Kubota, Nebrig, Sakamoto)
      MTWThF 9

25. Intensive Second-Year Modern Japanese
—Equivalent to 21, 22, and 23 combined. Pre-
requisite: 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 1:15
  28. 2 units, Win (Sakamoto) TTh 1:15
  29. 2 units, Spr (Sakamoto) TTh 1:15

ADVANCED

101, 102, 103. Modern Written Japanese —
Reading texts representative of various modern
written styles. Prerequisite: 23 or equivalent.
  101. 5 units, Aut (Kubota) 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

121, 122, 123. Conversation II—Prerequisite: 23
or consent of instructor.
  121. 2 units, Aut (Kubota) TTh 1:15
  122. 2 units, Win (Kubota) TTh 1:15
  123. 2 units, Spr (Kubota) TTh 1:15

199. Individual Reading in Japanese—(Asian
Languages majors only.) Prerequisite: 103 or
consent of instructor.
  4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE

200. Directed Reading in Japanese—Pre-
requisite: 213 or consent of instructor.
  units to be arranged,
  Aut, Win, Spr (Staff) by arrangement

201. 5 units, Win (Matisoff) Th 2:15-4:05
202. 5 units, Spr (Hare) W 2:15-4:05

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 (Ueda) MW 2:15-3:30

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

250. Introduction to Kambun—Selected readings from a variety of Japanese works written in Kambun, ranging from Kaifushō to Yoshida Shōin’s diary. Offered when there is sufficient demand.
4 units, Spr (Ueda) given 1986-87

251. Graduate Seminar: Japanese Historical Texts—(Same as History 498.) Medieval historical sources and research methods. The reading of documents in Kambun will be introduced.
5 units, Spr (Mass) W 2:15-4:05

256. Readings in Japanese Culture—Reading and discussion of articles on the identity of Japanese culture. The articles will be chosen from the works of prominent essayists, social critics, anthropologists, sociologists, and scholars in a wide variety of other fields. Taught in Japanese.
4 units, Aut (Ueda) given 1986-87

277. Classic Japan — (Same as 177 with additional work requiring knowledge of the language.)
4 units, Win (Hare) given 1986-87

4 units, Win (Levy) given 1986-87

284. Postwar Japanese Fiction—Selected readings in the major works of fiction of the postwar period, focusing on the short stories and novels of Abe, Oe and Mishima. Prerequisite: 213 or consent of instructor.
4 units, Win (Levy) M 2:15-4:05

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 1986-87

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 1986-87

295. Modern Intellectuals in Japanese Literature—(Same as 195 with additional work requiring knowledge of the language.)
4 units, Aut (Ueda) given 1986-87

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 1986-87

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

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 1986-87

299. Master’s Thesis or Translation—A total of 5 units, which may be taken in one or more quarters.
Aut, Win, Spr (Staff) by arrangement

396. Seminar in Modern Japanese Literature—Study of selected works by modern novelists. 5 units, Win (Ueda) given 1986-87

399. Dissertation.
(Staff) by arrangement

400. Advanced Language Training—Open only to students at the Tokyo Center. For more information, see the program description under “Inter-University Center for Japanese Studies in Tokyo.” The course is offered on a Pass/No Credit basis.
15 units per quarter, (Staff)
ADDITIONAL INFORMATION

For information concerning other opportunities for study in the Asian field, see listings under the following 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.

ASTRONOMY COURSE PROGRAM

Committee in Charge: (Chairman) Vahe Petrosian, Peter Banks, J. Richard Bond, Ronald N. Bracewell, Von R. Eshleman, John R. Spreiter, Peter A. Sturrock, Robert V. Wagoner, Arthur B.C. Walker, Jr.


Associate Professor: J. Richard Bond (Physics)

Professors (Research): J. Gethyn Timothy, G. Leonard Tyler (Electrical Engineering)

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 often given 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...

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.) This course is intended to familiarize undergraduates, without scientific background with the structure, origin and evolution of our universe. It will describe our growing knowledge of the objects which make up the universe: galaxies, stars, planets, etc. Some enigmas of modern astronomy, such as quasars, X-ray sources, black holes, and pulsars will also be discussed. Presentation will be non-mathematical. No prerequisites. (DR:7) 3 units, Win (Walker)

15B. Cosmic Horizons—(Enroll in Physics 15.) This course proposes to familiarize the non-science student with modern cosmology. After discussing the physical laws that govern the universe, its evolution will be traced from the initial primeval fireball, through the formation of galaxies, stars, and planets to the development of life. Exotic astronomical objects, such as quasars, X-ray sources, black holes, and pulsars will also be discussed. No prerequisites, but some algebra will be used. (DR:7) 3 units, Spr (Susskind)

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)

106. Planetary Exploration—(Enroll in Electrical Engineering 106.) Analysis and description of characteristics of the planets, their satellites, and near space environments, with emphasis on recent work using space probe, radio and radar methods of exploration. Comparative properties of the terrestrial and Jovian planets; planetary atmospheres, surfaces, interiors; rings of Saturn; planetary and satellite orbits and spacecraft trajectories, orbital perturbations; properties of the interplanetary gas, dust, comets, and meteorites. Origin and evolution of planetary systems. Remote sensing from spacecraft at radio, infra-red, light, and ultraviolet wavelengths. U.S. and Soviet space programs and their comparative engineering and scientific aspects. Prerequisites: one year of college engineering, mathematics, or physics. 3 units, Spr (Eshleman)

110. Introduction to Stellar and Galactic Astrophysics—(Enroll in Applied Physics 110.) Physics of the sun. Evolution and death of stars. White dwarfs, novae, planetary nebulae, supernovae, neutron stars, pulsars, binary stars, X-ray stars and black holes. Galactic structure: interstellar medium, molecular clouds, HI and HII regions, star formation and element abundances. Prerequisite: calculus and one year of college physics at the level of the Physics 50 series or equivalent. 3 units, Win (Sturrock)

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. Prerequisite: calculus and one
year of college physics at the level of the Physics 50 series or equivalent.
3 units, Spr (Petrovian)

190A, B, C. Independent Study in Astrophysics and Honors Thesis—Students enrolled in this course will undertake a detailed study of a selected problem in astrophysics with an individual faculty member or with several faculty members. 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—During this quarter the student should select the problem to be studied and develop the theoretical apparatus or initial interpretation of observational data required for the study of the selected problem. Students will be asked to prepare a detailed description of the problem and its background and a comprehensive discussion of the work planned in the subsequent two quarters.
1-9 units, Aut (Staff) by arrangement

190B. Continuation of Project—During this quarter the student should substantially complete the required computations or data analysis for the research project selected.
1-9 units, Win (Staff) by arrangement

190C. Completion of the Project—During this quarter the student should complete the research project and write a detailed paper presenting the methods used and results of the research program.
1-9 units, Spr (Staff) by arrangement

3 units, Spr (Sleep)

222. Classical Gravitation—(Enroll in Physics 222.)
3 units, Spr (Staff)
alternate years, given 1986-87

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)
3 units, Spr (Spreiter)

249. 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, Inan)

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 1986-87

348. Ionospheric Processes—(Enroll in Electrical Engineering 348.)
3 units, Spr (Banks)

350. STAR Laboratory Seminar in Radioscience—(Enroll in Electrical Engineering 350.)
1 unit, Aut, Win, Spr (Vesecky)

352. Electromagnetic Waves in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)
3 units, Spr (Helliwell)
alternate years, given 1986-87

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
3 units, Spr (Tyler)

356. Astrophysics Laboratory—(Enroll in Applied Physics 356.)
3 units, Sum (Walker)
alternate years, given 1986-87

3 units, Spr (Sturrock)

3 units, Win (Petrovian)

3 units, Aut, Win (Sturrock)
alternate years, given 1986-87

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)
3 units, Spr (Petrovian)
alternate years, given 1986-87

368, 369. Gravitation—(Enroll in Physics 368, 369.)
3 units, Spr (Susskind)

380A. Astrophysics Seminar: Topics in High-Energy Astrophysics.
3 units, Win (Sturrock)
alternate years, given 1986-87

392. Magnetospheric Physics—(Enroll in Electrical Engineering 392.)
3 units, Spr (Banks)
ATHLETICS, PHYSICAL EDUCATION, AND RECREATION

Emeriti: (Professor) John E. Nixon, Wesley K. Ruff; (Associate Professors) Luell W. Guthrie, Miriam B. Lidster, Marian S. Ruch; (Director of Intramurals) William P. Fehring; (Athletic Director) Joseph H. Ruetz; (Associate Director) Robert C. Young

Director: Ferdinand A. Geiger
Assistant to the Director: Sue LemMon
Associate Director: Alan A. Cummings
Associate Director Development: John R. Kates
Assistant Director Business and Finance: Nancy Padgett
Assistant Director Operational Services: Greg Asbury
Curriculum Coordinator: Elizabeth P. Weeks
Dance Coordinator: Lisa Codman
Director of Club Sports and Recreation: Shirley H. Schoof
Professor: Pamela L. Strathairn
Sports Directors: Mark Marquess (Baseball, men), Thomas Davis (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), Sara Saxe (Equitation), Edwin Hurst (Fencing), Sheryl Johnson (Field Hockey), Jack Elway (Football), Timothy Schaal (Golf, men), Tim Baldwin (Golf, women), Sadao Hamada (Gymnastics, men), Home Sardina (Gymnastics, women), Joe Petrucci (Sailing), Sam Koch (Soccer, men), Helen Keohane (Soccer, women), Kathleen Lincoln (Softball), Skip Kenney (Swimming, men), George Haines (Swimming, women), Richard Gould (Tennis, men), Frank Brennan (Tennis, women), Frederick Sturm (Volleyball), Dante Dettamanti (Water Polo), Chris Horpel (Wrestling)

Sport Assistant Coaches: Dean Stotz (Baseball), Gary Close, Bruce Pearl, Kermit Washington (Basketball, men), Sherry Posthumus (Fencing), David Baldwin, Tom Beckett, Larry Kerr, Otto Kofler, Dick Mannini, Tony Samuel, James Walsh, Tony Yelovich (Football), Remi Korchemny, David Wollman (Track and Field), Don Shaw (Volleyball)

Senior Lecturers: Susan Cashion, Carroll G. Diaz, Diane Freccero, Mary Margaret Neal, Elizabeth Weeks, Inga Weiss

Lecturers: Lisa Codman, Jancy Limpert, Halifu Osumare, Standley Scott, Gwendolyn Watson, Sharon Williams

Teaching Specialists: Joe Petrucci (Sailing), Shirley H. Schoof (Sports)

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. No other degrees in either dance or physical education are offered. Undergraduate students interested in either dance or physical education are offered. Undergraduate students interested in dance and/or coaching career are encouraged to seek specific information from Professor Strathairn (physical education and sports) or 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 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 performance of the student's own choreography, completion of a teaching internship 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, softball, swimming and diving, tennis, track and field, and volleyball.

Conference affiliations are the Pacific Ten Conference for the men and the Pacific West Athletic Association for the women, two 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 Registration Day to obtain meeting dates and times. Each quarter's printed materials and IM Handbooks are available on or after Registration Day. The Intramural Manager meetings are held the first Wednesday of Registration Week 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 library and 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 Curriculum Coordinator, Elizabeth Weeks, or Professor Strathairn 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, 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 Advanced SCUBA (see course description). Specific information on equipment and recommended class attire is available from the department, from those at Registration tables, and on the first day of class instruction.

Lockers—Lockers are available for students, without charge, from the Equipment Managers at Encina and Roble Gyms. The number of lockers at the Roble Gym requires that students not enrolled in a class wait until the second week of each quarter for locker assignment.

Towels and Swim Caps—Towels may be purchased at the Encina and Roble Gym locker-rooms. Towel laundry and exchange service is available, without charge, for those who purchase towels. Swim caps are required at the Roble Gym pool.
SCHOOL OF HUMANITIES
AND SCIENCES

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 and 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 (Limpert, Freccero)

70. 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)

70A. Ballet Technique II—Beginning-Intermediate level. Continuation of 70, repeating the fundamentals with increased complexity and introducing additional movement vocabulary. Prerequisite: 70 or equivalent.
   1 unit, Aut, Win (Staff)

71. 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)

72. Jazz Dance I—Introduction to jazz dance styles. Emphasis on rhythmic variation, coordination, isolation of body parts and movement combinations.
   1 unit, Aut, Win, Spr (Staff)

72A. Jazz Dance II—Beginning-Intermediate level emphasizing control, rhythmic coordination, and the learning of movement combinations. Prerequisite: 72 or equivalent.
   1 unit, Aut, Win, Spr (Staff)

73. Jazz Dance III—Intermediate jazz technique based on movement material from Africa and the Caribbean. Includes historical information on the Afro-American influence on American jazz dance. Prerequisite: consent of instructor.
   1 unit, Aut, Win, Spr (Osumare)

73A. Jazz Dance IV—Intermediate-Advanced technique emphasizing performance quality. Possible performance opportunities. Prerequisite: consent of instructor.
   1 unit, Spr (Staff)

75. Character Dance—Introduction to the discipline of character dance, a technique which integrates 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 (Codman)

78. 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 (Codman)

78A. 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 (Codman)

79. Conditioning Techniques for Dance—Movement analysis and fitness techniques designed for the particular needs of the dancer. Special attention to breath, alignment, endurance and performance skills, as well as theory and practical applications of selected body therapy techniques. Individualized according to ability and need. No dance training required. (PE:X)
   1 unit, Spr (Freccero) not given 1985-86

157. Introduction to Music for Dancers—Includes rhythm, melody, harmony, phrasing, dynamics and notation. Experiences with voice 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 notation. (PE:X)
   2 units, Win (Freccero)

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, (Weiss)

162. Dance Composition—Development of the craft of choreography, emphasizing concepts of design, form and content. (PE:X)
   2 units, Win (Staff)

   1 unit, Aut (Weiss)

165. Advanced Contemporary Dance II—Manipulation of movement influences and attitudes 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, Spr (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)

179. 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)

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, Aut (Cashion, Freccero)
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 a dance performance. (PE:X)
3 units, Win (Limpert)

364. Graduate Design Project—A three part, individually designed creative project required for completion of the master's degree. (PE:X)
5 units, Aut, Win, Spr (Cushion)

368. Dance Research—Tools and methods for dance research. Seminar sessions focus on selection and development of research topics. Research paper required. (PE:X)
3 units, Spr (Cushion)

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 disciplines of dance or physical education. (PE:X)
3-5 units, Aut, Win, Spr (Strathairn, Cushion) 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 and MW 2:15, TTh 2:15, MW 3:15 or TTh 3:15

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. No prerequisites. (PE:X) (DR:5)
3 units, Win (Raubitschek)

184. Athletic Training—For students intending a teaching/coaching, athletic training, or sports medicine career. Includes the spectrum of prevention, care and rehabilitation of injuries associated with dance and sports activities. 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 disciplines of dance or physical education.
3-5 units, Aut, Win, Spr (Strathairn, Cushion) 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 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 (Williams)

49. Swimming: Intermediate — Continued work on crawl, elementary backstroke, sidestroke, and safety skills. Introduction to or review of breaststroke and back crawl. Basic water safety. Conditioning as ability permits. Prerequisites: fair crawl, elementary backstroke, and sidestroke, fair level of conditioning.
1 unit, Aut, Win, Spr (Weeks, Kenney)
51. Water Polo—Introduction to and refinement of skills used in the sport of water polo.
   1 unit, Aut, Spr (Dettamanti)

52. Lifesaving—Increasing awareness of water hazards and preventing accidents in, on, and around the water. Learning appropriate rescue techniques. American Red Cross Advanced Lifesaving Certificate upon successful completion of the course. Prerequisite: strong 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)

153. Skin and SCUBA Diving—Includes lectures, skill sessions and three field trips. National certification upon successful completion. Fee. Student supplies mask, fins, snorkel, boots, gloves (to be discussed in class). Priority to students accepted for study at Hopkins Marine Station. Prerequisites: Swim test, medical clearance, consent of instructor. (PE:X)
   3 units, Aut, Win, Spr (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 (Weeks, Diaz, Williams)

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 (Staff)
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)

20A. Equitation: Advanced Beginner — Can walk, trot and canter, but not with very secure seat. Involves gymnastic work to develop position and rhythm.

1 unit, Aut, Win, Spr (Saxe)


1 unit, Aut, Win, Spr (Saxe)

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 (Staff)


1 unit, Aut, Win, Spr (Posthumus)


1 unit, Aut, Win, Spr (Hurst)

32. Tennis: Beginning — Covers fundamental strokes (forehand, backhand, service and net play), rules and scoring.

1 unit, Aut, Win, Spr (Gould, Neal, Staff)

33. Tennis: Intermediate — Review of fundamental strokes, introduction to the lob and overhead strokes, and utilization of strategy and tactics in game playing. Prerequisites: knowledge of rules and scoring, average ability in fundamental strokes.

1 unit, Aut, Win, Spr (Neal, Staff)

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)

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)

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)

121. Equitation: (Special Glass) — 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)

122. Golf: Advanced — Focus on understanding of and refining the golf swing as well as increasing power and distance. Fee. Prerequisites: ability to hit the ball with relative accuracy and distance and swing with good form.

1 unit, Aut, Win, Spr (Diaz)

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)

131. Fencing: Advanced — Concentration on practice of attacks. Individual lessons and some competitive experience. Fee. Prerequisite: promoted from 31 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 — 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 (Neal, Brennan, Staff)

132A. Tennis: Tournament—Advanced drills and practice sessions for tournament-experienced players of near varsity level ability. Consent of instructor.
1 unit, Aut, Win (Brennan, Gould)

137W. Field Hockey Officiating.
1 unit, Spr (Johnson) by arrangement

141. Volleyball: Advanced—Refinement of all skills with emphasis on offensive and defensive strategies. Prerequisites: strong skills and general knowledge of game plans.
1 unit, Aut, Win, Spr (Sturm, Shaw)

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 2:15

117V. Track and Field: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Johnson, Staff)
MTWThF 2:15

118V. Cross Country: Varsity (men's and women's teams).
1 unit, Aut (Johnson, Staff) MTWThF 2:15

123V. Golf: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Schaafer, Baldwin)
MTWThF 1 and by arrangement

131V. Fencing: Varsity—Men's foil, epee and saber teams and women's foil team.
1 unit, Aut, Win (Hurst, Posthumus)
MTWThF 3:15 and T 7-10 p.m.
Spr MTh 3:15

ATHLETICS, PHYSICAL EDUCATION AND RECREATION

133V. Tennis: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Gould, Brennan)
MTWThF 2:15

134V. Wrestling: Varsity.
1 unit, Aut, Win, Spr (Horpel)
MTWThF 3:15

135V. Baseball: Varsity.
1 unit, Aut, Win, Spr (Marquess, Stotz)
MTWThF 2:15

136V. Basketball: Varsity.
1 unit, Aut, Win (T. Davis, Staff) men's team
MTWThF 3:30
(vanDerveer, Staff) women's team
MTWThF, Aut 1-3:30 p.m.,
Win 6-8 p.m.

137J. Field Hockey: Junior Varsity — Women's team.
1 unit, Aut (Johnson) MTWThF 3

137V. Field Hockey: Varsity — Women's team.
1 unit, Aut (Johnson) MTWThF 3
Spr MTh 3:15

138V. Football: Varsity.
1 unit, Aut, Spr (Elway, Staff) MTWThF 3:15

140V. Soccer: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Koch, Keohane)

141V. Volleyball: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Sturm) MTWThF

145V. Softball: Varsity (women's team).
1 unit, Aut (Lincoln) MTWThF 3
Win, Spr MTWThF 2

149V. Swimming: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Kenney, Haines)
MTWThF 2:15

150V. Diving: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Schacone)
by arrangement

151V. Water Polo: Varsity.
1 unit, Aut (Dettamanti) MTWThF 2:15,
Win, TF 3, Spr MTWThF 3:15

155V. Sailing: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Petrucci)
TThF 2:15

156V. Crew: Varsity (men's and women's teams).
1 unit, Aut, Win, Spr (Dreyfuss, J. Davis)

152. Athletic Team Management—For student managers of intercollegiate teams. Pre-
requisite: 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

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 MTWThF 11-1.

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

125C. Cycling Club.

1 unit, Aut, Win, Spr

130C. 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, and Women's Water Polo) schedule activities each quarter for no credit.

BIOLOGICAL SCIENCES


Acting Chairman: Robert D. Simoni

Associate Chairman: (to be announced)


Associate Professors: Corey S. Goodman, Patricia P. Jones, Stuart H. Thompson, Peter Vitousek, Virginia Walbot, Ward B. Watt; By Courtesy: William F. Thompson


Professor (Research): Eduardo Zeiger

Senior Lecturer: Charles H. Baxter

Directors of Systematic Collections: Paul R. Ehrlich (Entomological Collections), John H. Thomas (Dudley Herbarium)
OFFERINGS AND FACILITIES

The Department of Biological Sciences comprises facilities and personnel housed in Herrin Laboratories, Herrin Hall, and the Jasper Ridge 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 general student; (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) various programs 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.

The Falconer Biology Library in Herrin Hall contains over 1200 current subscriptions and an extensive collection of monographs and reference works. A specialized library is maintained at the Hopkins Marine Station.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

UNDERGRADUATE ADVISING

Most members of the biology faculty are available for advising. The Student Services Office maintains a current list of faculty advisors, advising schedules, and research interests.

The Student Services Office is prepared to answer questions on administrative matters, such as requirements for the major, eligibility of courses as electives, and necessity for petition. A booklet entitled "The Bachelor of Science Handbook" which delineates policies and requirements is available at the Student Services Office. Academic advising is provided by members of the faculty, on such matters as choice of courses and career plans. The Biology Bridge is a student-operated adjunct to departmental advising. Biobridge undergraduate staff members provide advice on choosing an advisor and courses; organize departmental functions and activities such as the weekly noon lecture series and new majors orientation; and are also available for informal, drop-in counseling at the Student Services Office (Herrin Hall T-333).

Each declared major in biology is expected to select a regular advisor at an early date. The resultant continuity of academic advice is likely to be particularly advantageous to students who anticipate applying to medical school or graduate school, enrolling in the honors or terminal program, taking courses at Hopkins Marine Station, or attending one of the overseas campuses.

COURSE REQUIREMENTS

Candidates for the degree of Bachelor of Science must complete:

(1) Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 40</td>
<td>5</td>
</tr>
<tr>
<td>Biology 41</td>
<td>4</td>
</tr>
<tr>
<td>Biology 42</td>
<td>4</td>
</tr>
<tr>
<td>Biology 43</td>
<td>4</td>
</tr>
<tr>
<td>Biology 44X</td>
<td>3</td>
</tr>
<tr>
<td>Biology 44Y (may be replaced with 155H or 175H)</td>
<td>3</td>
</tr>
</tbody>
</table>

Total: 23

(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: 41

(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; or 132, 135

(b) 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, 109A, 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 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 (41) 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 year-long physics sequence Physics 21, 22, 23, 24, 25, 26, (or Physics 51, 53, 54, 55, 56, 57, 58).

For students considering taking the 15 unit research 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 Bio 155H or 175H may count as 10 elective units and may also substitute for Bio 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>Subject</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31, 33, 35, 36.</td>
<td>A</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Writing &amp; Distribution Requirements or Electives</td>
<td>A</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td>15</td>
<td>16</td>
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</table>

**SECOND YEAR**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 40. Principles of Biology</td>
<td>A</td>
<td>5</td>
<td>—</td>
</tr>
<tr>
<td>Biology 41. Principles of Biology</td>
<td>A</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Biology 42 and 43. Principles of Biology</td>
<td>A</td>
<td>8</td>
<td>—</td>
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</tbody>
</table>

**THIRD YEAR**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 21, 22, 23, 24 Introductory Physics</td>
<td>A</td>
<td>4</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>Distribution Requirements or Electives</td>
<td>A</td>
<td>11</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
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</tbody>
</table>

**FOURTH YEAR**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electives</td>
<td>A</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

**DEPARTMENTAL HONORS**

In order to graduate with “Departmental Honors" noted on the transcript, students must have been involved in at least 10 units of a suitable 199 research project. An Honors Petition proposal form must be completed and submitted to the Undergraduate Studies Committee for approval. In order to complete the program, the student must: (1) complete an Honors thesis approved by at least two readers; (2) participate in the Spring Quarter Undergraduate Honors Research Symposium; and (3) obtain at least a 3.0 (B) grade point average in all major requirements (cognate, core and elective courses). 199 grades are not computed into this grade average. Further information on requirements are available from the Student Services Office.

**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: 40, 41, 42, 43, 44XY, 110, 110L and (for those students applying to medical schools which explicitly require a course in embryology or developmental biology) 107 or 108, and such additions or substitutes as may be recommended by Stanford’s Premedical Advising Office (Undergraduate Advising Center, Old Union).

**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. Frustration and lost time can be avoided by getting credit evaluations and a course program outlined im-
mediately upon arrival. Course catalogs 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 major requirements must be evaluated on Course Equivalence forms (available in the Student Services Office) which will be kept in the student's file.

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 one year (three academic quarters) of registration, during which 45 units of credit are earned. At least 33 units must be completed in a combination of biology and cognate courses, of which at least 24 must be in biological sciences or authorized biology equivalent courses. Students must take 9 of these 24 units in biology courses rather than out-of-department equivalents. No financial support derived from Stanford University funds is available for either tuition or living expenses associated with the master's program. Appropriate application materials for the program can be obtained from the Graduate Admissions Office. 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 (See above). However, students from other disciplines, particularly the physical sciences, are 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 will submit their applications to the department for approval when application requirements are completed. The deadline for receipt of applications with all supporting materials 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 ten 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. Printed information regarding choice of a graduate school can be obtained from the Biology Bridge.
Office and the Undergraduate Advising Center at the Old Union.

An admitted applicant is required to conform to the requirements of the University as outlined in the "Degrees" section in this bulletin and to the department requirements stated below.

Courses Required of all Ph.D. Candidates — Each student must take at least three units of work as a graduate under each of four or more Stanford faculty members. Course work to be taken will be determined in consultation with an advising committee. All first year graduate students in the Ph.D. program are required to 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 year in residence. This normally involves two afternoons a week for four quarters and assignments are made in consultation with the students. At least four of the required eight units must be served in the core laboratory courses 44X or 44Y. Graduate students with departmental support are called upon to teach one-fourth time (2 units per year) in each of the 2nd, 3rd, and 4th years. Students on non-University fellowships or grants are not required to carry out this additional teaching.

Graduate Seminars, devoted to the discussion of current literature and research in particular fields of biology, are an important means of attaining professional perspective and competence. These seminars are presented under individual course listings or 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 directly after arrival 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, and then reports 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 (either regular or by courtesy). 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 second year, the student, in consultation with the dissertation committee, submits a dissertation proposal describing the area of specialization and a general outline of proposed research. The student then takes an oral examination from the dissertation committee on the proposed dissertation and on the area of specialization. Passing the oral examination automatically leads to departmental certification for admission to candidacy. If the oral examination is not passed, it may be retaken no later than five days before the end of the next Spring Quarter (second year). The dissertation committee will remain active for advice and guidance during the remainder of a student's graduate training, including the period of dissertation preparation and oral defense. Work should be planned so as to complete the entire Ph.D. program within four years.

Language Requirement — A reading knowledge of a modern scientific language (ordinarily French or German) is recommended at the time of entry. If an entering student is deficient, the advising committee and the student should carefully weigh the value of language study vs. other needs, and decide whether further study of a foreign language should be undertaken.

Residency Requirement — A minimum of three years (nine quarters) of full-time graduate registration is required of each candidate. The department normally accepts only full-time students for study leading to the Ph.D. However, it recognizes that because of family and child-bearing responsibilities, military or alternative service obligations, or other personal reasons, students may wish at various times to interrupt their graduate education or to pursue their studies on a half-time basis. The department is willing to undertake such arrangements, which can include partial stipends if the student is being supported from departmental funds.

Dissertation — A contribution to knowledge which is the result of independent work, expressed in satisfactory form. Abstracts of Ph.D. theses are published in Dissertation Abstracts.

The Oral Examination — This consists of a formal seminar open to the public, followed by a closed session of questioning. This examination
is taken after the dissertation is completed in draft form and approved by all members of the Reading Committee.

COURSES

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 COURSES

40, 41, 42, 43. Principles of Biology—A comprehensive study of the principles of modern biology. These courses should be taken in sequence, although not necessarily in the same year. Prerequisites for 41, 42, 43: Chemistry 31, 33, 35, 131, Mathematics 19, 20, and 21 or 41 and 42.

40. Evolutionary Biology—Study of basic unifying themes in biology from a modern evolutionary perspective. Major sections of the course will be: an introduction to the chemical basis of living structure and function; the principles and mechanisms of heredity; neo-Darwinian concepts of the operation of natural selection including the origins of life, the genetics of natural populations, and the origins of diverse species; and the nature of ecological interactions at population and community levels. This course begins the core sequence in Biological Sciences, but may also be taken by non-majors interested in a first course in biological concepts. Some previous experience with chemistry will be very helpful, but supplementary material will be provided to assist those without such experience. (DR:7)

5 units, Aut (Watt) MTWThF 10
Discussions (Staff)
M 1:15-3:05, M 3:15-5:05, M 7:30-9:20
p.m., T 1:15-3:05, T 3:15-5:05,
W 1:15-3:05, W 3:15-5:05, W 7:30-9:20
p.m., Th 1:15-3:05, Th 3:15-5:05

41. Biochemistry and Molecular Biology—Intermediate level course dealing with Biochemistry and Molecular Genetics. Topics will include structure of cellular macromolecules, proteins, lipids, carbohydrates, nucleic acids, structure and function of enzymes, enzyme kinetics, energy metabolism, photosynthesis, intermediary metabolism and regulation of metabolism, hormonal control of enzyme activity, genome structure, procaryotic genetics, gene transfer mechanisms, genome replication, DNA repair, genetic fine structure, mutagenesis, protein synthesis, genetic code, regulation of gene expression, recombinant DNA techniques, regulation of gene expression in eucaryotes. (DR:7)

4 units, Win (Simoni, Long, Yanofsky)
MTWTh lecture, F discussion 10

42. Cell and Developmental Biology—Intermediate level course covering the cellular, developmental, and molecular biology of eucaryotes. Topics will include the structure and function of organelles, chromosome structure and replication, the cell cycle, the structure and regulation of eukaryotic genes, and basic concepts in determination, differentiation, and morphogenesis. (DR:7)

4 units, Spr (Jones, Goodman, Schimke, Walbot) MTWThF 11

43. Organismal Biology—Intermediate level survey of the structure and function of organs and organ systems of plants and animals. Examination of the physico-chemical principles underlying the exchanges of mass and energy between organisms and their environments. Then the organ and organ system specializations which utilize these principles in adapting organisms to different environments will be discussed. A major theme will be the mechanisms by which the functions of each system are controlled and regulated. (DR:7)

4 units, Spr (Heller, Ray, Scheller)
MTWTh lecture, F discussion 9

44. Core Experimental Laboratory—This two-quarter course consists of laboratory projects which give students a working familiarity with some of the concepts, organisms and techniques of modern biological research. Emphasis is placed on experimental design and critical analysis of data. The course is taken concurrently with or subsequent to 40, 41, 42 and 43. 44X and Y should be taken in sequence. Prerequisites: Chemistry 31 and 33. Grading is mandatory Pass/No Credit.

44X. 3 units, Win (Green, Snapp, Day)
labs T, W, Th, or F 1:15-5:05
discussion sections by arrangement

44Y. 3 units, Spr (Green, Snapp, Day)
labs T, W, Th, or F 1:15-5:05
discussion sections by arrangement

45. Research Biology—This course is designed to allow students who have taken Biology 44X and 44Y to pursue specific experiments in greater detail. This is also designed as a possible entry into an honors project.

3-5 units, Aut (Woodward)
discussion Th 2-4 or by arrangement

50. Biology and the Oceans—Biology 50, rather than being a survey course, is 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 will give
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. No prerequisites.

4 units, Win (Baxter, Denny, Epel, Cilly, Mazia, Roughgarden, Thompson, and visiting lecturers)

TTh lecture

Three weekend field trips (accommodations provided at Hopkins Marine Station)

51. Scientific Philosophy and Bioethics—The philosophy of science is analyzed from various perspectives (e.g., philosophy, science, politics, society). These perspectives are treated from historical as well as contemporary considerations. Much of the emphasis leans toward analyses of bioethical controversies and how these relate to the philosophy and practice of science today. (DR:3)

3 units, Aut (Woodward) MWF 1:15

UPPER DIVISION COURSES

Prerequisites: The upper-division course descriptions refer to prerequisite courses from the core sequence by their new numbers. For students who took the core courses prior to 1980-81, the following equivalencies pertain: 40 is equivalent to former 1 and 23; 41 is equivalent to the former 21; 42 is a new course; 43 is equivalent to the former 22; and 44 XY is the equivalent of the former 24 YZ.

101. Biology for Humanists—A course intended for majors in the humanities and social sciences. Topics to include a history of contemporary ideas in biology, the analysis of scientific writing, some epistemological and moral issues associated with biological research, and a study of economic and political forces affecting the direction of biological research. The coverage of the history of ideas in biology will present sufficient contemporary scientific material so that the course can be counted towards the distribution requirement in science for nonscience majors. The objective of the course is to present the pursuit of biological research as a human activity. This course does not qualify toward biology elective units for biology majors. (DR:7)

3 units, Win (Staff) TTh 11

105. Biological Circadian Rhythms—Biological clocks that sense daily cycles analyzed in a variety of organisms. Physiological, genetic and biochemical approaches to localizing understanding mechanisms of both the oscillator and its blue light photoreceptor will be followed. Learning how organisms track time is the object of this line of inquiry. 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 will 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.

4 units, Aut (Vitousek) MWF 10, plus lab by arrangement

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: 41 and 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 core or Human Biology core.

3 units, Spr (Porzig, Wessells) MWF 9

110. Vertebrate Biology—Structure, function, behavior, and evolution of vertebrates. Prerequisites: Biology core, or Human Biology core.

4 units, Aut (Wessells) MW 8

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.) Purpose is to present information
on the functioning of organ systems with emphasis on mechanisms of control and regulation. Topics will include structure and function of the endocrine and central nervous systems, cardiovascular physiology, respiration, salt and water balance, 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 Bio. 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: 40 or equivalent.

5 units, Aut (Fultz, Holm, Long, Mooney, Ray) 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: 40 and 43, or consent of instructor.

4 units, Win (Mooney) TTh 11; field trips by arrangement, alternate years, given 1986-87

125. Ecosystems of California—Principles of ecosystem function with emphasis on vegetation components and on California systems. Prerequisite: 40, or Human Biology 2A.

4 units, Spr (Mooney) TTh 11; field trips by arrangement,

128. Systematics and Ecology of Vascular Plants—Lectures, laboratory, field studies. Prerequisite: consent of instructor.

4 or 5 units, Spr (Thomas) WF 1:15 lab WF 2:15-5:05 field trips by arrangement

130. Algae/Fungi—An introduction to these groups, their ecological significance and utilization in studying cell and developmental biological problems. Lectures, laboratories, and field trips. Prerequisite: 40 or equivalent.

4 units, Win (Fultz, Grossman) MWF 1:15, lab T 2:15-5:05

131. Mosses and Ferns—Structure, development, evolutionary relationships of mosses and ferns. Lectures, laboratories, and field trips. Prerequisite: 40, 43, or consent of instructor.

5 units, Aut (Thomas) WF 2:15-5:05, alternate years, given 1986-87

132. Seed Plants—Structure, development, evolutionary relationships of seed plants. Lectures, laboratories, and field trips. Prerequisites: 40, 43, or consent of instructor.

5 units, Spr (Holm) TTh 1:15-2:05, lab TTh 2:15-5:05

133. Plants and Civilization—Discussion of the economic uses of plants and plant substances. Food, fiber, medicinal, and structural uses will be considered from a biological and ecological point of view. Lectures and demonstrations. Prerequisites: Biology or Human Biology core, or consent of instructor.

4 units, Win (Holm, Thomas) MWF 11

Demonstrations: W 2-4; Th 10-12, or 2-4; not given 1985-86

134. Seminar on Replication of Nucleic Acids—Modes of replication and their control in prokaryotic and eukaryotic systems. Critical review of current literature. Prerequisite: 41 and/or consent of instructor.

3 units, Aut (Hanawalt) TTh 4:15-5:30, alternate years, given 1986-87

135. Seminar on Developmental Genetics—Genetic expression and its developmental basis, especially in such representative organisms as Drosophila, mice, and men. Prerequisites: 40, 42 or consent of instructor.

3 units, Spr (Center) T 7-9, alternate years, given 1986-87

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 utilized, emphasizing experimentation and observation of living cell, including their microscopy, micromanipulation and chemistry. The course is at the post-graduate level but advanced undergraduates will be considered. Course taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Epel, Mazia)

137. Maize Genetics—Discussion of modern techniques in maize genetics and of phenomena
such as controlling elements, paramutation and cytoplasmic inheritance. Practical experience in setting up a field experiment, planting seed, tagging plants, and plant maintenance. Field projects may be continued over the summer as 199 or 300. Prerequisites: 166 or 167, or consent of instructor.

2-3 units, Spr (Walbot) MW 1:15

138H. Biomechanics of Intertidal Organisms—Introduction to the mechanical design of wave-swept organisms with 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. Course taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Denny) alternate years, given 1986-87

140. Highlights in Photobiology—Basic principles of the action of light upon biological systems. Lectures, discussion of current literature, and student reports on special topics including: photosynthesis, photoperiodism, phototropism, vision, photoinactivation and recovery. Prerequisites: 40, 41, 42, 43.

3 units, Win (Briggs, Hanawalt) alternate years, given 1986-87

140H. Physiological and Cellular Features of Adaptation in Marine Algae—Course will focus on physiological adaptations by marine algae to intertidal and subtidal environments. Lectures will review algal identification, environmental factors and physiological processes such as photosynthesis. Laboratories will concentrate on methods for algal physiology. Students will conduct individual research projects. This course is designed for upper division undergraduate and graduate students. Course taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Staff)

141. Biostatistics—An introduction to the statistical analysis of biological data. Lectures, discussion and student exercises.

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

147. Signal Transduction in Cells—This advanced course considers the mechanisms by which cells alter their activity in response to extracellular stimuli. Emphasis will be on cell. cell signalling, as by hormones and growth factors and on triggers for developmental change, as during germination, fertilization and embryonic inductions. Course will rely heavily on current literature.

2 units, Aut (Epel) W 2:15-4:05 alternate years, given 1986-87

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 alternate years, given 1986-87

153. Introductory Neurobiology—(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 (Wine) TTh 1:15-2:30 alternate years, given 1986-87

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 (Same as Psychology 107), or consent of instructor.

3 units, Win (Scheller) MW 10

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 (same as Psychology 107), or consent of instructor.

4 units, Win (Goodman) MWF 10 alternate years, given 1986-87

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)
156. Plant Physiology—Principal functions of green plants, including photosynthesis, gas exchange, water and nutrient transport, mineral metabolism, growth, and environmental responses. Introduces and emphasizes quantitative aspects of these functions. Prerequisites: 41, 42, 43, or equivalent, and introductory organic chemistry or biochemistry.

4 units, Win (Ray) MWF 10
lecture MWF 10; discussion TTh 10

159H. Problems in Behavioral Biology—
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. Course taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Baxter)

160H. Problems in Subtidal Ecology—
Studies will 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. 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 of 105H — Subtidal Communities, but individuals with equivalent training and background will be considered. Course is intended for students seriously interested in designing and carrying out research studies in the SCUBA zone and results will be prepared as a scientific paper and presented at a course symposium. Course taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Baxter)

161. Topics in Evolutionary Biology—
Current methods of approach to such evolutionary subjects as tempo and mode, origin of major categories, cytogenetics, hybridization, polyploidy, and apomixis. Lectures, discussion, and library research. Prerequisites: 40, 42, 43.

3 units, Spr (Holm) by arrangement
alternate years, given 1986-87

162. Biogeography—
Survey of major principles of ecological and historical geography of plants and animals. Prerequisite: 40.

3 units, Aut (Holm) TTh 11

164. Animal Behavior: Neurobiological Aspects—
(Same as Psychology 147.) Ethological studies of behavior with an emphasis on understanding physiological substrates of simple behavior. Prerequisites: 43 or Hum Bio 003A or Psych 107 or consent of instructor.

4 units, Aut (Wine) TTh 1:15-2:30

165. Animal Behavior: Ecological and Evolutionary Aspects—
A comparative survey of principles and patterns of animal behavior stressing their evolution and adaptive significance. Emphasis will be placed on vertebrates. Lecture and discussion. Prerequisite: 40 or Human Biology 002A. (DR:7).

3 units, Aut (Heller) MWF 9

166. Genetics (Eukaryotes)—
The principles of genetics as developed in and applied to studies of eukaryotic organisms. Emphasis will be placed on the transmission of genetic factors. Prerequisite: 40 or consent of instructor.

3 units, Win (Regnery) MWF 11

167. Genetics (Prokaryotes)—
Continuation of 166 with emphasis on prokaryotes. Basic genetic principles applied to bacteria and viruses. Methods of genetic mapping; correlation of genetic and physical structure; mechanism of recombination. Prerequisite: 166.

3 units, Spr (Campbell) MWF 11

168. Vegetation and Fire—
An examination of the past and present role of fire in the evolution and maintenance of vegetation types, with particular reference to the diverse California flora. Prerequisite: consent of instructor.

3 units, Aut (Thomas) Th 2:15-4:05;
field trips by arrangement, alternate years, given 1986-87

170. Microscopy for Biologists—
A broad survey of the methods which use light and other radiation (electrons, X-rays) for the analysis of cells in biological and medical research. Topics range from cell sorters and holography through polarized light and electron microscopy. The lectures cover the physical principles. The laboratory involves partial assembly and extensive use of pertinent instruments. Campus laboratories, developing advanced optical techniques for biology, will be visited. Prerequisites: 41, 42, 43, 44XY.

3 units, Aut (Green) TTh 1:15;
lab T or Th 2:15-5:05

171. Techniques in Electron Microscopy—
Practical training in the use of the transmission and scanning microscopes. Course covers specimen preparation, microscope operation, photography, and interpretation. General theory is covered in 170, the usual prerequisite.

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
will 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 enable students to design and carry out their own research in molecular biology. Prerequisites: Bio core and consent of instructor.

8 units, Aut (Berlani) MWF; lecture 10-11; lab 12:30-5:05 plus other hours by arrangement

175H. Problems in Marine Biology—Lectures, laboratory work, field studies, and individual problems. 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)

177. Animal Locomotion—Introduction to the mechanisms and energetics of animal locomotion. Subjects include: ciliary flagellar locomotion, terrestrial locomotion (crawling, walking, running), swimming in fish and cephalopods, flight in insects and birds and the cost of locomotion. Basic principles of the fluid and solid mechanisms relevant to the study of locomotion are presented. Intended for graduate students and upper level undergraduates with a solid background in zoology. A knowledge of vertebrate and invertebrate anatomy, calculus, and introductory physics helpful, but not required.

3 units, Win (Denny) MT

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, alternate years, given 1986-87

180. Conservation Biology—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: 40 or equivalent and permission of instructor.

2 units, Spr (Wilcox) M 7-9 pm
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) MWF 1:15

183. Colloquium on Population Studies—(Same as Human Biology 060, Food Research

184. Biology of Insects—An introduction to the functional biology of insects. Insect anatomy, biochemistry, behavior, ecology, physiology and systematics will be considered, as well as more specialized topics intended to illustrate or emphasize unusual features of insects which make them attractive as objects of research. Lab sometimes meets for the full time as a lab or field exercise, and at other times only for the first hour as a lecture-discussion. Prerequisites: 40, 41, 42, 43, or consent of instructor.

Spr (Watt) MWF 11
lab T 1:15-5:05,
alternate years, given 1986-87

185. Coevolution—Evolutionary interactions among different kinds of organisms—plants and herbivores, models and mimics, predators and prey, parasites and hosts, etc. Emphasis will be on the importance of these interactions in understanding problems of community structure and human ecology. Lectures, discussion and library research. Prerequisite: 40 or Human Biology 3A and consent of instructor.

3 units, Spr (Ehrlich) 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: 40 or Human Biology 2A and consent of instructor.

3 units, Spr (Ehrlich, Holm) M 2:15-4:05,
alternate years, given 1986-87

187. Topics in Epizootiology—Lectures, discussions, and readings on the effects of particular diseases on infra-human animal populations. Prerequisite: 40 or consent of instructor.

3 units, Spr (Regnery) TTh 10

188. Ecosystems of the Tropics—An examination of diverse tropical ecosystems ranging from lowland rainforest to savanna, from shifting cultivation to high-elevation ecosystems. The focus will be on production, nutrient cycling, and regulation of ecosystem structure and function: the specific content will depend in part upon student participation in this seminar course.

1-3 units, Spr (Vitousek) Th 2:15-4:05
alternate years, given 1986-77

190. Population Biology of Butterflies—Lectures will focus on field studies of the dynamics and genetics of butterfly populations, life histories, and resource utilization. Also covered will be the evolution and taxonomy of this group of insects which has become a key research tool in population biology. Lab will include field
work on *Euphydryas* populations now under study, both on campus and elsewhere in California. Prerequisites: 40 and consent of instructor.

3-5 units, Spr (Ehrlich) 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, Roughgarden);
Spr only (Thomas) by arrangement

199. 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. Petitions for "Special Problems" shall 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 COURSES**

205. DNA Repair and Mutagenesis—Interactions of mutagens and carcinogens with DNA. Response of living systems to damaged genetic material, including molecular mechanisms for DNA repair. Enzymology of DNA modification and repair. Inducible repair responses and "error-prone" mechanisms. Human hereditary deficiencies in DNA repair. Relationships of DNA repair and mutagenesis to carcinogenesis. Prerequisite: 41 and/or consent of instructor.

3 units, Spr (Hanawalt, Friedberg, K.C. Smith) TTh 1:15-2:30

206. 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—Structure, function, and biosynthesis of cellular membranes and organelles. The course will be based on the current literature and will require extensive student participation. Prerequisites: Biochemistry 200-201 or equivalent experience in biochemistry and molecular biology, as well as consent of instructors.

4 units, Aut (Rothman, Simon) TTh 10-12 alternate years, 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: 41.

3 units, Win (Campbell) MWF 9

215. Biochemical Evolution—Lectures and discussion periods covering biochemical viewpoints on diverse aspects of the evolutionary process. Topics will include, but not be limited to: prebiotic biochemistry and the origins of life; adaptive organization of metabolism; enzyme polymorphisms and other biochemical aspects of population genetics; "macromolecular phylogeny" and "protein clocks." Prerequisites: 40, 41, 42, 43, or substantial equivalents.

3 units, Spr (Watt) MWF 9

222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques—Course presents an advanced treatment of membrane physiology and several modern experimental techniques. Emphasis will be 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 advanced undergraduates. Course is taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Gilly, S. Thompson)

225. 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);
Spr only (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: 41, 42, and Biochemistry 200 (can be taken concurrently) or consent of instructor.
3 units, Aut (Jones) MWF 10
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 (Shimke) TTh 11
plus 1 hour by arrangement
alternate years, given 1986-87

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 1985-86

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

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: 43, or an equivalent course in animal physiology.
3 units, Win (Heller) by arrangement

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, Spr (Feldman) MWF 3:15,
alternate years, given 1986-87

3 units, Aut (Roughgarden) TTh 1:15-3:05
alternate years, given 1986-87

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 then 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. Taught at Hopkins Marine Station. Apply to Hopkins.
6 units, Sum (Roughgarden)
alternate years, given 1986-87

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

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 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 (Goodman, 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)
by arrangement
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. Topics for 1985-86 will be: Autumn — Organelle Molecular Biology; Winter — Advanced Plant Physiology; Spring — Ecology, physiology and Molecular Biology of Nitrogen Metabolism.

1-3 units, Aut, Win, Spr (Green, Long, Mooney, Ray, Vitousek, Walbot, Briggs, Bjorkman, Berry, Grossman, W. Thompson) T 5

345. Seminar in Genetics and Molecular Biology—Enrollment limited to graduate students directly associated with departmental research groups in genetics or molecular biology.

1 unit, Aut, Win, Spr (Campbell, Hanawalt, Long, Ferkins, 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

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 (Ehrlich, Holm) by arrangement

354. Seminar in Population Biology — Prerequisite: consent of instructor.

1-3 units, Aut, Win, Spr (Ehrlich, Feldman, Holm, Mooney, Roughgarden, Vitousek, Watt) Spr only (Thomas) by arrangement

383. Seminar in Population Genetics—Literature review and research discussion of current problems in the theory and practice of population genetics. Student participation required. Prerequisite: consent of instructor.

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

384. Seminar in Population Ecology—Discussions of recent and classical research papers in ecology, and presentation of work in progress by seminar participants. Prerequisite: consent of instructor.

1-3 units, Spr (Roughgarden) by arrangement

DIVISION OF MARINE BIOLOGY

HOPKINS MARINE STATION


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. Cilly

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 biology, oceanography, microbiology, and embryology.

The Station is open during the entire year and maintains a permanent staff of resident investigators and technical assistants; this staff is increased by visiting faculty members, especially during the summer. There are facilities for visiting investigators and for elementary and advanced instruction in biology. For further information, see the Hopkins Marine Station Bulletin, or write Hopkins Marine Station, Pacific Grove, CA 93950.

AUTUMN, WINTER, AND SPRING QUARTER COURSES

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. Prerequi-
sites: 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)

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 Coterminous M.S. Program. Arrangements must be made by consultation or correspondence.
  (Staff) by arrangement

300H. Research—Graduate study involving original work may be undertaken with members of the staff in the fields indicated below.


M. Denny: Biomechanics—The mechanical properties of biological materials and their consequences for animal size, shape and performance.

D. Epel: Developmental Biology—Physiology and regulation of early embryonic development.

W. Gilly: Membrane physiology of nerve and muscle cells; control of sodium and calcium ion channels and of excitation-contraction coupling. Comparative neuromuscular physiology of marine invertebrates.

D. Mazia: Cell Reproduction—Mitosis, cell division and cell cycles in eggs of marine invertebrates.

J. Roughgarden: Theoretical ecology.

S. Thompson: Neurophysiology — Neuronal control of behavior and mechanisms of ion permeation in membranes.

**SUMMER QUARTER COURSES**

The summer program is open to all advanced undergraduate, graduate, postdoctoral students and teachers whose biological background, teaching or research activities can benefit from a summer’s study of marine life. Application blanks may be obtained by writing directly to the Academic Secretary, Hopkins Marine Station, Pacific Grove, CA 93950. Completed applications should be submitted by March 31. Applications received later are considered if space is still available in classes.

The Summer Quarter is divided into two terms of five weeks each. Those courses requiring the lower tides of early summer are scheduled in the first term. It is possible to register for either term, or for the full quarter.

Although some classes meet only on alternate days, the majority meet daily for formal work, and in all classes the laboratories are open all week long and most students spend part of their few “off” days in the laboratory or library. For this reason, registration is possible for only one course during each five week session.

**FIRST TERM**

105H. Subtidal Communities—Lectures, laboratory, and field trips treating shallow water marine communities. Emphasis 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 alternate years, given 1986-87

140H. Physiological and Cellular Features of Adaptation in Marine Algae—Course will focus on physiological adaptations by marine algae to intertidal and subtidal environments. Lectures review algal identification, environmental factors and physiological processes such as photosynthesis. Laboratories concentrate on methods for algal physiology. Students will conduct individual research projects. Designed for upper division undergraduate and graduate students.

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.)

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

256H. 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 alternate years, given 1986-87

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 (Baxter, Staff) by arrangement

199H. Special Problems—(See above, Autumn, Winter and Spring Quarters.)

COMMITTEE ON BLACK PERFORMING ARTS

Director: Sandra L. Richards (Drama)
Committee in Charge: Kennell Jackson (Afri- can and Afro-American Studies and History), Halifu Osumare (Dance), John Rick- ford (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, Aut, Win, Spr (Staff)

39. Theater Performance: Crew—(Enroll in Drama 039.) Students may receive credit for the participation in the design and technical areas of committee productions.
1-5 units, Aut, Win, Spr (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 73.) 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)

73A. Jazz Dance IV—(Enroll in Athletics 74.) Intermediate class emphasizing the Afro-American contribution to American jazz dance. Focus on rhythmic vitality, movement isolation and performance techniques. Prerequisite: consent of instructor.
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 introducing 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 retained Africanisms, slavery, the Black family, Afro-American artists, and Afro-American identity.
5 units, Aut (Gibbs, Staff)

150. Contemporary Black Playwrights—(Enroll in Drama 150.) Study of 20th century Black playwrights including Richard Wright, Ntozake Shange, Athol Fugard, Derek Walcott.
5 units, Win (Richards)

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)

161F. The Harlem Renaissance—(Enroll in English 161F.) Surveys major works of literature and culture involving Black Americans in the 1920's, particularly in New York. Writers to be discussed include Countee Cullen, Claude McKay, Jean Toomer, Langston Hughes, Carl Van Vechten, Nella Larsen and Eugene O'Neill.
5 units, Aut (Drake)
CHEMISTRY*


Chairman: John Ross


Associate Professors: Steven G. Boxer, Michael D. Fayer, Keith O. Hodgson, Wray H. Huestis, Paul A. Wender

Assistant Professors: John W. Frost, Steven M. George, Nathan S. Lewis, 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.

AMERICAN CHEMICAL SOCIETY CERTIFICATION

Students who wish to be certified as having met the minimum requirements of the American Chemical Society for professional training must complete, in addition to the above requirements, at least six units from Chemistry 136 and/or 190; and at least three additional units from one of the following: Chemistry 136, any chemistry course numbered above 200 for which permission to register had been granted by the instructor; Biochemistry 200; or an advanced course in mathematics or physics. A reading knowledge of scientific German or Russian is strongly recommended.

HONORS PROGRAM IN CHEMISTRY

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

To be admitted to the program, the student must have a grade average of at least B in all course work in the University. In addition to the minimum requirements for the B.S. degree, the student must complete nine units of Chemistry 190 to be taken three units per quarter for three quarters; and nine additional units from Chemistry 221, 223, 225, 227, 251, 253, 255, 271, 273, 275, Biochemistry 200, 201, Mathematics 130, 131, 132, physics lecture courses numbered 100 and higher, Geology 278, or other advanced courses approved by the student's advisor and by the supervisor of his or her in work Chemistry 190. An overall 3.3 average
in mathematics, physics and chemistry is required for graduation with honors.

Students who wish to be admitted to the Honors Program should register in the department office at the beginning of their senior year. Those who do not meet all of the above formal requirements, may petition the department for admission.

TYPICAL SCHEDULE FOR FOUR-YEAR PROGRAM
FIRST YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
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<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>—</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 36</td>
<td>Chemical Separations</td>
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<td>—</td>
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<td>Writing Requirement</td>
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<td>German 1, 2, 3</td>
<td>First-Year German</td>
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<tr>
<td>Math. 19, 20, 21</td>
<td>Calculus and Analytic Geometry</td>
<td>3</td>
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SECOND YEAR

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<tbody>
<tr>
<td>Chem. 131</td>
<td>Polyfunctional Compounds</td>
<td>3</td>
<td>—</td>
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<tr>
<td>Chem. 132</td>
<td>Qualitative Organic Analysis</td>
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<tr>
<td>Chem. 133</td>
<td>Special Topics in Organic Chemistry</td>
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<td>3</td>
<td>—</td>
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<tr>
<td>Chem. 134</td>
<td>Theory and Practice of Quantitative Chemistry</td>
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<td>4</td>
<td>—</td>
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<tr>
<td>Chem. 136</td>
<td>Synthesis Laboratory</td>
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<tr>
<td>Math. 22, 23</td>
<td>Analytic Geometry and Calculus</td>
<td>3</td>
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<td>—</td>
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<tr>
<td>Physics 51, 53-54</td>
<td>Mechanics, Sound, Electricity</td>
<td>—</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Electives (see Note 1 below)</td>
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<td>7</td>
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THIRD YEAR

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<td>Chem. 171, 173, 175</td>
<td>Physical Chemistry</td>
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<td>3</td>
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<td>Chem. 174, 176</td>
<td>Physical Chemistry Laboratory</td>
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<td>Chem. 151, 153</td>
<td>Inorganic Chemistry</td>
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<tr>
<td>Physics 55-56, 57-58</td>
<td>Light, Heat, Atomic Physics</td>
<td>5</td>
<td>4</td>
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FOURTH YEAR

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<tbody>
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</tbody>
</table>

Note 1.—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, 276; Engr. 50; Appl. Earth Sci. 105; Mat. Sci. and Engr. 105; Med. Micro. 101; Biol. Sci. 40, 41, 42, 43; Biochem. 200, 201; Comp. Sci. 106, 135; Civil Engr. 170, 175, 276A.

TEACHING CREDENTIALS

The requirements for certification to teach chemistry in the secondary schools of California may be ascertained by consulting the section on credentials under "School of Education" in this bulletin and the Credential 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. 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. Note 1—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, 276; Engr. 50; Appl. Earth Sci. 105; Mat. Sci. and Engr. 105; Med. Micro. 101; Biol. Sci. 40, 41, 42, 43; Biochem. 200, 201; Comp. Sci. 106, 135; Civil Engr. 170, 175, 276A.
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 20, 21, 1985 and all must be taken at this time.

MASTER OF SCIENCE

All applicants for the degree of Master of Science in Chemistry are required to complete, in addition to the requirements for the bachelor's degree, a minimum of 39 units of work. Of the 39 units approximately two-thirds must be in the department and must include at least 12 units of advanced course work in chemistry exclusive of the thesis. Of the 12 units, at least three units must be from Chemistry 221, 223, 225, 251, 253, 255, 271, 273, or 275.

MASTER OF ARTS IN TEACHING (CHEMISTRY)

In cooperation with the School of Education, the department offers a program leading to a degree, Master of Arts in Teaching (Chemistry). This degree is intended for candidates who have a teaching credential and who wish to strengthen further their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements are outlined in this bulletin under "School of Education, the Master of Arts in Teaching."

DOCTOR OF PHILOSOPHY

The graduate student does not become a formal candidate for the Ph.D. degree until he or she has passed the department qualifying and language examinations and has been admitted to candidacy by the University Committee on the Graduate Division. Filing for admission to candidacy for the Ph.D. degree must be done before June of the second year of graduate registration. The foreign language requirement for the Ph.D. in organic chemistry ordinarily will be met in German and 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.

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.

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.

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.

All students majoring in biophysical chemistry are required to take: (1) Chemistry 221 and 271 (or be exempted therefrom by passing special examinations by the professors of the courses); (2) Chemistry 287, 289, 291 and 293; and (3) two additional courses (at least six units) of advanced lecture courses in fields appropriate to their research interests to be chosen in consultation with their research supervisors.

Students with an exceptionally strong background in physics and mathematics may, upon special arrangements, pursue a program of studies in chemical physics.
Before a candidate may request scheduling of the University oral examination, clearance must be obtained from the major professor and the chairman of the Department Graduate Study Committee. Conditions that must be fulfilled before clearance is granted vary with the different divisions of the department and may be ascertained by consulting the chairman of the Committee.

It is the policy of the department to encourage and support in every possible way the pursuit of research and of other work along advanced lines by qualified students. Information concerning staff members with lists of their recent research publications will be found in the Directory of Graduate Research published by the American Chemical Society.

Ph.D. MINOR IN CHEMISTRY
Candidates for the degree of Doctor of Philosophy in other departments who wish a minor in chemistry must complete with a grade average of "B" or better, 12 units of chemistry courses more advanced than those that meet the minimum requirements for a bachelor's degree in chemistry.

FELLOWSHIPS AND SCHOLARSHIPS
In addition to the University fellowships and scholarships that are open to properly qualified students, there are at present several departmental fellowships in chemistry. The Edward Curtis Franklin Fellowship, James W. McBain Memorial Fellowship, Frederick P. Whitaker Fellowship, William H. and Myrtle B. Sloan Scholarship, David L. and Lavinia E. Sloan Memorial Scholarship, John Maxon Stillman Scholarship, and the Robert M. and Katherine F. Loeser Scholarship are granted only to graduate students. The William H. Nichols Scholarships are open to graduates and undergraduates; the Frank Gard Scholarship and Eastman Kodak Scholarships are available to undergraduates only.

There also are teaching assistantships and research assistantships open to advanced students. Application forms for fellowships, scholarships, and teaching assistantships may be obtained from the Department of Chemistry.

COURSES
Note—Laboratory fees required in laboratory courses, against which charges are made for breakage, are a minimum of $30 per quarter.

UNDERGRADUATE COURSES
30. Introduction to Chemistry—For students with no high school chemistry preparation. Introduction to chemical principles: moles, valence, stoichiometry, definitions.
3 units, Aut (Koenig) TTh 1:15-2:30
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 (Anderson)
lec (1) MWF 9; lec (2) MWF 11,
one recitation by arrangement
4 units, 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 (Kluge, Wender)
lec (1) MWF 9; Lec (2) MWF 11,
one recitation by arrangement
Spr (Brauman) TTh 1:15-2:30
35. Organic Monofunctional Compounds—Organic chemistry of oxygen, nitrogen aliphatic and aromatic compounds. Prerequisite: 33. Pre-register in Chemistry Department.
4 units, Aut (van Tamelen) MWF 1:15
4 units, Spr (Huestis) 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. The course is 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. The course satisfies the distribution requirement in natural sciences. (DR:7)
3 units, Spr (Zare) MWF 10
one recitation section by arrangement
130. Theory and Practice of Identification—Lectures on theory and interpretation of ultraviolet, infrared, nuclear magnetic resonance
and mass spectral data. Laboratory involves identification of unknowns and components of a mixture using derivatives and spectra. For students in biomedical sciences. (Chemistry majors take 132.) Prerequisites: 35, 36 and concurrent registration in 131.

4 units, Aut (Pirrung, Frost)
lec. (1) TTh 9 lab M, T, W, or Th 1:15-5:05

131. Organic Polyfunctional Compounds—
This course covers the chemistry of aromatic compounds, polysaccharides, amino acids, proteins, natural products, dyes, purines, pyridines, nucleic acids and polymers. Prerequisite: 35.
3 units, Aut (Schmitt) lec TTh 11-12:15
3 units, Win (Huestis) TTh 1:15-2:30

132. Qualitative Organic Analysis—Separation of mixtures of organic compounds and identification of the components using rational synthesis and analysis of spectral data. Required for and limited to chemistry majors; others maybe admitted with consent of instructor. Prerequisites: 35, 36 and concurrent registration in 131.
5 units, Aut (Pirrung, 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 (Kovacic) MWF 11

134. Theory and Practice of Quantitative Chemistry—The course will deal with the theory and practice of quantitative analysis. Methods considered will include gravimetric, volumetric, spectrophotometric, and electrometric. Prerequisite: 132.
5 units, Win (Lewis)
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 (Kovacic) TTh 11-12:15
3 units, Spr (Boxer)

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—
(Designated as 291.) Problems of introducing a new, practical birth control method involve legal, political, cultural and economic factors in addition to purely biological ones. Course deals with a critical evaluation of logistic aspects of human fertility control. For further details see Human Biology 150A. 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 alternate years, given 1986-87

139. Pest Control—Technical and Policy Aspects—
(Same as Human Biology 152.) Course focuses on technical, operational and policy issues of pest control in agriculture and public health. History of chemical pest control, present research on biorational 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. For further details see Human Biology 152. 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 1986-87

151. Inorganic Chemistry I—Systematic introduction to theories of electronic structure, stereochemistry, and symmetry properties of inorganic and organometallic molecules. Topics will include ionic and covalent interactions, electron-deficient bonding, and elementary ligand field and molecular orbital theories. Emphasis will be placed on the chemistry of the metallic elements. Prerequisites: 35 and 171.
3 units, Win (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 (McCullough) MWF 10

171. Physical Chemistry—Chemical thermodynamics: fundamental principles, Gibbsian equations, equilibrium conditions, phase rule, systematic deduction of equations, gases, solu-
tions. 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 will present an introduction to 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 (Chabay) lee TTh 10 plus lab MW 2:35-5:25 or TF 1:15-4:05


3 units, Spr (George) MW 10:30-12

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 (McConnell) lee 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 COURSES

Undergraduates may register for chemistry courses numbered 200 and above only if admitted to the Honors Program or if special permission has been granted by the instructor.


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 (Pirrung) 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, biorganic 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)

251. Selected Topics in Advanced Inorganic Chemistry—May be repeated for credit. Prerequisite: one year of physical chemistry.

3 units, Aut, or Win, or Spr (Staff) TTh 11, by permission of instructor

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, Win (Solomon) TTh 10-12

257. Research Proposals in Inorganic Chemistry—Research progress reports (Autumn Quarter) and research proposals (Winter and Spring Quarters) will be presented in oral and written form. Writing ability and oral defense will be criticized as well as scientific content. Required of all second-year inorganic students.
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, Mössbauer 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, Win, Spr (Lewis) 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 will be placed on spectroscopic techniques including magnetic resonance and optical methods. Prerequisite: Chemistry 287.
3 units, Win

291. Biophysical Chemistry—Special topics in biophysical chemistry. Minimal prerequisites are previous or concurrent registration in Chemistry 171 and 173, or the equivalent.
3 units, Win (McConnell) 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: Chemistry 291 or consent of instructor.
3 units, Spr (McConnell) TTh 10 not given 1985-86

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 laboratories. All teaching assistants in chemistry are required to register for this course.
1-3 units, Aut, Win, Spr (Staff) by arrangement

300. Department Seminar—Attendance is required of all graduate students, and all undergraduates registered for 190.
1 unit, Aut, Win, Spr (Zare) Th 4

301. Research in Chemistry—Research seminars and directed reading dealing with newly developing areas in chemistry and experimental techniques. Open to qualified graduate students with the consent of the major professor. May be repeated for credit. Registration required of all graduate students who have passed the qualifying examination.
2 units, Aut, Win, Spr (Staff) by arrangement

RESEARCH AND SPECIAL ADVANCED WORK

190. Introduction to Methods of Investigation—For general character and scope, see 200, below. Limited to undergraduate students admitted under the Honors Program or by special arrangement with a member of the teaching staff. Concurrent attendance in 300 required.
(Staff) by arrangement

200. Research and Special Advanced Work—Properly qualified students are encouraged to undertake research, or other advanced laboratory work along lines not covered by courses already listed, under direction of any member of teaching staff with whom arrangement is made. For all such research and special work, students will register for 200 (or 190 if in undergraduate standing), giving name of staff member under whom work is carried on and number of units agreed upon.
(Staff) by arrangement

CHICANO FELLOWS PROGRAM

Visiting Assistant Professor: Teresa McKenna

Recognition of the growing social importance and size of the Mexican-origin population of the United States has led many leading American universities to establish Chicano study programs. Since 1971 the School of Humanities and Sciences at Stanford has affirmed the educational necessity of providing academic opportunities for undergraduates to learn about Chicano society and culture by sponsoring the Chicano Fellows Program.

Since its inception the Chicano Fellows Program has had a dual purpose: to offer a selection of courses on the Chicano experience in this country; and to provide a teaching 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 1982-83, the instructional offerings of the Program have been significantly strengthened and enhanced. In 1985-86, as in the three 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. Listed below are upper-division courses open to both undergraduate and graduate students which are offered in the departments of English, Spanish and Portuguese.

Information of course offerings within this new study area is available from the Administrative Assistant of the Chicano Fellows Program (415) 497-3091. Students should check with the Administrative Assistant for further information.

PROGRAM COURSES

For the 1985-86 Chicano Fellows Course Bulletin, please check with Administrative Assistant, Chicano Fellows Program, Bldg. 390, Rm. G (The Nitery).
181. Third World Women In Literature—
(Same as English 163.) Course will examine the
images of women as portrayed in the literature
of the Third World as well as in the ethnic
literature of the United States. The psycholog-
ical, socio-political and literary implications of
these images will be critically discussed.
5 units, Win (McKenna)

182. Chicano Literature—(Same as English
162A.) Introductory survey of Chicano prose,
fiction and non-fiction. Students will be in-
structed in critical and analytical reading as well
as introduced to innovative narrative strategies
in the works of Mexican writers who have been
born and educated in the United States.
5 units, Spr (McKenna)

183. Seminar in Ethnic Autobiography—
(Same as English 160H.) Course will focus on
autobiographies written by members of ethnic
groups (Chicano, Black, Asian) as well as con-
sciously feminist writers in the United States.
(Not an introductory course. Students will be
asked to sign up; limited to 20 students.)
5 units, Spr (McKenna, Islas)

DEPARTMENTAL COURSES

For (DR) information, see the respective
departments.

SPANISH

11B. Second-Year Spanish for Bilingual Stu-
dents—Designed for students of Hispanic back-
ground. 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 Stu-
dents—Introduction to various Hispanic
dialects, with emphasis on Chicano Spanish and
bilingualism in speech and literature.
4-5 units, Win (Staff)

13B. Second-Year Spanish for Bilingual Stu-
dents—Applied Spanish for functional pur-
poses. Emphasis on vocabulary development.
Some grammar review.
4-5 units, Spr (Staff)

130B. Mexican and Chicano Cultural Read-
ings—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 Moravesik (Philosophy
and, by courtesy, Classics), Susan TREGGIARI
(Classics and, by courtesy, History)

Associate Professors: Wilbur Knorr (History of
Science), Susan A. Stephens, Michael
Wigodsky, John J. Winkler

Assistant Professors: Sabine G. Mac Cormack
(Classics and History), Jody Maxmin (Art
History and Classics), Mark H. Munn, Bruce
B. Rosenstock

Professor (Teaching): Edward W. Spofford

Lecturers: Robert Hamerton-Kelly (Classics
and Religious Studies), Mary-Lou Munn

Visiting Professor: Carolyn Dewalt (Winter and
Spring)

Bonsall Visiting Professor: G.M.E. de Ste-
Croix (Spring)

Webster Visiting Professor: John P. Barron
(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 philos-
ophy, 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 Cul-
ture sequence and for those who have already
taken one and who desire more thorough knowl-
edge of various aspects of the ancient world.

The major in Classics affords an opportunity
for the student to develop three things: a com-
petence in the classical languages, an apprecia-
tion, comprehension, and enjoyment of clas-
sical 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.
SCHOOL OF HUMANITIES
AND SCIENCES

Some students may elect to go on to graduate work, with a goal of teaching Classics.

ADMISSION TO
THE DEPARTMENT

Those who are considering a major in Classics (Latin and Greek) should enroll in the department as early as possible, since at least three years of work in Latin or Greek or both will generally be required of them, and those with no previous knowledge of Latin (or Greek) should begin the study of the language in their freshman year, or as early as possible in their sophomore year. Prospective majors in Classical Studies should normally enroll not later than the beginning of their junior year, but are urged to discuss their plans with a member of the department as early as possible.

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 (141-3, 151-3, 161-3, 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. 2 courses in ancient history, and a course in ancient art or archaeology. The introductory sequence (1,2,3, or 51,52) or one 100-level course in Latin is highly recommended. The remaining courses to make up the total may be chosen from other departmental courses or (with permission of the advisor) from relevant courses in other departments (such as Art, Philosophy, Humanities, or modern languages). (Beginning courses in Greek, if required, may be counted towards the total of 55 units.) A summer at Stanford-in-Greece is strongly recommended. (See “Note 1” below.)
   b) Latin: at least 55 units, including a minimum of 31 units in Latin courses at the 100 level or higher. It is recommended that one of these courses be Latin Style and Syntax, two courses in ancient history, and a course in ancient art or archaeology. The introductory sequence (1,2,3, or 51,52) or one 100-level course in Greek is highly recommended. The remaining courses to make up the total may be chosen from other departmental courses or (with permission of the advisor) from relevant courses in other departments (such as Art, Philosophy, Humanities, or modern languages). (Beginning courses in Latin, if required, may be counted towards the total of 55 units.) A semester at the Rome Classical Center is strongly recommended. (See “Note 1” below.)

3. Classical Studies. This major is recommended for students who wish to study the classical civilizations in depth as part of their general educational experience, but do not have perhaps the time or the background to study the languages to the extent required by the major in Classics. The required minor is intended to assist students in relating their work in classics to particular aspects of modern civilization. This major is particularly suitable for students who think of proceeding to law, business, or medical school, or to graduate work in history, archaeology, or comparative literature. It is not suitable for those who may wish to teach Latin or Greek in high school or college, as the language work is insufficient for this purpose. Additional language work would be necessary.
before entering graduate school in classics. Requirement: 55 units made up of:

a) 40 units in the major, including (1) at least two courses in Latin or Greek at the 100 level or higher; or one course in one of the languages at the 100 level or higher, plus the 1, 2, 3, or 51, 52 series in the other language; (2) at least one course in the department from each of the following groups: literature; philosophy and political theory; ancient history; religion and mythology; art and archaeology. In some cases courses in other departments may be substituted, with permission of the Undergraduate Studies Committee.

b) A minor consisting of not less than 15 units in a relevant minor field outside the department; such fields might include not only other humanities subjects but also anthropology, psychology, sociology, political science, or a combination of such courses agreed upon with the advisor. This requirement is waived if the student completes a second major program, but in this case 55 units of Classics courses (or approved equivalents) must be completed for the major. A summer at Stanford-in-Greece is strongly recommended, or a semester at the Rome Classical Center.

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.

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 PROGRAM IN CLASSICS

Students who wish to be considered for Honors in Classics must complete the bachelor's degree program in Greek, Latin or Classical Studies. 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 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.

HONORS PROGRAM IN HUMANITIES

For majors in Classics with appropriate interests, an Honors Program in Humanities is offered, a description of which will be found under "Humanities Special Programs."

ROME CLASSICAL CENTER

Classics majors are strongly urged to attend the Intercollegiate Classical Center at Rome. The Center is managed by Stanford University for about 50 constituent colleges and universities including Stanford. It is open to Stanford majors in Classics, History, and Art History (see the Center brochure). All courses given in the Center receive full credit at Stanford and may be applied to the respective major.

All students interested in this program should consult the chairman of the department.

STANFORD IN GREECE

The Classics Department prepares and assists qualified students to study in Greece in the summer, both at the American School of Classical Studies and in programs operated by Stanford. Students who are not Classics majors are eligible, and all students should take 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, 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 undergrad-
uate major in the department. This would normally mean the completion of at least 18 units of graduate courses and 18 units of work at the 140 level or above.

3. The satisfactory completion of one Greek course at the 100 level (if the undergraduate major has been Latin) or one Latin course at the 100 level (if the undergraduate major has been Greek).

4. The passing of an examination testing the candidate’s ability to translate into English from a selected list of Greek and/or Latin authors.

5. The writing of a thesis, or the passing of an examination on a particular author or topic.

6. A reading knowledge of French or German.

Students who are candidates for the Ph.D. degree may also (on the recommendation of the department) become candidates for the A.M. degree. In their case requirement 5 above will be waived provided that they have completed some work beyond the course requirements listed under 2 and 3 above.

**DOCTOR OF PHILOSOPHY**

University regulations regarding admission and application for candidacy are discussed in the “Degrees” section of this bulletin.

All candidates for the Ph.D. degree in Classics must fulfill the following requirements:

1. They must complete at least three years (nine quarters) of full-time work, or equivalent, in study beyond the bachelor’s degree. This must include the first-year graduate program (unless the student is exempted by examination) and normally at least 12 graduate seminars acceptable to the department, in addition to the doctoral dissertation. At least three consecutive quarters of graduate work and the final units of credit in the program must be taken at Stanford.

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 examination.
   d) An oral examination on the candidate’s dissertation subject and on two special topics, such as selected authors or selected aspects of Greek or Latin literature, linguistics, history, archaeology, philosophy, epigraphy, papyrology, or paleography.

3. The examinations in translation from Greek and Latin authors 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 IN GREEK

#### INTRODUCTORY COURSES

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 (McCall) MTWF 9

2. **First-Year Greek**—Continuation of 1.  
   5 units, Win (McCall) MTWF 9

3. **First-Year Greek**—Continuation of 2.  
   5 units, Spr (Dewalt) MTWF 9

41. **First-Year Greek**—Accelerated course. Completion of Greek 51 and 52 fulfills (DR:4).  
   6 units, Win (Staff) MTWThF 1:15

42. **First-Year Greek**—Continuation of 51. Completion of Greek 51 and 52 fulfills (DR:4).  
   6 units, Spr (Staff) MTWThF 1:15

The intensive Greek course (Greek 10) offered in Summer Quarter also prepares students to enter Greek 101 in Autumn Quarter.

#### INTERMEDIATE COURSES

101. **Second-Year Greek**—Reading of selections from Plato.  
   5 units, Aut (Staff) MWF 10

102. **Second-Year Greek**—Euripides, one play.  
   5 units, Win (Knorr)

103. **Second-Year Greek**—Homer, Odyssey.  
   5 units, Spr (Edwards)

104. **New Testament Greek**.  
   3 units, Win (Hamerton-Kelly) T 10-12

111. **Sophocles**—One play.  
   4 units, Aut, (Spofford) MWF 2:15
ADVANCED COURSES

160. Individual Work. by arrangement

163. Thucydides. 4 units, Spr (Munn)

166. Aristophanes. 4 units, Win (Wigodsky)

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.

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

175. Greek Style and Syntax—This course is designed to teach some of the nuances of Greek syntax and style. Classes will be devoted to stylistic analysis of selected prose authors, techniques of sight-translation, and the writing of idiomatic Greek prose. The course is designed for the major, but all students enrolled in Greek language courses are encouraged to take Greek 175 as soon as possible after the completion of 103.

4 units, Aut (Winkler) MWF 2:15

201. Introduction to Classical Scholarship. 1 unit, Aut, Win, Spr (Wigodsky, Staff)

202. Tutorial in Greek Poetry.
3 units, Aut, Win (Rosenstock, Raubitschek) MW 9-10:30

205. Greek Language and Style.
3 units, Win, Spr (Edwards, Dewalt)

The above courses are offered every year. Other courses alternate or vary from year to year. 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 (Staff) MTWF 9

2. First-Year Latin—Continuation of 1.
5 units, Win (Staff) MTWF 9

3. First-Year Latin—Continuation of 2.
5 units, Spr (Winkler) MTWF 9

51. First-Year Latin—Accelerated course.
Completion of Latin 51 and 52 fulfills (DR:4).
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 COURSES

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 (Treggiari) MWF 11
with review session by arrangement

5 units, Win (Davis) MWF
with review session by arrangement

103. Second-Year Latin—Selections from Virgil, Aeneid.
5 units, Spr (Dewalt) MWF
with review session by arrangement

113. Latin Elegy. (DR:2)
4 units, Aut (Courtney) MWF 11

118. Post-Classical Latin—(Same as English 208.) Careful reading of Latin texts of graded difficulty, beginning with the Vulgate Bible, working through various patristic writings and medieval literature toward Latin of the Renaissance.
4 units, Win (McCormack)

ADVANCED COURSES

152. Petronius.
4 units, Spr (Davis)

153. Roman Satire.
4 units, Win (Courtney)

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.

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

175. Latin Style and Syntax—Course is designed to teach some of the nuances of Latin syntax and style. Classes will be devoted to

GRADUATE COURSES

201. Introduction to Classical Scholarship.
1 unit, Aut, Win, Spr (Wigodsky, Staff)

3 units, Aut, Win (Wigodsky, Davis)
TTh 10-11:30

205. Latin Language and Style.
3 units, Win, Spr (Courtney, Wigodsky)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1984-85 there were literary seminars in the following authors or topics: Cicero: Tusculans and De Officiis, Ovid's Amatory Poetry. The following courses and seminars will be offered in 1985-86. (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.
by arrangement

264. Ancient Rhetoric and Literary Criticism.
5 units, Spr (McCall)

270. Latin Prose or Verse Composition.
by arrangement

363. Lucretius.
5 units, Aut (Wigodsky) Th 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.

COURSES IN HEBREW

For courses in Hebrew, see Linguistics.

COURSES IN 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 COURSES

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—Course will study the heroic epics of Greece (Homer), Mesopotamia (Gilgamesh), England (Beowulf) and France (Roland) and discuss 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 (Edwards)

12. Greek Tragedy: Aeschylus, Sophocles, Euripides—(Same as Drama 151.) (DR:2)
4-5 units, Win (McCall)

13. Love in Classical Poetry—Interpretations of Greek and Latin love poetry in translation, with focus on cultural values and literary conventions; comparisons between ancient and modern conceptions of love; discussion of continuities and discontinuities in the Western tradition. Selection of authors includes Homer, Sappho, Catullus, Propertius, Vergil, Horace and Ovid.
3-4 units, Aut (Davis) MWF

21. Romantic Comedy and Popular Fiction: Euripides to Shakespeare—Course studies the experimental plays of Euripides and Shakespeare, explores their background in ancient and renaissance novels and folk tales. A wide selection of tale-types is introduced from collections such as the 1,001 Nights, which students practice by telling in class. (DR:2)
4 units, Spr (Winkler)

160. Individual Work.
by arrangement

PHILOSOPHY AND POLITICAL THEORY

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, Win (Staff)

8. Classical Politics—Lectures on the political philosophy of Plato and Aristotle and on their impact on political theory and practice in antiquity and in modern times. Reading of Plato’s Republic, Aristotle’s Politics, and related texts. (DR:3)
3 units, Aut (Raubitschek) MWF

9. Women in the Ancient World—(Same as Feminist Studies 163.) Identifies the image of the female in ancient myth and religion, and discusses the actual status of women at various periods of antiquity. In addition to ancient literature, readings include some modern feminist studies.
3 units, Win (Stephens)

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, Aut (Roberts) MWF

165. Hellenistic Philosophy—(Same as Philosophy 113.) The Epicurean and Stoic philosophers and their influence in Rome: the philosophical writings of Cicero and Seneca.
3-4 units, Spr (Wigodsky)

265. Hellenistic Philosophy—Same as 165 with extra work for graduate credit.
See also Philosophy 111, 112B, 211, 212B.

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 (Munn) MTWF

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) MTWTh

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) MTWTh
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 be deployed to explain how and why this happened. (DR:5)

5 units, Aut, (McCormack) MTWTh 11

111. Social and Economic History of Greece — (Same as History 104.)

3-4 units, Spr (de Ste-Croix)

160. Individual Work in Ancient History.

By arrangement

181. Roman Society in the Age of Cicero and Augustus— (Same as History 206B.) A discussion of the social structure, institutions, and mores of a pivotal and well-documented period of Roman history. Topics will include the composition and life-styles of the senatorial class; slaves, freedmen, and the lower classes; the ‘network’ systems of clientela and amicitia; marriage and concubinage. Students will exploit the available sources: contemporary letters, speeches and poetry, later literary works, inscriptions, and juristic writings.

4 units, Spr (Treggiari)

(Courses at the 200 level are mainly for graduate students.)

261. Individual Work in Greek History.

By arrangement

262. Individual Work in Roman History.

By arrangement

326A,B. Problems in Late Roman Republican History— (Same as History 305A,B.)

5 units, Aut, 2 units Win (Treggiari)

T 2:15-4:05

340. Early Christian Attitudes to Women, Sex and Marriage— (Same as History 303.)

5 units, Spr (de Ste-Croix)

RELIGION AND MYTHOLOGY

18. Greek Mythology— Topics will include Cosmology, the Herakles legend, the Underworld, Platonic myth-making, modern survivals, and the nature of myth itself. Readings will be supplemented with material drawn from Greek art and modern Greek folklore. (DR:3)

3-4 units, Aut (Rosenstock) MWF 11

ART AND ARCHAEOLOGY

See also Art 5, 100 A, B, C, D, 201.

14. Classical Athletics — 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. No prerequisites. (DR:5)

3 units, Win (Raubitschek)

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, Aut (Munn) TTh 2:15-4:15

108. Topography and Monuments of Greece — A survey of the principal cities, sanctuaries, and historical places from the Mycenaean era to the Roman period. This course is 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, Win (Munn)

109. The City of Athens— The history and archaeology of ancient Athens from the Bronze Age to the Roman period, focusing on the city in the time of Pericles and Socrates.

3-4 units, given 1986-87

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, Spr (Munn, van Andel) TTh 2:15-4:05

120. Greek Vase-Painting— (Same as Art 102.) A survey of Greek vases and their painters from the Protagorean 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) TTh 1-2:15
127. Archaeological Practicum.  
2 units, Aut, Win, Spr (Munn)  
F 2:15-4:05 Art Museum

160. Individual Work in Human Settlement and Landscape in the Aegean.  
by arrangement  
(Courses at the 200 level are mainly for graduate students.)

260. Individual Work in Human Settlement in Landscape in the Aegean.  
by arrangement

INDO-EUROPEAN LINGUISTICS

25. Creek and Latin Words in Medical Terminology—Study of the Greek and Latin roots of modern scientific vocabulary and of the origins and development of the English language. No foreign language required; recommended especially for pre-medical students.  
3 units, Spr (Devine) MW 2:15

3 units, (Devine) by arrangement

5 units, Aut (Decine) M 2:15-4:05

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,B. Introduction to Cosmology — (Same as History of Science 138 A,B,C and Philosophy 138 A,B,C.) A three-quarter sequence on the history of the exact sciences, with special emphasis on the field of cosmology. Technical aspects of the classical theories (Ptolemaic and Copernican), including mathematics, astronomy, physics, and chemical theory, together with the more speculative aspects in natural philosophy and theology. Completion of Classics 138A and 138B fulfills (DR:3) and (DR:6).  
138A. Ancient Period.  
4 units, Win (Knorr) MWF 1:15  
138B. Middle Ages to Newton.  
4 units, Spr (Knorr) MWF 1:15

COMMUNICATION

Emeriti: (Professors) Nathan Maccoby, Wilbur Schramm, (Adjunct Professor) Julian Blaustein, (Lecturer) Jules Dundes

Chairman: Elie Abel

Director, Institute for Communication Research: Donald F. Roberts

Director, John S. Knight Professional Journalism Fellowship Program: James V. Risser

Managing Director: Harry N. Press

Director, Mass Media Institute: Jules Dundes


Assistant Professor: Jeremy Cohen

Professors (Teaching): Ronald Alexander, Marion Lewenstein, James V. Risser

Associate Professor (Teaching): Kristine Samuelson

Adjunct Professor: Julian Blaustein

Lecturers: Jules Dundes, Harry Press

Consulting Professor: Edwin B. Parker, John Hulteng

Visiting Professor: Richard Carter

Visiting Assistant Professor: Albert Timms

The Department of Communication engages in research in communication and offers curricula leading to the A.B., A.M. and Ph.D. degrees. The Master of Arts degree prepares students for careers in print and broadcast journalism or documentary film or fiction screenwriting, or in applied communication research. The Ph.D. degree leads to careers in teaching and research or other related specialties.

The Institute for Communication Research is the research arm of the department and offers research experience to advanced Ph.D. students.

The John S. Knight Professional Journalism Fellowship Program brings promising mid-career journalists to study at the University in a non-degree program. Twelve U.S. journalists are joined by five "International Fellows" sponsored by Reuters and The German Marshall Fund.

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

Beginning with the 1984-85 academic year, all new undergraduate majors will 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 undergraduate curriculum is intended for liberal arts students who wish to build a fundamental knowledge of the communication function in society. 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 Communications Department, plus a course in statistics and a course in computer science (unless exempted from the latter). Not more than 12 units of transfer credit, or Summer Session credits may be applied to meet department requirements. The eight core courses equal 37 units. An additional 14 elective units must be taken within the Communications Department. In addition, the statistics course, offered in the Psychology, Statistics, and 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 their 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

   These three courses are pre-requisites, in varying combinations, for the remaining seven core courses, which may be taken in any sequence (as long as additional pre-requisites for certain courses are also met):
   2. a) Editorial Techniques 100 (pre-requisite: 1) Statistics; Computer Science)
   b) Mass Communication Theory 108 (pre-requisite: 1; Statistics; Computer Science)
   c) Research Methods 106 (pre-requisite: 1; Statistics; Computer Science)
   d) Introduction to Film and Video 114 (pre-requisite: 1 and 100)
   e) History of Journalism 140; or History of Film 141 (pre-requisite: 1 and 108)
   f) Contemporary Media and the Law 110 (pre-requisite: 1 and 108)
   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 of 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 (print or broadcast, Film (documentary production/writing or fiction screenwriting, 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 longer time, depending on the complexity of their film project. Students in the fiction screenwriting sequence are required to submit a script within two years of completion of coursework. 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 Film may concentrate in either documentary production and writing or fiction screenwriting. The documentary film production and writing sequence requires Communication 223A, B, C and 224A, B, C. The fiction screenwriting sequence requires Communication 211A, B, C and 212A, B, C. Courses in film aesthetics, history and criticism are also available. All students may select, in consultation with their advisors, other courses 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 Print and Broadcast Journalism master's program are required to take: Communication 200, 235, 252, 275, and 290. Students emphasizing print will take Communication 207 and 249; students emphasizing broadcasting will take Communication 210, 242A, 242B, and 242C. Students with undergraduate journalism training or media experience should check with their advisors to determine which of the above departmental courses could be replaced with electives.

The master's program in Applied Communication Research is a terminal program intended to train communication research practitioners in such fields of application as communication and national development, health communication, communication 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 (Statistics or Psychology 60, Communication 206, 252, 253, 267, 268, 313), 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, 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 specialization examinations by the completion of the third academic year of study.
3. Demonstrate proficiency in tools required in area of specialization. Chosen with the advice of the faculty, such tools may include foreign languages, statistics, computer programming, etc.
4. Complete both a master's research project (first-year project) and a pre-dissertation research project (second-year project).

5. Teach or assist in teaching at least two courses.

6. Have at least one year of work experience in the mass media or in another activity relevant to the area of specialization, prior to writing the dissertation.

7. Complete a dissertation satisfactory to an advisory committee of three or more faculty members and to the University Committee on the Graduate Division.

8. Pass the University oral examination, which may be either a comprehensive covering the same area as the written specialization examination or a defense of the dissertation.

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:

A. Communication 311A: Theory of Communication I

B. Communication 311B: Theory of Communication II

C. Communication 313: Computer Analysis of Communication Research Data

D. Communication 317: Doctoral Research Methods I

E. Communication 318: Doctoral Research Methods II

F. Communication 319: Doctoral Research Methods III

One of the following, two-quarter statistics sequences should be completed by the end of Winter Quarter in the first year:

A. Psychology 60: Statistical Methods

B. Statistics 160: Introduction to Statistical Methods I

C. Education 250A: Statistical Analysis in Educational Research

D. Any two equivalent courses

Students must also complete a third course which will advance their knowledge in a broad area of statistics, preferably in analysis of variance or multivariate analysis. Each of the following courses would satisfy the requirement:

A. Psychology 152: Analysis of Data

B. Statistics 201: Introduction to Data Analysis

C. Statistics 205: Introduction to Nonparametric Statistics

D. Statistics 206: Applied Multivariate Analysis

E. Education 250C: Statistical Analysis in Educational Research II

F. Education 250D: Statistical Analysis in Educational Research

G. 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:

A. Communication 397: First-year Research Project

B. Communication 398: Pre-dissertation Research Project

Depending on the area of Communication study the student chooses to emphasize, additional courses are selected, with the assistance of the advisor, from within the department's offerings and from other University departments. Requirements vary depending on the area emphasized.

Ph.D. candidacy expires five years after admission to candidacy by the University Committee on the Graduate Division. Reapplication will require reexamination.

Other programs leading toward the Ph.D. and involving communication may be pursued in the Graduate Division Special Programs. These are individually planned for unusually well-qualified students.

Ph.D. MINOR IN COMMUNICATION

Candidates for the degree of Doctor of Philosophy in other departments who elect a minor in Communication will be required to complete a minimum of 20 units of graduate courses in the Communication department, including a total of three theory or research methods courses,
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 which will be highly valued in applicants are high scholarship, training in the behavioral sciences (including training in statistics and research methodology), and training for or experience with the mass media. For further information write to the director.

MASS MEDIA INSTITUTE

During the Summer Quarter, the Department of Communication conducts a series of 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)
   *5 units, Aut (Cohen)
   sections by arrangement

100. Editorial Techniques I—A reporting and writing course emphasizing various forms of journalism: news, broadcast, interpretation, features, opinion. Detailed criticism of writing. Prerequisite: typing speed of 35 words a minute,
   *5 units, Aut (Rivers, Levenstein)
   Win (Rivers, Rüsser)
   Spr (Staff)
   Sum (Staff)

101. Film Aesthetics—(Graduate students register for 201.) A theoretical, historical examination of the nature of the film medium. Attention is given to the problems of aesthetics and communication from the viewpoints of the practitioner, the critic, and the audience.
   4 units, Spr (Breitrose)
   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 1985-86

   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.
   *4 units, Aut (Staff)

108. Mass Communication Theory—Mass media effects will be the main topics addressed in this course which is intended to 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 (Staff)

110. Contemporary 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. Prerequisites: 1 and 108.
   *5 units, Spr (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.

*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)

117. 16mm Film Production—A practical, hands-on course in 16mm film production to be taken concurrently with Comm. 118 by people who are 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 Comm. 114 and consent of instructor. Lab fee to be announced.

5 units, Spr (Alexander)

118. Advanced Film Writing and Directing for Documentary Films—Course will develop writing skills for the pre-production, production and post-production of visual media. Special emphasis will be placed 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, Comm. 117, taken concurrently. Prerequisites: successful completion of Comm. 114 and consent of instructor. Lab fee to be announced.

5 units, Spr (Alexander)

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. In addition to media ethics, the course deals with such current media problems as the dwindling of the journalistic channels, the changing roles of the media, media accountability, and the relationships between government and the media.

4 units (Rivers) given 1986-87

139. Literature of the Press—Readings from the writings of journalists—about their lives, about their work. Several basic readings for all students; additional readings by individual students for the purpose of leading seminar discussions. Ideas to be discussed: 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 10.

4 units, Win (Lewenstein) given 1986-87

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.

4 units, Win (Lewenstein)

141. History of Film — (Graduate students register for 241.) Studies in the development of the motion picture as an art form and a means of communication. Lab: Screenings of films announced in class.

4 units, Win (Staff) plus evening film showings

142A. Broadcast Journalism I—Writing, production and direction of radio and TV news. Prerequisites: 100 and consent of the instructor.

5 units, Aut (Staff) and lab by arrangement

142B. Broadcast Journalism II — Writing, production, and direction of radio and TV news. Prerequisites: 100 and consent of the instructor.

5 units, Win (Staff) and lab by arrangement

142C. Broadcasting in America—(Graduate students register for 242C.) The development of American broadcasting and its contemporary problems.

4 units, Spr (Breitrose)

144. Photojournalism—Introduction to the techniques of black and white still photography emphasizing approaches to the photo essay. The course will include an introduction to the works of the great documentary photographers.

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

157. Public Information Programs—(Graduate students register for 257.) Emphasizing health information programs and their effects on public knowledge, attitude, and behavior, this course also examines information programs concerned with energy conservation, environmental protection, educational and occupational opportunity, consumerism, etc. The in-
terplay of research and fieldwork will be analyzed in case studies of successful programs.

3 units, Spr (Staff)

158. Organizational Communication—(Graduate students register for 258.) Interpersonal and organization factors affecting communication efficiency in organizations. Topics include information processing, motivation, leadership styles, environmental uncertainty, and communication networks.

3 units, not given 1985-86

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 an examination of the relevant literature, questions of the role of the "organization" of the media in the formation of "news," "biases," and the "effects" of media on individual "agenda," attitudes and behaviors will be explored.

5 units, Win (Brody) not given 1985-86

167. Diffusion of Innovations—(Same as Values, Technology, Science and Society 172.) (Graduate students register for 267.) Course takes multidisciplinary approach to diffusion in business, education, law, government and consumer groups. Emphasis is on role of communication in spread of new technology, new ideas, and new values among individuals, within organizations, and among organizations in the U.S. and abroad. Special emphasis upon computer related innovations, energy conservation innovations and on scaling down in a limited-growth future.

3-4 units, Spr (Staff)

168. Formative Research for Message Design—(Graduate students register for 268.) Focuses on low-cost research methods for the systematic design of persuasive messages. Lectures and weekly assignments deal with setting behavioral objectives, identification of audience characteristics, assessment of information needs, selection of instructional strategy, production of draft messages, pre-testing of draft messages, utilization of messages, and feedback systems design.

3 units, Win (Breitrose)

169. Interactive Communication Technologies—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: 1.

*4 units, Spr (Staff)

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) not given 1985-86

175. Reporting of Public Affairs—Coverage of traditional news beats, such as police, city hall, education and courts as well as issue-oriented coverage of policy area beats. Prerequisite: 100.

5 units, Win (Rivers)

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. This seminar examines the new technologies that have transformed the global flows of news, economic data, cultural and technical information. Prerequisite: Communication 1. Seniors and graduate students in communication and international relations have first priority, with permission of instructor.

4 units, Win (Abel)

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. These classes will be organized around writing projects oriented toward the field of specialization.

4 units, Spr (Staff)

177A. Specialized Workshop: Opinion Writing—(Graduate students register for 277A.)

4 units, Spr (Abel)

177E. Specialized Workshop: Critical Writing— (Graduate students register for 277E.)

4 units, Spr (Staff)

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. Students examine the interplay between editorial and business decisions.

4 units, Spr (Lewenstein)
180. Film Criticism— (Graduate students register for 280.) An attempt to develop a critical view of film. Readings and discussion will consider models of artistic and literary criticism as points of comparison. The student will be introduced to journalistic, psychoanalytical, Marxist, structuralist and semiological approaches. Weekly reviews will stress the meaning of the films and a lucid writing style. Prerequisites: 100 and 101, or 141.
4 units, Spr (Breitrose) given 1986-87

185. Internship Experience—Professional experience in the media. Open only to Communication majors.
0 units for graduate students
1-4 units for undergraduate students
Aut, Win, Spr (Leuenstein)
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)

191. Individual Work—Major students with high academic standing are permitted to undertake individual work.
1-4 units, any quarter (Staff)
by arrangement

COURSES PRIMARILY FOR A.M. STUDENTS

200. Editorial Techniques I—A reporting and writing course emphasizing various forms of journalism: news, interpretation, features, opinion. Detailed criticism of writing. Prerequisite: typing speed of 35 words a minute. For graduate students.
5 units, Aut (Abel)

205S. Basic Film Production—Introduction to film writing and production techniques, covering the basics of cinematography, sound and editing.
9 units, Sum (Alexander)

201. Film Aesthetics—(Graduate section. See 101.)

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. With laboratory that includes editing copy. Associated Press, news evaluation and page make-up.
3 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. Contemporary 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)

211A. Screenwriting I—Introduction, through reading, discussions, and assignments, to screen and television writing. Prerequisite: to be taken concurrently with 212A. Admission by application to the master's program.
5 units, Aut (Blaustein)

211B. Screenwriting II—Development of material to form the basis of a full screenplay to be written for 211C. Follows 211A, which is a prerequisite. To be taken concurrently with 212B.
5 units, Win (Blaustein)

211C. Screenwriting III—Divided between seminar in more advanced writing and individual work with instructor on student's script. Prerequisites: 211B and consent of instructor.
5 units, Spr (Blaustein)

212A. Script Analysis I—First of one-year series required for master's in screenplays to implement the work in the 211 series. Both adaptations and original material will be used, and there will be screenings of films based on several of the scripts. To be taken concurrently with 211A. Admission by application to the master's program.
5 units, Aut (Blaustein)

212B. Script Analysis II—Continuation of 212A, which is a prerequisite.
5 units, Win (Blaustein)

212C. Script Analysis III—Continuation of 212B, which is a prerequisite.
5 units, Spr (Blaustein)

219. Survey Design and Analysis—Introduces the student to survey research via the design and execution of a survey instrument. If feasible the instrument will employ computer assisted telephone interviewing (CATI) technology as a means of illuminating the intersection of politics
and media. Limit 25 students; graduate students get first preference. Prerequisite: FS 203A, Statistics 60, Psychology 60, or equivalent.

5 units, Spr (Brody)

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. Primarily for A.M. students.

3 units, Sum (Dundes) MWF 11

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 is placed on conceptualizing and executing ideas for the production work done jointly with 224A. All aspects of preproduction at an introductory level will be 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, as well as practical training in fundraising and distribution. To be 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 16mm film in color utilizing synchronous sound. Project will be carried through postproduction 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.

3 units, Sum (Wallenstein)

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)

240. History of American Journalism — (Graduate section. See 140.)

241. History of Film — (Graduate section. See 141.)

242A. Broadcast Journalism I—Writing, delivery and direction of radio and TV news. Prerequisites: 200 and consent of instructor.

5 units, Aut (Staff)

plus lab by arrangement

242B. Broadcast Journalism II—Writing, direction and production of radio and television news. Prerequisites: 242A, and consent of instructor.

5 units, Win (Staff)

242C. Broadcasting in America — (Graduate section. See 142C.)
248. Interactive Videodisc: Research and Instructional Design—Interactive videodisc systems combine television's audio-visual quality with the interactivity of the microcomputer. Using laser technology, they have a huge storage capacity and can rapidly access television content in response to the user's input. Seminar covers research on the design and effectiveness of instructional videodiscs, paying special attention to interactive formatting, learner motivation and control, individualized feedback, and related research on instructional media including television, videotext, and computers. Enrollment limited to 15.

3 units, Aut (Lieberman)

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. The course will also be concerned with the regulation of the tele-communications industry by the FCC. Junior standing and above.

5 units, Spr (Franklin) MWF 11

250. Magazine Writing — (Graduate section. See 150.)

251. Communication and Development—Required for master's students specializing in Communication and National Development. A critical review of the literature on the causes of underdevelopment, the nature of development planning, and the potential and practice of mass media in Third World countries as a tool of transformation.

3-5 units, Aut (Staff)

252. Communication Theory and Social Change—Required for master's students specializing in Communication and National Development. A critical review of the literature on the causes of underdevelopment, the nature of development planning, and the potential and practice of mass media in Third World countries as a tool of transformation.

4 units, Win (Staff)

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 Spr, (Staff)

257. Public Information Programs — (Graduate section. See 157).

258. Organizational Communication — (Graduate section. See 158.)

259. Diffusion of Innovations — (Graduate section. See 167.)

268. Formative Research for Message Design — (Graduate section. See 168.)

269. Interactive Communication Technologies—(See 169.)

270. Communication and Children I — (Graduate section. See 170.)

271. Communication and Children II — (Graduate section. See 171.)

273. Communication and Health—Seminar on campaigns designed to change information attitudes and behavior with particular reference to health. Designed for graduate students in Communication. For others, consent of instructor. Not taught every year. Consult Time Schedule.

4 units, Spr (Staff)

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 (Lewenstein)

276. International Communication: Structures and Issues—(Graduate section. See 176.)

277. Specialized Workshops — (Graduate sections. See 177.)

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

COURSES PRIMARILY FOR PH.D. STUDENTS

311A. Theory of Communication—Approaches to communication theory; seminar and tutorial meetings; extensive reading and papers. Required of all Communication doctoral students; others by consent of instructor.

4-5 units, Aut (Staff)

311B. Theory of Communication—Continuation of 311A. Prerequisite: 311A.

4-5 units, Win (Staff)

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 nonexperiments. Previous or concurrent enrollment in statistics required.

4 units, Aut (Staff)

318. Doctoral Research Methods II — Continuation of 317. Sampling questionnaire design, attitude scale construction, survey administration, computer analysis of data.

4 units, Win (Staff)

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 (Staff)

370. Advanced Communication Theory and Method Seminar I — May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.

3 units, Aut (Staff) by arrangement

371. Advanced Communication Theory and Method Seminar II — May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.

3 units, Win (Staff) by arrangement

372. Advanced Communication Theory and Method Seminar III — May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.

3 units, Spr (Cohen) by arrangement

375. Communication Theory Review Seminar — Limited to Ph.D. students. Prerequisites: 311A, 311B.

3 units, Spr (Roberts) by arrangement


3-6 units, Aut, Win, Spr (Staff) by arrangement

398. Pre-Dissertation Research Project — Advanced research for Ph.D. candidates.

3-6 units, Aut, Win, Spr (Staff) by arrangement

399. Advanced Individual Work.

1-8 units, Aut, Win, Spr (Staff)

400. Dissertation Research.

6-10 units, Aut, Win, Spr (Staff) by arrangement

Committee in Charge: John Bender, David Wellbery (Co-Chairmen), Karl Berger, Russell Berman, N. Gregson Davis, Joseph Frank, John Freccero, René Girard, Herbert Lindenberger, Mary Pratt, Jeffrey Schnapp, William Todd, John Winkler

Professors: N. Gregson Davis (Classics and Comparative Literature), Gerald Gillespie (German Studies and Comparative Literature), David C. Halliburton (English, Comparative Literature, and Modern Thought and Literature), Herbert Lindenberger (Comparative Literature and English), James J. Y. Liu (Chinese and Comparative Literature), Charles R. Lyons (Drama and Comparative Literature), Makoto Ueda (Japanese and Comparative Literature)

Associate Professors: Mary Pratt (Spanish and Portuguese and Comparative Literature), William M. Todd III (Slavic 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. Students who think that they may wish to concentrate in Comparative Literature are urged to select Comparative Literature 21, 22, 23 to fulfill the Western Culture requirement.

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 literature.

6. One literature course—not necessarily in the original language—drawn from a cultural tradition distant from that of the student’s main areas of interest.

7. Two additional literature courses drawn from the following:
   a) Courses listed under Comparative Literature.
   b) Courses offered in translation by the foreign language departments in languages outside the student’s two languages.
   c) Advanced literature courses offered at the overseas campuses.

8. Honors essay—an essay in literary criticism (2 units, spring, 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
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 1986. Completed applications are due January 1, 1986. 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 half-time and one quarter at quarter time. Comparative Literature Fellows must complete what ever pedagogy courses are required by the departments in which they teach.

Minimum Course Requirements

1. Comparative Literature 369 (Major Modern Critics) and three additional seminars (or courses that assign a long paper) of a primarily comparative nature; at least one of these additional seminars must be on literary theory or criticism.

2. At least three graduate courses in each of two literatures other than the student’s native literature.

3. A sufficient number of courses in the student’s primary field to assure his or her knowledge of the basic works in one national literature from its beginnings until the present day.
Minimum course requirements must be completed before the student is scheduled to take the University oral examination. These requirements are kept to a minimum so that students will have sufficient opportunity to seek out new areas of interest.

Examination—The examination will consist of three sections, the last of which will constitute the University oral examination. Each student's reading lists for the examination must be approved by an examination committee. The examination will consist of the following sections, each of which takes the form of an oral colloquy between the student and a committee of faculty members with interests in the subject area of the particular section:

1. A literary genre, to consist of (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.

PhD MINOR IN COMPARATIVE LITERATURE

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.

1. **Introduction to Drama**—(Enroll in Drama 1.) Introduction to major dramatic forms, concentrating on selected masterpieces in order to develop theatrical sensibility in reading dramatic texts.
   
   4 units, Win (Esslin)

2. **The Age of Heroes**—(Enroll in Classics 11.) This course will study the heroic epics of Greece (Homer), Mesopotamia (Gilgamesh), England (Beowulf), and France (Roland) and discuss 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.
   
   3-4 units, Spr (Edwards)

3. **Creek Tragedy: Aeschylus, Sophocles, Euripides**—(Enroll in Classics 12.)
   
   4-5 units, Win (McCatt)

4. **Love in Classical Poetry**—(Enroll in Classics 13.) Interpretations of Greek and Latin love poetry in translation, with focus on cultural values and literary conventions; comparisons between ancient and modern conceptions of love; discussion of continuities and discontinuities in the western tradition. Selections of authors includes Homer, Sappho, Catullus, Propertius, Vergil, Horace, and Ovid.
   
   3-4 units, Aut (Davis)

5. **Romantic Comedy and Popular Fiction: Euripides to Shakespeare**—(Enroll in Classics 21.) This course studies the experimental plays of Euripides and Shakespeare, explores their background in ancient and renaissance novels and folktales. A wide selection of tale-types is introduced from collections such as _1,001 Nights_, which students practice by telling in class.
   
   4 units, Spr (Winkler)

61,62,63. **Western Thought and Literature**—An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.

61. **The World of Classic Antiquity**—(Enroll in Humanities Special Programs 61.) Homer, Bible, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Virgil, Seneca, Ovid.
   
   5 units, Aut (Edwards, McCall, Staff)

62. **Christian and Secular Europe: Medieval and Renaissance**—(Enroll in Humanities Special Programs 62.) St. Augustine, Boethius, Aquinas, Medieval romance, Dante, More, Machiavelli, Luther, Montaigne, Cervantes, Galileo, Shakespeare, Milton.
   
   5 units, Win (Evans, Staff)

63. **From the Enlightenment to the Present**—(Enroll in Humanities Special Programs 63.) Voltaire, Darwin, Marx, Freud, Dostoevsky, Rousseau, Conrad, Woolf, Faulkner, and selected 19th and 20th century poems.
   
   5 units, Spr (Chace, Staff)

90. **Introduction to the Humanities**—(Enroll in Humanities Special Programs 90.) Basic themes and issues of the humanities as treated in important works. From various humanistic disciplines, including texts from the Western Culture courses that are re-examined in greater depth. Prerequisite: Completion of the Western Culture requirement. Honors majors given preference in enrollment.
   
   5 units, Aut (Lindenberger)
   
   Spr (Ryan)

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, Win (Ueda)

   
   4 units, Spr (Cohn)

136A. **European Thought in the 19th Century**—(Enroll in History 136A.) Great thinkers and major movements of the 19th century, particularly romanticism, liberalism, Marxism and the origins of modern irrationalism, seminal writings of Burke, Mill, Marx, Ruskin and Nietzsche.
   
   5 units, Spr (Cohn)

145. **The Spanish Republic, the Civil War and the Aftermath**—(Enroll in Spanish and Portuguese 145.) Examines various cultural aspects of the period from the Second Republic to the
en of Juan Carlos I (1932-present) paying particular attention to 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 other topics that will be studied.

3-5 units, Spr (Sutherland)

160. The Humanistic Imagination: Marx, Nietzsche, and Freud—(Enroll in English 160.)
5 units, Aut (Saldívar)

194. Literature and the Humanities—(Enroll in Humanities Special Programs 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)

208. Autobiography and Literature: Gender and Genre—(Enroll in Modern Thought and Literature 208.) A study of Western autobiography from its self-conscious inception at the end of the eighteenth century until the present. Focus will be upon the similarities and differences between the writing of women and men inscribing their life stories. Special attention paid to recent critical theory on autobiography as a modern literary form and as an historical document. Readings selected from: Rousseau, Goethe, George Sand, Harriet Martineau, John Stuart Mill, Elizabeth Cady Stanton, Mary McCarthy, Simone de Beauvoir, Jean-Paul Sartre, Anne Moody, and Maxine Hong Kingston.
5 units, Win (Yalom, Bell)

213. Literary Theory and The Golden Age Comedia—(Enroll in Spanish and Portuguese 213.) Course sets out to propose 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 Gold Age comedia would be helpful, but it is not a requirement. The texts used will be those which also have been translated into English. Where there are no translations, translated extracts will be provided.
3-5 units (Wynter)

214. Studies in Medieval Literature—(Enroll in Spanish and Portuguese 214.) 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.
3-4 units (Sutherland)

215. Women in Early Spanish Literature—(Enroll in Spanish and Portuguese 215.) Study works by Spain's early women writers, among them Leonor López, Teresa de Cartagena, Florencia Pinar, Santa Teresa, and Maria de Zayas. Treatises directed to women, La formación de la mujer cristiana and La perfecta casada, will also be discussed.
3-5 units (Sutherland)

230. Russian Formalism and Structuralism — (Enroll in Slavic Languages and Literatures 230.) The Russian Formalists' contribution to literary criticism and theory; the relationship of Russian Formalism to critical movements in the West; the Prague School, and the Russian Structuralists. No knowledge of Russian is required, but knowledge of Russian, French, German, or Czech is highly desirable.
4 units (Brown) given 1986-87

4 units, Win (Harrison)

241A-243A. 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 English 1985-86).

241A. 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 (Wellbery)

242. Seminar on Medieval Italian Literature—(Enroll in French and Italian 242.)
4 units, Spr (Freccero)

242A. Deutsche Geistesgeschichte II — (Enroll in German Studies 242.) From Hegel to Nietzsche. The outlines of Hegel's phenomenology and his model of historical develop-
ment as the becoming-conscious of freedom. The transformations of this model in the cultural criticism of Heine, the anthropology of Feuerbach and the dialectical materialism of Marx and Engels. Nietzsche's radical critique of the idea of the nature of man and of his historical self-actualization.

3-5 units, Win (Wellbery)

243A. 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 be discussed in order to indicate possible applications to literary theory.

3-5 units, Spr (Wellbery)

246. The Divine Comedy in Translation— (Enroll in French and Italian 246.) For students unfamiliar with the poem or the Italian language.

4 units, Aut (Schrapp)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought and Cultural Worlds— (Enroll in Spanish and Portuguese 248, Same as African and Afro-American Studies 248.) This course provides 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)

254. Romantic and Early Realistic Drama— (Enroll in Drama 254.)

5 units, Spr (Esslin)

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, Win (Ueda) given 1986-87

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 (Liu) given 1986-87

263C. Feminist Literary Criticism: Theory and Practice— (Enroll in English 263G.) The development of feminist approaches to the study of literature with emphasis on the significance of feminist theory to the practice of criticism.

5 units, Spr (B. Gelpi)

264A. Contemporary Narrative Theory: an Introduction— (Enroll in English 264A.) A close reading of selected texts from the classic period of British and American fiction in light of narrative models developed by such theorists of fictional form as Vladimir Propp, A. J. Greimas, Roland Barthes, Tzvetan Todorov, René Girard, Peter Brooks, and Shoshana Felman. Background reading and classroom discussion of recent trends in structuralism, deconstruction, and post-Freudian psychoanalysis will set the stage for our study of such exemplary texts as Fielding's Joseph Andrews, Bronte's Wuthering Heights, Dickens's Great Expectations, Poe's The Case of M. Valdemar, James's The Turn of the Screw, and Conrad's Heart of Darkness.

5 units, Spr (Stewart)

265. Seminar on Italian Renaissance Epic— (Enroll in French and Italian 265.)

4 units, Aut (Springer)

267. Freud and Literary Criticism— (Enroll in English 267.) The application of Freudian and post-Freudian psychological theory to the study of literature. Reading of several works by Freud (e.g. The Interpretation of Dreams) and examination of recent adaptations of Freudian ideas by literary critics. Enrollment limited; permission of instructor required.

5 units, Aut (Castle)

273A. European Novel I: Renaissance Heritage— (Enroll in German Studies 273A.) Theory and practice of prose fiction in Europe from Rabelais and Cervantes to the Enlightenment period, study of the evolution of form, subject matter, and terminology in the romance and novel; special attention to the humorous, encyclopedic, picturesque, quester, and adventure modes in British, French, German, Spanish, and Italian literature. The relevance of post-Romantic theory (e.g., Todorov, Barthes, Warning, Genette, Bakhtin, Meyer) to pre-Romantic fictions.

3-5 units, Aut (Gillespie)

274A. European Novel II: Sentiment, Education, and the Crisis of Development— (Enroll in German Studies 274A.) The emergence of psychological and confessional models from Mme de La Fayette to Goethe; special attention
to the novel as vehicle for the concept of Bildung (formation, education) in such major authors as Fielding, attacks on eighteenth-century norms by radicals such as de Sade, pre-Romantic anxieties as experienced by Rousseau and others, and the revolution of fiction in Sterne. The eighteenth century in the light of modernist and contemporary critiques of Western "consciousness" and the archeology of knowledge (e.g., Nietzsche, De Man, Foucault).

3-5 units, Win (Gillespie)

275. Fascism and Culture: The Fascist Avant Garde—(Enroll in French and Italian 275.)

4 units, Win (Schnapp)

275A. European Novel III: The Romantics—(Enroll in German Studies 275A.) Readings from American, English, French, German, and Italian romantic authors. Romantic theory and practice of the novel, with special emphasis on genres and modes (sentimental, confessional, educational, arabeous, gothic, horrific, etc.) in relation to major concepts (antihero, artist problem, ego, "double," the detective story, over-soul, romantic irony, etc.) Applications of semiotic analysis and discourse theory to Romantic writing and Romantic self-criticism.

3-5 units, Spr (Gillespie) given 1986-87

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. Such topics as the transition from Romantic Realism to Positivism and Naturalism, the rise of the historic 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, Caldos.

3-5 units, Win (Gillespie) given 1986-87

277. Literature of Decadence—(Enroll in German Studies 277.) 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 (Gillespie) given 1986-87

279. The European Novel—(Enroll in French and Italian 279.) Self and other in the European novel from Chrétien de Troyes to Virginia Woolf (The Waves). The novel and the end of the philosophical subject; Sartre, phenomenology and beyond.

4 units, Win (Girard)

280. Graduate Seminar: Theory of Narrative—(Enroll in Slavic Languages and Literatures 300.) Studies of narrative (fictional, historical, sacred) as verbal structure, representation, rhetoric, and social institution. Readings will include theoretical writings by Jakobson, Barthes, Bakhtin, Iser, Lukács, and others. Discussions will analyze these readings and relate them to selected works of Russian and European literature. A seminar for graduate and advanced undergraduate students. Pre-requisite: consent of instructor.

4-5 units, Spr (Todd)

280B. Graduate Seminar: Theater as Model of Self and Society in Russian 19th Century Literature—(Enroll in Slavic Languages and Literatures 300B.)

4 units (Frenkel) given 1986-87
301. Colloquium: Studies in the Intellectual History of the Middle Ages—(Enroll in English 301.)
5 units, Win (Howard)

306. Introduction to Literary Theory and Criticism—(Enroll in Spanish and Portuguese 306.) Initial readings in the major currents of 20th century literary theory and criticism. Course is roughly chronological, beginning with the Russian Formalists, and moving on to Bakhtin, Auerbach, reader response, feminist criticism, marxist approaches, semiotics. All readings in English. Can be taken as a continuing course with Spanish 307.
4-5 units, Win (Pratt)

307. Readings in Latin American Criticism—(Enroll in Spanish and Portuguese 307.) Selections from the principal figures in Latin American literary and cultural studies. Course will be organized around topics such as modernismo, the dictator novel, indigenismo, mass culture, the politics of the vanguard.
4-5 units, Aut (Pratt)

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 Frye, Lukács, Benjamin, Auerbach, Bathes, and Derrida.
5 units, Aut (Lindenberger)

307B. Colloquium: Post-Modern Fiction: American and European—(Enroll in English 307B.) Discussion and investigation of works by writers who have extended the classic modern tradition. Readings of such authors as William Burroughs, Robert Creeley, Samuel Beckett, Aidan Higgins, Claude Mauriac, Robert Pinget, Italo Calvino, Juan Cottiisolo, Julio Cortazar, Nicholas Mosley, and Milan Kundern.
5 units, Win (Pratt)

310. Discourse and Ideology—(Enroll in Spanish and Portuguese 310.) The 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 determining meaning, discursive practices in the French tradition, British empirical analyses, American sociolinguistics.
4-5 units, Aut (Pratt)

315. The Grail—(Enroll in French and Italian 315.)
4 units, Win (Cazelles)

345. Marxism and Literary Criticism—(Enroll in German Studies 345.) An introduction to important issues and figures in Marxist literary criticism. Themes such as ideology, alienation, commodity exchange, and the social function of culture will be discussed with reference to the works of figures including Lukács, Adorno, Benjamin, and Brecht. The contemporary debate on the institutional character of literature (Bürger) as well as the contributions of critics outside the German tradition (Goldman, Eagleton, Jameson) will be treated.
3-5 units, Win (Berman)

348. Topics in Contemporary Criticism—(Enroll in German Studies 348.) Discussion of current debates in literary theory and methodology.
3-5 units, Spr (Berman, Wellbery)

349G. The Young Goethe—(Enroll in German Studies 349G.) Course will consider the works of Goethe prior to the Italian journey with special emphasis on Werther, Götz von Berlichingen, the Urfaust, and lyric poetry. Attention will be given to new developments in Goethe research and to the relevance of current methodological debates to the study of Goethe's work.
3-5 units, Aut (Wellbery)

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 1986-87

352. Seminar: Comedy—(Enroll in Drama 352.)
5 units, Win

354B. Semiotics of Drama—(Enroll in Drama 354B.)
5 units, Spr (Esslin)

361. Seminar: The Modern Tradition—(Enroll in English 361.) 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)
Seminar: Medieval and Renaissance Romance—(Enroll in English 362.) 5 units, Spr (Bloomfield)

Freud and Literary Theory—(Enroll in French and Italian 396.) Freud on individual desire, crowds and social organization. The Oedipus complex and the Father of the Horde. The influence of Freud on contemporary French and American theory. 4 units, Aut (Girard)

Emeriti: (Professors) George B. Dantzig, John G. Herriot, (Professor, Research) Arthur Samuel
Chairman: Nils J. Nilsson
Assistant Chairman for Undergraduate Education: Stuart T. Reges
Associate Professors: Joseph E. Oliger, Terry Winograd
Assistant Professors: David Cheriton, Michael Genesereth, Manolis G. H. Katevenis, Keith A. Lantz, Ernst Mayr, Paul Rosenbloom
Professors (Research): Thomas Binford, Bruce C. Buchanan
Associate Professor (Research): Gino Wiederhold
Associate Professor (Teaching): Charles A. Bigelow

Affiliated Associate Professors: John T. Gill, III (Electrical Engineering), John Hennessy (Electrical Engineering), Susan A. Awick (Electrical Engineering), Edward H. Shortliffe (Medicine), Fouad A. Tobagi (Electrical Engineering)

Consulting Professor: Forest Baskett
Consulting Associate Professors: Richard P. Gabriel, Barbara J. Giosz, Stanley J. Rosenfield
Consulting Assistant Professors: John Y. Halpern, Fernando C. N. Pereira

Industrial Lectureships: Daniel Bobrow, Johann de Kleer, Kenneth Kahn, Sanjay Mittal, Mark Stefik, John Williams

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 many sponsored research projects use the Information Technology Systems (I.T.S.) 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 and ACIS.

Score is a DECsystem-2060 running the TOPS-20 operating system. It includes 2048K words of main memory and 2.2 billion bytes of online storage. Score is predominantly used for departmental research.

SAIL is a DECsystem-1080 running the WATTS timesharing operating system. SAIL supports 64 local display consoles, plus other local and remote terminals. The SAIL facility includes two central processors, 20304K words of main memory, and 1.6 billion bytes of disk storage. SAIL is operated by the Computer Science Department. Users include members of the Electrical Engineering, Mechanical Engineering, Mathematics, and Psychology Departments.

Sushi is a DECsystem-2060 running to PS-20. It includes 1024k words of main memory and 1.1 billion bytes of disk storage. Sushi is available to all 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 intelligence to biomedicine. SUMEX operates a large DECSYSTEM 2060, a 2020, a VAX 11/780, and more than twenty personal Lisp machines. Students doing research in appropriate areas may be granted access to SUMEX.

The Computer Science Department also operates several SUN workstations, Xerox Alto personal computers, linked together by the Ethernet communications network.

The departmental policy on providing computer access to its students is flexible and evolv-
ing. At present, Ph.D. students are generally offered accounts on Score, SAIL, and the Altos and unsupported master's students are offered Sushi accounts with access to other systems as needed.

The VAX 11/780 called Navajo is used for research in large-scale numerical problems and for general departmental use. There are other VAX computers associated with specific research projects.

In addition to these systems, various other facilities are present in the department. Among these are a variety of Hewlett-Packard systems and several kinds of personal work stations.

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.

PROGRAMS

Although Stanford does not offer an undergraduate degree in Computer Science, such a degree is presently being planned. Undergraduates interested in this area should also see listings under the departments of Electrical Engineering and Mathematical and Computational Science in this bulletin.

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 (CSMS) and the M.S. in Computer Science: Artificial Intelligence (CSAI). The CSAI program differs from the standard CSMS 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.

MASTER OF SCIENCE IN

COMPUTER SCIENCE

The degree "Master of Science in Computer Science" (CSMS) is intended as a professional degree and does not lead to the Ph.D. degree. Students planning to obtain the Ph.D. degree should apply directly for admission to the Ph.D. program.

Applications for admission to the Master of Science program must be received by January 1. Exceptions are made for applicants to the CSMS program who are either Honors Coop applicants or who are already students at Stanford. These applications will be considered each quarter for the next. Information on deadlines is available from the department.

PROGRAM REQUIREMENTS

A candidate is required to complete a program of 42 units of courses numbered 100 or greater. 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 from courses listed in Requirements 1 and 2. This means that 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 108A, CS 108B, CS 108C, CS112; CS22 (for Specialization 5 only).

2. The following core courses or their equivalents must be completed: CS212; CS223A; CS237A; CS242; CS243; CS246; CS254 or CS257A; CS261; Math 120 or Math 120S. 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 CSMS 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 CSMS degree. CS500, CS510, CS520, CS522, CS527, CS540, CS545.

A program of 21 units in an area of specialization must be completed. All courses in this area must be taken for letter grades. Five 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. CS393 (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 244A, CS 245, CS 312A or CS 312B, CS 346, EE 271.
   b) At least 9 units selected from the remainder of the previous group and the following courses: CS 248, CS 265, CS 318, CS 340, CS 342, CS 343, CS 344, CS 345, CS 446, EE 183, EE 272A, EE 272B, EE 281, EE 288, EE 312, EE 374, EE 466, EE 467.

3. Software Theory
   b) At least 9 units from the following courses: CS 244, CS 245, CS 340, CS 342, CS 343, CS 344, CS 345, CS 346, CS 446.

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 456, OR 340A.

5. Symbolic and Heuristic Computation
   a) The following courses: CS 254, CS 257A, CS 257B, CS 306.
   b) At least 12 units from the following courses: CS 233A, CS 223B, CS 275, CS 276, CS 326, CS 327A, CS 327B, CS 327C, CS 329, CS 523; no more than one of CS 328A, CS 328B, CS 328C.

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 Tom Binford, Bruce Buchanan (Chairman), Bill Clancey, Ed Feigenbaum, Mike Genesereth, and Paul Rosenbloom.

The CSAI program will begin in Autumn Quarter each year. Normally, a student will spend two years in the program. Each quarter the student will register half-time (9 units) and serve as a research or teaching assistant half-time (20 hours per week). The first year will involve acquiring the fundamental concepts and tools through course work and project involvement. During the second year, the student will implement and document a substantial 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.

PROGRAM 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): required are CS 223A and CS 223B. The other courses may be chosen from CS 275, CS 276, CS 326, CS 327, 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 243; CS 245; CS 246; CS 312.

3. Theoretical computer science (3 units): choose one course from: CS 257A or CS 306.

4. Practicum (27 units) CS 393 or CS 499. 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
2. Each student, to remain in the Ph.D. program, must meet the following requirements:

   a. To remain in the Ph.D. program, a student must pass a comprehensive exam. The exam covers six major areas as follows: digital systems (hardware), artificial intelligence, numerical analysis, programming systems (software), mathematical theory of computation, and analysis of algorithms. Once a student passes the exam, he or she will be evaluated for 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 Assistant for Academic Affairs has further details.

   b. The student must complete a coherent program of study covering the basic areas of computer science and related disciplines. The student must also demonstrate satisfactory quarterly progress on an AI research project.

   c. Each program that deviates 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.

   d. 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.

   e. 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. The comprehensive exam has two sections, the written exam and the programming project. The written exam covers six major areas as follows: digital systems (hardware), artificial intelligence, numerical analysis, programming systems (software), mathematical theory of computation, and analysis of algorithms. 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 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.

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 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 $7,551 for the nine-month year. Some may work full time in the summer for approximately $1,678 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 should not plan on being appointed to an assistantship.

Students with NSF fellowships and traineeships may have the opportunity to supplement their stipends by serving as graduate student assistants.

GUIDE TO SELECTING INTRODUCTORY COMPUTER SCIENCE 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 106H. These courses provide training adequate for the occasional use of computer programs 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 and CS 105B. These courses cover a certain amount of the material in CS 106, 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 basic computer skills for tasks unrelated to programming should take CS1. Various sections of CS1 are oriented towards different styles and brands of computers.

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:

To learn Computer Science—CS 106X, CS 108A, CS 108B, CS 108C
COURSES FOR UNDERGRADUATE STUDENTS

Note on Computer Science course numbers. The Computer Science Department has just made major changes to the numbers of its courses, effective in Autumn 1985. A guide for converting old numbers to the new ones is available from the department secretary.

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 will examine the DEC-20 timesharing system available at the LOTS Computing Center. Section B will examine the DEC Professional 350 microcomputer. Section C will examine the Apple Macintosh microcomputer. And Section D will examine the IBM PC. Sections will be offered when appropriate staff are available to teach them, as listed in the Time Schedule. Students can take more than one section for credit, but may not repeat the same section.

1 unit, by arrangement

3. Programming in FORTRAN—An introduction to FORTRAN for students with experience in programming in a high-level programming language other than BASIC. Prerequisite: 105B, 106A, or equivalent.

2 units, Aut, Spr (Staff) MWF 12, first 8 weeks only

4. Programming in Pascal—A shortened alternative to 105A and B or 106A, for students with previous knowledge of computer programming. Not intended for students with a knowledge of Pascal. Prerequisite: knowledge of a computer programming language other than BASIC.

2 units, Aut, Spr (Staff) MWF 12, first 8 weeks only

Sum (Staff)

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 (Staff) by arrangement

60. Discrete Mathematics—Introduction to the mathematics used in computer science. Topics include: symbolic logic, induction, relations, permutations, set theory, trees, graphs, groups, boolean algebras, and lattices.

3 units, Aut (Staff) MWF 1:15

75. Computers and Language—(Same as Linguistics 35.) A basis for understanding computer use dealing with language and implications of computer systems in everyday life situations. Introduces basic principles of computing and linguistics through lectures, films, discussions and demonstrations of existing systems. Term paper required. Students will not be assumed to have prior computer background. Enrollment limited. (DR:4) or (DR:8)

5 units, Spr (Winograd) MWF 10

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

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. No prerequisite. (DR:8)

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

105A,B. Introduction to Computers—Two-quarter sequence designed for non-technical majors to develop a working knowledge of computers as they are utilized in our society. Different from 101 as it requires considerable interaction between student and computer. 105 is both a programming course and an issues course, taught to be comprehensible by students without a strong math and/or technical background.
Students are given options to complete either programs or projects. Pascal programming language 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. 105A and B together provide the same coverage of programming as 106A. Students in technical fields are encouraged to take 106. Prerequisite: Mathematics 3 or equivalent. Recommended: IA. (DR:8)

105A. *4 units, Aut (Staff) MWF 10, 1:15
Win (Staff) MWF 10, 1:15
Spr (Staff) MWF 10, 1:15
Sum (Staff) MTWTh 10

105B. *4 units, Aut (Staff) MWF 10, 1:15
Win (Staff) MWF 10, 1:15
Spr (Staff) MWF 10, 1:15
Sum (Staff) MTWTh 10

106A,B. Introduction to Software Engineering—(Formerly 106 and 107, same as Engineering 070A.) This two-quarter sequence gives a broad overview of the engineering of computer applications. The course is divided into 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; modules; object oriented design; and writing adaptable code. In the computer science portion students will examine recursion and analysis techniques that predict memory and time usage of algorithms. In the applications portion of the course students will 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: 4, 105AB, 106H, 106X. Prerequisite for 106A: Mathematics 3 or equivalent; recommended: CSCI A. Prerequisite for 106B: old 106 or 106A or 106H.

106A. (DR:8)
*5 units, Aut (Reges) MWF 9
Win (Staff) MWF 9, 2:15
Spr (Staff) MWF 9, 2:15
Sum (Staff) MTWTh 9, 11

106B. *5 units, Win (Reges) MWF 2:15
Spr (Staff) MWF 2:15
Sum (Staff) MTWTh 2:15


*5 units, Aut (Floyd) MWF 2:15

106X. Introduction to Software Engineering (Accelerated)—(Same as Engineering 70X.) Covers the programming and software engineering concepts of 106A,B in one quarter. It is intended as preparation for 108A,B,C, for students whose previous programming experience is sufficient to help them cover this fundamental material more rapidly. Prerequisite: Mathematics 3 or equivalent.

5 units, Spr (Reges) MWF 9

107. Systematic Programming—(Note: This course is being phased out in favor of the new 106B course. Students who can wait until Winter are advised to take the new 106B instead.) Introduction to systematic program design, use of a variety of data structures, recursion, manipulation of text. Records and pointers. Notions of program correctness and testing. Modularization, portability, and good programming practice. CS 107 is intended as a second course in programming for the practicing scientist or engineer. Prerequisites: 4, 105B, 106 or equivalent; knowledge of most of Pascal.

*5 units, Aut (Theodorou) MWF 2:15

108A,B,C. Fundamentals of Computer Science—Three-quarter introduction to mathematics and science underlying computer programming, intended for students who plan to do advanced work. Topics include: logic, graph theory, matrices, functions, relations, binary arithmetic, finite automata, formal languages, program verification, abstract data types, recursive algorithms, logic, and proof; these form a mathematical basis for the engineering and understanding of good computer programs. Further topics include: models of computation such as Turing machines, the organization of a simple digital computer, machine language and assembly language, efficiency analyses of recursive algorithms, runtime representation of data structures, memory management issues, binding and allocation, coroutines, input-output processing, interrupts. A brief exposure to various continuing areas of Computer Science such as computer architecture, programming lan-
guages, algorithms, data structures, numerical analysis, and operating systems. The course is divided into both a lecture and a small-group lab. Students will write substantial programming projects in the laboratory part of the course. Different laboratory sections will be offered, each with a different orientation and, therefore, a different set of programming problems. Some sections will be oriented towards computer science majors and other sections will be oriented towards students in other disciplines. This course includes the material of CS60, so students are advised not to take both.

Prerequisite: 106B or 106X or old 107.

108A. (DR:6)
5 units, Aut (Reid) MWF 10

108B. 5 units, Win (Reid) MWF 10
108C. 5 units, Win (Reid) MWF 10


3 units, Aut (Manning)
Win (Staff)

123. Introduction to Artificial Intelligence—Artificial Intelligence (AI) is the part of computer science that studies the symbolic representation of knowledge for computer use, and the symbolic inference processes used for reasoning with the knowledge. This course is a basic introduction to AI concepts and methods for problem solving, planning hypothesis formation; knowledge representation; knowledge acquisition (learning); perceptual behaviors; and AI's programming methodologies and tools. Applications of AI will be used illustratively. AI programming will not be taught or done. Prerequisite: 22, 105 A and B, 106, or equivalent. A reading knowledge of LISP will be useful but is not required.

3 units, Spr (Feigenbaum) TTh 1:15-2:30

135. Numerical Methods—This survey course is designed to acquaint students in science and engineering with methods and techniques for solving scientific problems of a mathematical type on digital computers. Emphasis is given to practical problems and pragmatics. Program libraries are studied and used. Problems to be discussed include interpolation and approximation of data, solution of differential equations, numerical integration, solution of linear and nonlinear systems of equations, fast Fourier transforms. Pitfalls in automatic computation and their remedies are discussed. 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. Object-Oriented Design with Ada—Introduction to the principles of software engineering and object oriented design using the Ada programming language. The process of specification, implementation and verification 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: 107 or 108B. 3 units, Win (Gorin) TTh 11-12:15

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. Attend biweekly lectures on system software and work as the on-duty LOTS consultant. Interested students should talk to the Student Coordinator at LOTS. 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 specific 105 or 106 course. Attend three weekly meetings to discuss introductory courses in general, the specific course in particular, and techniques
implement programming projects covering a variety of system architectures and techniques for knowledge acquisition and explanation.

2 or 3 units, Spr (Genesereth)

TTh 9:30-10:45

237A,B,C. Numerical Analysis—This three-quarter sequence is 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 if they wish. 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 area 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 5B or 106; Mathematics 113 (C.S. 237C has the additional prerequisite of Mathematics 130); or equivalents.

237A. 3 units, Aut (Dahlquist) MWF 2:15

237B. 3 units, Win (Golub) MWF 2:15

237C. 3 units, Spr (Oliger) MWF 2:15

242. Programming Languages—Introduction to several programming languages, such as LISP, Ada, Snobol, APL, PROLOG, and/or Simula. Comparison of issues in programming language design, and language features that result from them. Runtime representation of data and control constructs. Memory management issues, recursion, binding and allocation, scoping, parameter passing mechanisms, compilation vs. interpretation, modules and classes, abstract data types, exception handling. Several programming assignments, each in a different language, will be given; emphasis will be on proper use of the features and facilities of each language and its runtime system. Prerequisites: 108A; knowledge of Pascal and machine language.

3 units, Aut (Linton) (Enroll in Electrical Engineering 285.)

Spr (Owicki) (Enroll in Electrical Engineering 285.)
243. Compilers—(Enroll in Electrical Engineering 283.) 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: 242. 3 units, Win (Linton)

244. Computer Networks: Architecture and Implementation—Motivations and objectives of computer networks; overview of network architectures; layered architectures and the ISO Reference Model; network functions. Circuit-switching and packet-switching; physical level protocols; data link protocols including HDLC and multiaccess link control. Network control, transport, and session protocols including routing, flow control; end-to-end communication and internetworking. Presentation layer protocols including virtual terminal and file transfer protocols, cryptography, and text compression. Specific examples and standards will be cited throughout the course for point-to-point, satellite, packet radio, and local networks. Prerequisite: 246 or equivalent; may be taken as corequisite.

3 units, (Cheriton) TTh 11-12:15
Win (Tobagi) (Enroll in Electrical Engineering 354.)


3 units, Win (Wiederhold) MWF 11


4 units, Aut (Lantz) TTh 1:15
Win (Linton) (Enroll in Electrical Engineering 286.)

248. Computer Graphics—Topics in computer graphics: display technology, transformations, graphics coordinate systems, color representation, hidden surface elimination, shading and light-source simulation, input device technology, human engineering, animation graphics, structured display files, three-dimensional representation, anti-aliasing, calligraphic and raster graphics issues. Specific implementations cited throughout. Prerequisite: ability to learn and use the computer languages necessary for graphics programming.

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


3 units, 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. No prerequisites.

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

257B. Deductive Systems—A continuation of CS257A. A description of formal logical systems oriented toward automated deduction and theorem proving. Special emphasis on topics relevant to the synthesis, verification, and transformation of computer programs, and to logic programming. Well-founded induction; theory of expressions and substitutions; resolution; unification; skolemization; deductive tableaux. Prerequisite: 257A.

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

260. Concrete Mathematics—Finite difference calculus; manipulation of sums and products; properties of binomial coefficients, Stirling numbers, harmonic numbers, Fibonacci numbers; use of generating functions to solve recurrence relations; asymptotic expansions; analysis of algorithms. An emphasis on obtaining simple closed-form answers to problems when it is possible. Prerequisites: Mathematics 22, 42, or equivalent.

3 units, Aut (Staff) MWF 1:15


3 units, Aut (Ullman) MWF 3:15
Spr (Staff) MWF 3:15

261N. Introduction to NP-Completeness—
Nondeterministic computation; Turing machines and their polynomial-time equivalence to real computers; reducibilities among problems; Cook's theorem; examples of NP-complete problems. (Students participate in approximately the last third of 261.)

1 unit, Aut (Ullman) MWF 3:15
Spr (Staff) MWF 3:15


3 units, Win (Floyd) MWF 3:15


3 units, Win (Pratt) MWF 3:15

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)

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; queueing 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 (Tobagi)

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, Shortliffe, Wiederhold) TTh 2:15

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. No prerequisites.

3 units, Win (Shortliffe) 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. Prerequisites: 271A.

2-4 units, Spr (Fagan, Shortliffe, Buchanan) TTh 12:15

273 Concepts of Text—(Same as Art 281.)
What every literate person should know about the basic principles of the visual organization of text. Subjects include handwriting, typewriting, typography, and computerized documents. Perceptual, linguistic, and semiological issues will be discussed. Course work will consist primarily of visual exercises. No prerequisites.

3 units, Aut (Bigelow) F

275. Computational Models for the Syntax of Natural Language—(Same as Linguistics 227.)
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.

3 or 4 units, Win (Winograd) MWF 10

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 or 4 units, Win (Winograd) alternate years, given 1986-87

277. Computational Models of Discourse—
(Same as Linguistics 236.) Text and conversa-
tion structure. Computational theories of anaphora, focus, and information structure. Plans and speech acts. Use of world knowledge and reasoning in computer analysis and generation of discourse.

3 or 4 units, Spr (Staff)

COURSES 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 2:45-4:45

304. Problem 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 (Majr) TTh 11:00-12:15

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: 106B or equivalent ability to program.
3 units, Aut, (McCarthy) TTh 1:15-2:30

309. Industrial Lectureships in Computer Science—Each quarter the Computer Science 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. Prolog and Natural Language Analysis—Introduces the logic programming language Prolog as a tool for natural language analysis and related topics in artificial intelligence, through a progression of natural language analysis examples. No previous experience with logic programming or natural language analysis is required. The following topics will be discussed: representing context-free grammars in Prolog; definite clause grammars; the logical variable; difference lists; top-down parsing and the Prolog execution model; syntactic analysis of complex constructions; semantic translation rules and logical form; general computations in grammars; structure manipulation and multistage analysis; operations on logical forms; deductive question-answering in Prolog; metalevel computation and the embedding of grammar formalisms in Prolog; extralogical operations; implementation of alternative parsing algorithms; the organization of a natural-language question-answering system. Examples will be available as running Prolog programs and will be used for exercises. Prerequisites: elementary notions of logic, formal language theory, and symbolic computation.
3 units, Aut (Pereira)

309B. Functional Programming—Current research topics in the design and implementation of functional programming languages, including formal semantic models, rewriting rules and the algebra of problems, abstract data types, program transformations, infinite sequences, and the use of stream-valued stream functions to accommodate persistent memory and interactive input/output. The particular language FP will be studied in depth, with examples drawn from other functional languages such as SASL, ML, KRC, and Hope. Prerequisite: a graduate-level course in programming languages.
3 units, Win (Williams)

309C. Programming Languages for AI Systems—The design of programming languages to provide computational mechanisms for AI research and expert systems. Topics include object-oriented and access-oriented programming; logic programming; unification algorithms; representation of dependencies, contexts and layers; representations of assumptions; algorithms for truth maintenance; constraints; meta-circular interpreters; architectures for reflection. Prerequisite: Working familiarity with LISP.
3 units, Spr (Bobrow, de Kleer, Kahn, Mittal, Stiefik)

312A. Processor Design: ALU and Its Control—(Enroll in Electrical Engineering 382A.) Data representation, integers, floating point and residue representation. Bounds on arithmetic speed, algorithms for high speed addition, multiplication and division. Pipeline arithmetic. Implementation and control issues using PLA's and microprogramming control. Prerequisites: 112 (E.E. 182) or equivalent.
3 units, Win (Flynn, Lundstrom)

312B. Processor Design: Memory Hierarchy and Control Unit Design—(Enroll in Electrical Engineering 382B.) Cache and main memory design, virtual storage system. Instruction decoding and timing. Pipeline execution and interlocks. Instruction set characteristics.
317. Fault Tolerant Computing Systems—

3 units, Spr (McCluskey)

318. Testing Aspects of Computer Systems—

3 units, Spr (McCluskey)

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

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 Psychology 106, Computer Science 223A, or equivalent experience.

3 units, Spr (Rosenbloom) MW 9:30-10:45

36. 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) alternate years, given 1986-87

267A. Introduction to Robotics and Computer Vision—(Enroll in Mechanical Engineering 219.) An introduction to the basics of robot 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, applications, locomotion. Knowledge of matrix algebra and some familiarity with basic control theory and rigid body mechanics suggested.

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

327B. Introduction to Robotics and Computer Vision—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: both 327A and 327B, or both 223A and 223B.

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 instructors and limited to 15. Prerequisites: advanced undergraduate standing and either 223, Psychology 106, or equivalent experience.

2 or 3 units, Aut (Pavel, Gluck) alternate years, given 1986-87

328B. Applying Cognitive Psychology to Computer Systems—(Enroll in Psychology 286.)
This course surveys broad issues in applying psychology to various domains with emphasis on computer-user interaction. The emphasis is on using models of human abilities and limitations in solving real problems. The course 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, Spr (Pavel)
alternate years, given 1986-87

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 (Staff) 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 237B.

3 units, Aut (Oliger)

337B. Advanced Numerical Analysis—Solution of linear problems: linear equations, iterative methods for large sparse systems; linear programming, linearization of nonlinear problems. Prerequisites: 237A and 237B.

3 units, Win (Staff)

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. Particular attention will be paid to the implementation of methods and to realistic applications. Prerequisites: 237C and 237B.

3 units, Spr (Staff)

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 237B.

3 units, Aut (Staff) MWF 11
alternate years, given 1986-87

338B. Advanced Topics in Numerical Analysis—The algebraic eigenvalue problem: perturbation theory, numerical algorithms for dense and sparse matrices; error analysis; special applications; inverse problems. Prerequisites: 237A and 237C.

3 units, Win (Staff) MWF 11
alternate years, given 1986-87

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, given 1986-87

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. Topics in Concurrent Programming—(Enroll in Electrical Engineering 483.) Current research topics in the exploitation of concurrency in computations for microprocessors, distributed systems, and highly concurrent machines. Subjects that may be covered include programming language features and implementation, formal models, and the match between algorithms and architecture. Prerequisite: 246 (E. E. 286).

2-4 units, Aut (Owicki)
alternate years, given 1986-87

342. Programming Language Design—Exposure to the problems of programming l
guage 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 units, Aut (Reid)

alternate years, given 1986-87

343. Advanced Compilers — (Enroll in Electrical Engineering 383.) Lectures and discussion explore implementation issues in depth. Major focus on optimization techniques and advanced code generation. A significant project will be included. Prerequisite: 243 (EE. 283).

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 (Tobagi)

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; concurrent operations on the database. Query optimization and concurrency control for distributed database systems. Prerequisites: A familiarity with file organization, as in 245, and with predicate calculus, as in 257A, will be assumed.

3 units, Spr (Tobagi) MWF 11

346. Advanced Operating Systems — In-depth treatment of selected topics in operating system design. Emphasis will be on topics not covered in 246, such as naming and binding, protection, reliability, distributed system issues, user interfaces, construction strategies, modeling and performance evaluation, system management, and portability. Significant project will be included. Prerequisite: 246 (EE. 286).

3-6 units, Win (Cheriton) TTh 1:15-2:30

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)

351. Introduction to Complexity Theory—Basic machine models and complexity measures, their properties and relationships. Diagonalization; reduction; complete problems. Concrete representative problems for the most important complexity classes (logspace, nlogspace, P, NP, Fspace). Complexity of decision procedures for first-order logics like Presburger Arithmetic or finitely generated commutative semigroups.

3 units, Aut (Papadimitriou)


3 units, Aut (Pratt) TTh 9:30-10:45

357. Advanced Theory of Computation—Topics in the theory of programs, including the semantics of programming languages, formalization and proof of properties of programs, modal and temporal logics of programs, and the theory of concurrent programs. Prerequisite: 257A or equivalent.

3 units, Spr (Staff)


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 (Yao) TTh 1:15-2:30

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, Win (Staff) TTh 11-12:15

363B. Combinatorial Algorithms — Scheduling, flow analysis, graph separators and applications, concentrators, boolean networks, sorting networks, computation in groups, linear and integer programming, vertex elimination and sparse systems, approximation algorithms for NP-complete problems. Prerequisites: 261, 262, 263, or equivalents.

3 units, Aut (Staff)


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


3 units, Spr (Yao)


3 units, Aut (Yao)

367A. Parallel Computation — Parallel machine models, parallel computation thesis, interconnection networks, properties of VLSI layouts, area-time tradeoffs and lower bounds, sorting, routing, and other basic algorithms and their efficient implementation in VLSI and multiprocessor networks. Prerequisites: 261, 264, and 351, or equivalents.

3 units, Win (Mayr)

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; parallel scheduling. Prerequisite: 367A or equivalent.

3 units, Spr (Ullman)

368. Computational Geometry — Develops skills in 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. Specific topics may vary from year to year, including such things as: convex hulls; subdivisions; point location; intersection and containment; range searching. Recommended: 261.

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

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. In close cooperation with participating physicians, 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 Eco
nomics Systems 231 or equivalent and some familiarity with computer programming. No formal medical background is required.

3 units, Spr (Holtzman) M 3:15-5:30


3 units, Aut (Winograd)

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

393. Computer Laboratory—A substantial computer program is designed and implemented. A detailed written report is required. Recommended as preparation for dissertation research. Intended for graduate students of Computer Science; consent of instructor required. Register using the section number associated with the instructor.

any quarter (Staff) by arrangement

399. Independent Project.

any quarter (Staff) by arrangement

446. Distributed Systems—Motivation for distributed systems; basic architecture model; review of layered protocols; interprocess communication and synchronization; naming; protection; reliable operation, atomic transactions, multiple copy update, and error recovery; decentralized control; debugging, testing, and measurement; hardware issues. Specific implementations will be cited throughout the course. Significant project will be included. Prerequisite: 346.

3 units, Spr (Staff)

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. Artificial Intelligence Seminar.

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


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: 223A, 223B, and consent of instructor.

3 units, Win (Staff)

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

528. Learning in Man and Machine—(Same as Psychology 295.) Computational methods of learning, covering relevant current research in both artificial intelligence and cognitive psychology. Intended for graduate students in both fields. Students give presentations in class on weekly readings and submit, as a final paper, a proposal for a research project. Prerequisites: Previous training in either cognitive psychology or artificial intelligence.

2 or 3 units, Win (Bower, Rosenbloom, Cluck) by arrangement


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

1-3 units, (Staff) by arrangement

1-3 units (Staff) by arrangement

575. Artificial Intelligence and Language Seminar.
1-3 units (Staff) by arrangement

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.

Emeriti: (Professor) Wendell Cole, (Associate Professors) Helen W. Schrader, H. Donald Winbigler, Elisabeth Buckingham, (Adjunct Professor) Evelyn M. Draper, (Assistant Professor) Naomi Wragge
Chairman: Charles R. Lyons
Professors: Martin Esslin, Charles R. Lyons (Drama and Comparative Literature), Eleanor Prosser (Drama and English), Douglas A. Russell, Carl Weber
Associate Professor: William S. Eddelman
Assistant Professors: 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

The requirements for the degree of Bachelor of Arts with a major in Drama are planned to integrate the critical and historical study of drama with the study and experience of performance. The major provides aesthetic and critical opportunities for students to develop special aptitudes. For example, a student may elect an emphasis in acting, directing, and design. Students are encouraged to declare their major in their sophomore year.

The core program required of all majors:

1. Acting. Fundamentals of Acting: Drama 120A.
2. Literature and Criticism. Three courses to be chosen from the following: Drama 150-159. Students may substitute one course in dramatic literature at 100 level or above from another department.
3. Theatre History. History of the Theater: Drama 160 or Drama 161.
4. Design and Production. Introduction to Design and Production: Drama 30 and Drama 31; and one of the following courses: 130A, 131A, 132A, 133A.
5. Performance. Each major must complete a minimum of 8 units in laboratory courses in departmental theater productions to be divided between Drama 29 and Drama 39 with a minimum of 6 units in Drama 39; 2 units each in sets, costumes and lighting.
6. 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 PROGRAM IN 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 an honors essay, the work for which will normally begin in Spring Quarter of the junior year and be completed by the end of Winter Quarter of the senior year. To enter this program, the student must be accepted by a member of the department who will agree to advise him or her on the essay. In considering an applicant for such a project, the advisor 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 drama.

Normally the student will prepare the Honors Essay proposal in Spring Quarter of the junior year (registering in Drama 200, “Honors Essay Proposal,” 1-3 units). Upon 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 assigned a second reader. The Senior Honors Essay will be written under the guidance of the advisor during the Autumn and Winter quarters of the senior year. For each quarter, the student should register in Drama 201, “Senior Honors Essay,” for 3-5 units. The essay should be completed no later than the first week of the student’s last quarter before graduation. All honors projects should extend over at least two academic quarters and must receive no less than 8 units of academic credit, up to a maximum of 15 units.

Upon successful completion of the essay, candidates for Honors will be awarded “Honors,” “High Honors,” or “Highest Honors.”

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. 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 theater history and design.

Applicants for the Ph.D. program should write directly to the Department of Drama for information and applications. In addition to the required statement of purpose, all applicants must submit a statement detailing their practical theater experience and a sample of their written critical work. Applicants for the program in design and theater history must also submit a portfolio. Graduate students in the Department of Drama begin their course of studies in the Autumn Quarter of each academic year; there are no mid-year admissions. All graduate students must be degree candidates.

University regulations regarding this degree are discussed in the “Degrees” section in this bulletin. The following departmental requirements are in addition to the University’s basic requirements for the doctorate.

UNITS AND COURSE REQUIREMENTS

1. A minimum of 72 units of graduate courses and seminars in support of the degree in addition to the doctoral dissertation.
2. The course sequence in research and criticism (300 and 301).
3. The course sequence in design (230, 231, 232) to be completed by the end of the second year.
4. A minimum of four seminars in dramatic literature, theater history, or critical theory. One of the graduate seminars is to be taken outside of the Department of Drama.
5. Two years in the series in directing. Students in criticism/directing must complete
the first-year and second-year workshop in directing (370A, B, C and 371A, B, C) and a third-year production project (372). Students in history/design must complete the series of advanced design courses (330A, 330B, 330C) and a third-year in design project (331).

LANGUAGE REQUIREMENTS

The candidate must demonstrate reading knowledge of two foreign languages in both of which there is a major body of dramatic literature. The language requirement may be fulfilled in any of the following ways:

1. Achievement of a sufficiently high score (70th percentile) on the foreign language examination prepared by the Educational Testing Service. Latin and Greek are not tested by ETS.
2. A reading examination given each quarter by the various language departments, except for Latin and Greek.
3. Passage with a grade of B or higher of a course in literature numbered 100 or higher in a foreign language department at Stanford.

The requirement in one language is to be met by the end of the first year. The requirement in the other language must be met by the end of the third year.

TEACHING REQUIREMENT

Three quarters of supervised teaching at half-time and one quarter at quarter time, are a required part of the Ph.D. program. The requirement is normally met by assisting a faculty member for one quarter during the first year, by teaching two courses during the second year, and by teaching one during the third.

EXAMINATIONS

The candidate must complete four examinations, three written and one oral, by the end of Winter Quarter of the third year. Examinations are offered annually in each of the following periods of dramatic literature:

- Classical
- Medieval and Renaissance
- Neoclassical
- Romantic and early realistic
- Modern, 1870-1918
- Contemporary, 1918 to the present

Students in the criticism/directing program will be required to take the examinations in Classical, Medieval and Renaissance, and Modern drama. The fourth examination will be of the student’s choice. Students in the theater history/design program will be required to take two examinations in theater history and one in design. The fourth examination will be in one of the periods of dramatic literature, the specific period to be defined in consultation with his or her adviser and approved by the departmental Graduate Study Committee. The core reading list of dramatic texts for each period is available. Each student, however, is to submit a critical bibliography to his or her adviser 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 adviser, and (2) a dissertation prospectus. Both the field of concentration and a rough draft of the prospectus must be approved by the candidate’s adviser and by the departmental Graduate Study Committee by the end of Spring Quarter of the third year.

APPLICATION FOR CANDIDACY

By the end of the second year of residence, the following requirements must be completed:

1. The course sequence in research and criticism, the course sequence in design, and two years of advanced directing and/or design.
2. One language.
3. At least two examinations.

Based on its evaluation of the student’s progress, the Graduate Study Committee will certify the student’s qualifications for candidacy. Upon favorable action, the student will file formal application for candidacy, as prescribed by the University, by the end of Spring Quarter.

DISSERTATION

Normally, this program should be completed in four years. The first year should be devoted to full-time graduate study; the second and third years to graduate study and teaching; the fourth year to writing the dissertation. Following formal admission to candidacy, the dissertation
must be completed and approved with five years from the quarter in which candidacy is granted. A candidate taking more than five years will be required to reinstate his or her candidacy by re-passing the written examinations on dramatic literature.

FELLOWSHIPS

The Department of Drama awards a number of fellowships to graduate students in the Ph.D. program. Procedures for applying for financial aid are included in the admission packet. The appropriate financial aid application must be filed by January 15.

SUMMER SESSION

A special brochure is available, with full details of courses given in the summer by the Department of Drama.

INTRODUCTORY COURSES

Courses number 1 through 99 are introductory courses open to all students. Although they include basic courses required of the major, they are designed also for the student whose major is undeclared or is not in Drama.

1. Introduction to Drama—Introduction to major dramatic forms, concentrating on selected masterpieces in order to develop theatrical sensibility in reading dramatic texts. (DR:2)
   4 units, Win (Lyons) MWF 9

2. Introduction to Theatrical Style—An introductory course in the development of theatrical style and in the major periods of western culture presented through slides, lectures, and discussions. (DR:2)
   4 units, Aut (Russell) MWF 1:15

5. Introduction to Black American Drama—Introductory course tracing the development of Black Drama in the United States; its literature and performing companies, from 1858-1969.
   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.
   3 units, Aut, Win, Spr (Staff)
   MW 12:45-2 or TTh 12:45-2

   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. No prerequisites.
   3 units, Aut (Valenzuela) MW 4:15-6:05
   Beginning; TTh 4:15-6:05 Advanced

27B. Continuation of basic movement and improvisational skills for the actor. Explore the meaning of words, emotions, imagination through poetry and plays. No prerequisites.
   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. No prerequisites.
   3 units, Spr (Valenzuela) MW 4:15-6:05
   Beginning; TTh 4:15-6:05 Advanced

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 the undergraduate to the theatrical arts and crafts of scenic design, and costume design.
   5 units, Aut (Russell, Wilson) MWF 11
   plus lab by arrangement

31. Introduction to Stagecraft and Lighting Design—A lecture-laboratory course in practical aspects of theatrical production. Emphasis will be given to a survey of production processes and standard production techniques.
   5 units, Spr (Ramsaur, Stewart) TTh 10-12

32. Costume Construction—The basic craft of drafting and constructing costumes. May be repeated for credit.
   4 units, Aut (Cleveland)
   TTh 1:15-3:05 plus lab dhr

33. Theater Graphics.
   4 units, Aut (Stewart) MW 10-12

34. Stage Management—A project course for students who are stage managing a production, or who would like to learn the process of stage management.
   1-5 units, any quarter (Stewart)
   by arrangement

35. Sound Design for the Stage.
   4 units, Spr (Stewart) MW 10-12

39. Theater Performance: Crew—Students may receive credit for the participation in the design and technical areas of departmental productions (set and costume construction, lighting, properties). The number of units received is determined by the instructor. Prerequisite: consent of instructor. May be repeated for credit.
   1-5 units, any quarter (Stewart)
   by arrangement
INTERMEDIATE COURSES

Courses number 100-199 are intermediate courses designed primarily for the major but open to all undergraduates who have the necessary prerequisites.

120A, B, C. Fundamentals of Acting—An introduction to the elements of self-awareness, characterization, and theatrical expression for the beginning actor. Prerequisite: sophomore standing or consent of instructor. 120A, B, C must be taken in sequence.

120A. 4 units, Aut (Ryan, Weber) TTh 10-12, TTh 1:15-3:05, or MW 10-12
4 units, Win (Weber) TTh 1:15-3:05

120B. 4 units, Win (Ryan, Weber) TTh 10-12, TTh 1:15-3:05, or MW 10-12
4 units, Spr (Weber) TTh 10-12
Prerequisite: 120A or consent of instructor

120C. 4 units, Spr (Ryan, Weber) TTh 10-12 or MW 10-12
Prerequisite: 120B

121A. Acting Workshop—Training in the problems of the actor as a theatrical instrument and the extension of these techniques to the level of interpretation. May be repeated for credit. Prerequisites: 120A, B, C or consent of instructor.

121A. Improvisation.
4 units, Spr (Ryan) MW 1:15-3:05

121B. Advanced Scene Study.
4 units, Spr (Ryan) MW 10-12
and 1 hour by arrangement

121C. Advanced Scene Study.
4 units, Spr (Weber) TTh 1:15-3:05

123. Audition Techniques.
4 units Aut (Ryan) M 2:15-5:05

124. Psychology and Drama: Identity and Role—Same as Psychology 170. Practicum.
3 units, Win (Ryan, Zimbardo) M 2:15-5:05, W 4-5

127. Movement Demonstration Course for Actors—A demonstration of movement for the actor based on body alignment, breath, feeling, motive and imagination. The technical craft of movement will be designed as ritual. Improvisations will also be stressed using words to be interpreted with spontaneous movement and words. Choreographing Sonnets as well as scenes from Shakespeare’s works. Course should end with a final showing for the public.
2 units, Win (Valenzuela) TTh 4:15-6:05

128. Theatrical Makeup.
2 units, Win (Strayer) W 2:15-4:05

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 presentational techniques including floor plans, elevations, sketches, and models. Ongoing projects. Prerequisite: 30, 33 or consent of instructor.
4 units, Win (Wilson) T 1:15-4:05, plus lab by arrangement

130B. Scenic Design II—Advanced work in the designing of scenery with an emphasis on mechanical perspective, color rendering, and scale model building. Weekly assignments and ongoing projects. Prerequisite: 130A.
4 units, Spr (Wilson) T 1:15-4:05, plus lab by arrangement

130C. Scenic Painting—Basic painting techniques used in the scenic studio to translate scaled designers’ elevations into finished scenery. Weekly assignments and ongoing projects. Prerequisite: 30 or consent of instructor.
4 units, Aut (Wilson) F 1:15-4:05, plus lab by arrangement

131A, B, C. Lighting Design.

131A. Stage Lighting Mechanics—A lecture-lab course dealing with all practical aspects of lighting: electricity, light sources, instrumentation, control, and design process.
4 units, Aut (Staff) TTh 10-12 and lab by arrangement

131B. Stage Lighting Aesthetics—A laboratory discussion course concentrating on the aesthetic principles of lighting design; interpretation, concept, process, and practice. Lighting designers for departmental one-acts, dorm shows, and community productions will be assigned from this class. Prerequisite: 131A.
4 units, Spr (Ramsaur) TTh 10-12

131C. Advanced Stage Lighting Design—The course will include projects in lighting mechanics and lighting design resolved through experimentation, class discussion and written report, and through practical
application in dorm shows and other community productions. Lighting designers for major departmental productions will be assigned from this class. Prerequisite: 131A and 131B.

1-4 units, Aut, Win, Spr (Staff) by arrangement

132A,B,C. Costume Design—Visual analysis of historical styles of costume design interpreted for the modern theater and developed by the student in various presentational media.

132A. Costume Design—A discussion-laboratory course in basic techniques of designing and historical stage costumes. Weekly design assignments.
4 units, Aut (Russell) T 10-12

132B. Costume Design—A course in the aesthetics of costume design with weekly design assignments.
4 units, Win (Russell) T 10-12

132C. Advanced Costume Design—Advanced design projects with an emphasis on more complex costume design problems presented weekly for analysis and discussion.
4 units, Spr (Russell) by arrangement

133A,B,C. Technical Production. Prerequisite: Drama 31.

133A. Stagecraft—A lecture-lab course in basic production practices. The student will have the opportunity to learn and practice the theory and use of standard tools and materials used in stage scenery construction.
4 units, Aut (Stewart) MW 10-12

133B. Advanced Technical Production—Projects in advanced technical production practices, resolved with experimentation, drawings, and written reports. Technical directors for major departmental productions may be assigned from this class. Prerequisite: Drama 133A and 133B, or consent of instructor.
1-5 units, any quarter (Staff) by arrangement

135. Project in Design and Technical Theater—Project in stage design, costume design, lighting design, or stage managing. Prerequisite: consent of instructor.
1-5 units, any quarter (Staff) by arrangement

140. Workshop in Playwriting.
5 units, Win (Lyons) TTh 10-12

141. Great Directors in the Theater—An examination of the styles and techniques of the leading directors from the emergence of the function to Brook and Grotowsky.
4 units, Win (Esslin) MW 1:15

150. Contemporary Black Playwrights—(DR:5)
5 units, Win (Richards) MWF 1:15

151. Greek Tragedy: Aeschylus, Sophocles, Euripides.—(Same as Classics 12.) (DR:2)
4-5 units, Win (McCall)

152. Medieval and Renaissance Drama—(DR:2)
5 units, alternate years, given 1986-87

153. Neoclassic Drama.
5 units (Staff)

154. Romantic and Early Realistic Drama.
5 units Spr (Esslin) MWF 9

155. Modern Drama 1870-1918—(DR:2)
5 units, alternate years, given 1986-87

156. Contemporary Drama from 1918.
5 units (Esslin) alternate years, given 1986-87

157. American Drama (1920-1950)—(DR:2)
5 units, Aut (Richards) MWF 1:15

158. American Women Playwrights.
5 units, (Richards) alternate years, given 1986-87

159A,B,C. Shakespeare—(Same as English 173ABC.)

159A. 5 units, Aut (Ryan)
159B. 5 units, Win (Rebholz)
159C. 5 units, Spr (Orgel)

160. History of Theater—Classical Greece to the Eighteenth Century.
4 units (Eddelman) alternate years, given 1986-87

161. History of the Theater—Nineteenth and Twentieth Centuries.
4 units, Spr (Eddelman) MWF 10

162. History of Costume and Fashion—A lecture-survey course in the history of dress in the Western World from ancient times to the present.
4 units (Russell) MWF 11 alternate years, given 1986-87

170. Introduction to Directing—Prerequisites: 120A,B,C or consent of instructor.
4 units, Spr TTh 4:15-6:05

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

1-3 units, any quarter by arrangement
199. Senior Honors Essay.
   6-10 units (during 2 quarters)
   by arrangement

**ADVANCED COURSES**

Courses numbered 200-299 are designed for advanced undergraduates and graduates.

230. Scene Design for Graduate Directors.
   4 units, Aut (Wilson) Th 1:15-4:05

231. Lighting Design for Graduate Directors
   —(Same as 131C.)
   4 units, Spr (Ramsaur) TTh 10-12

232. Costume Design for Graduate Directors
   —(Same as 132B.)
   4 units, Win (Russell) T 10-12

235. Projects in Design and Technical Production.
   1-5 units, any quarter (Staff)

240. Workshop in Playwriting.
   5 units, Win (Lyons) TTh 10-12

250. Contemporary Black Playwrights—(See Drama 150.)
   5 units, (Richards)

251. Greek Drama—(See Drama 151.)
   5 units

252. Medieval and Renaissance Drama—(See Drama 152.)
   5 units,

253. Neoclassic Drama—(See Drama 153.)
   5 units (Staff)

254. Romantic and Early Realistic Drama—
   (See Drama 154.)
   5 units (Staff)

255. Modern Drama (1870-1918)—(See Drama 155.)
   5 units (Esslin)

256. Contemporary Drama from 1918—(See Drama 156.)
   5 units (Esslin)

   5 units, Aut (Richards) MWF 1:15

258. American Women Playwrights.
   5 units, (Richards)
   alternate years, given 1986-87

260. History of Theater—Classical Greece to
   the Eighteenth Century.
   4 units, Aut (Eddelman)
   alternate years, given 1986-87

261. History of Theater—Nineteenth and
   Twentieth Centuries.
   4 units, Spr (Eddelman) MWF 10

262. History of Costume and Fashion.
   4 units, Win (Russell) MWF 11

270. Independent Project in Directing—Pre-
   requisite: Drama 170 and approval of depart-
   ment of Drama curriculum and academic policy
   committee.
   2-5 units, any quarter (Staff)
   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**

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

301. Research in Theater Methods: Theater History.
   5 unit, Win (Eddelman, Russell)
   MW 2:15-4:05

330A,B,C. Design Workshop — Advanced
   course in design for the theatre.

330A. 5 units, Aut (Eddelman, Ramsaur,
   Russell, Wilson) by arrangement

330B. 5 units, Win (Eddelman, Ramsaur,
   Russell, Wilson) by arrangement

330C. 5 units, Spr (Eddelman, Ramsaur,
   Russell, Wilson) by arrangement

331. Design Project—Design of a full-length
   production in conjunction with directing
   project (Drama 372).
   5 units, any quarter (Eddelman,
   Ramsaur, Russell, Wilson)
   by arrangement

350. Seminar in Greek Drama.
   5 units (Lyons)
   alternate years, given 1986-87

351A. Seminar: Samuel Beckett.
   5 units, Win (Eddelman) MWF 10-12

352. Seminar: Comedy.
   5 units, Win (Lyons) TTh 2:15-4:05

354A. Seminar: Twentieth Century Aesthet-
   ics.
   5 units, Aut (Eddelman) MW 2:15-4:05

354B. Seminar: Semiotics of Drama.
   5 units, Spr (Eddelman) MW 10-12

370A,B,C. Directing Workshop I—Investiga-
   tion of basic directional problems in scenes.
   using a multi-form theatre space, design-
   ing actor/audience relationships and composi-
modular scenic units. Performances limited to class. Prerequisite: consent of instructor.

370A. 5 units, Aut (Weber) by arrangement
370B. 5 units, Win (Weber) by arrangement
370C. 5 units, Spr (Staff) 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

372. Directing Project—Production of full-length play. Public performances. 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

CENTER FOR EAST ASIAN STUDIES

Director of the Center: Albert E. Dien

Affiliated Faculty:


Art: John La Plante, D. Michael Sullivan (Emeritus), Melinda Takeuchi

Asian Languages: Yin Chuang, Albert E. Dien, Thomas W. Hare, Kung-yi Kao, Hiroyasu Kubota, Ian Levy (on leave Spring), James J. V. Liu (on leave Autumn), William A. Lyell, Susan K. Matisoff (on leave Autumn), Kinue Nishimura Nebrig, David S. Nivison (on leave Spring), Hiroshi Sakamoto, Dorothy Shou, Makoto Ueda, John C.Y. Wang (on leave Winter and Spring)

Business: Richard T. Pastace

Economics: Masahiko Aoki, John G. Gurley, Lawrence Lau

Education: David Grossman, Robert B. Textor (on leave Autumn)

Food Research Institute: Terry Sicular

History: Prasenjit Duara (Mellon Fellow), Peter Duus, Harold L. Kahn, Mark I. Man- ccall, Jeffrey P. Mass, Lyman P. Van Slyke (on leave 1985-86)

Linguistics: William J. Poser (on leave Spring)

Philosophy: David S. Nivison (on leave Spring)

Political Science: Nobutaka Ike, John W. Lewis, Daniel Okimoto, Robert E. Ward

Religious Studies: Harvey B. Aronson, Carl Bielefeldt (on leave Autumn and Winter), Robert Buswell, Anne Klein, David S. Nivison (on leave Spring), Lee H. Yearley

In addition, a number of other Stanford faculty have some teaching or research interests related to East Asia: Takeshi Amemiya (Economics), Walter P. Falcon (Food Research), William B. Gould (Law), Robert D. Hess (Education), Bruce F. Johnston (Food Research), Dudley Kirk (Emeritus, Food Research), Ramon Myers (Hoover Institution), 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) 497-3362.
dent 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 as a senior essay in East Asian Studies. Insofar as possible, the essay should integrate the substantive concentration. It may be written for one of the courses offered as part of that concentration or in connection with directed individual study with the approval of the student's major advisor. In the latter case, up to 5 units of individual study may be credited toward the substantive concentration.

**HONORS PROGRAM**

Majors with a grade-average of 3.25 or better in all courses related to East Asia may apply for the honors program, preferably no later than the final quarter of the junior year. Application entails submitting an honors prospectus to the student's advisor for approval. Admission is granted by the subcommittee on the A.B. Program, acting on the advisor’s recommendation.

Honors requirements are satisfactory completion of (1) an honors thesis of high quality, approximately 40 typewritten pages in length, to be submitted in lieu of the senior essay otherwise required for the major, (2) 5-10 units of directed individual study in connection with the thesis project, and (3) one advanced-level colloquium or seminar treating China, Japan, or both.

**COTERMINAL DEGREE**

The Center for East Asian Studies will admit a limited number of undergraduates to work for a coterminal A.M. in East Asian Studies. Applications for admission to this program should be submitted 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 380, Stanford University, Stanford, California 94305. The deadline for applications for admission and financial aid for 1986-87 is January 15, 1986.

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. Three core courses must be within a single department; of these, one must be a seminar in which a research paper on China or Japan is written. The six additional area courses may be taken in departments of the students' choosing. Some theory-oriented or methodological courses may be used to meet part of these requirements provided they are demonstrably useful for understanding East Asian problems. Except in unusual circumstances, credit toward the area course requirement will not be given for courses taken prior to entering the A.M. program. Students in this program may, however, take courses for exchange credit at the University of California, Berkeley with the approval of their advisor and the Dean of Graduate Studies.
JOINT DEGREE PROGRAMS

East Asian Studies and Law—This joint program grants an A.M. degree in East Asian Studies and a Doctor of Jurisprudence (J.D.) degree. It is designed to train students interested in a career in teaching, research, or the practice of law related to East Asian legal affairs. Interested students must apply separately to the East Asian Studies A.M. Program and to the Stanford School of Law and be accepted by both. Completion of this combined course of study requires approximately four academic years depending upon the student’s background and level of training in Chinese or Japanese.

East Asian Studies and Education—This joint program grants an A.M. degree in East Asian Studies and a secondary school teaching credential in social studies. To be eligible for this program, students should apply first to the A.M. program in East Asian Studies and then apply to the Stanford Teacher Education Program during their first year at Stanford. Completion of this program requires two years including at least one summer of study when beginning the education component of the program.

EAST ASIAN STUDIES AND FOOD RESEARCH

Qualified graduate students may apply for A.M. degrees within the Food Research Institute and the Medical School.

A Master of Arts degree may be awarded by the Food Research Institute to students who complete 25 units of work in the Institute with 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 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

21. The World Outside the West: Change and
Tradition Before the Age of European Imperialism.
5 units, Aut (Fox, Roberts, Staff)
22. The World Outside the West in the Age of
European Imperialism.
5 units, Win (Collier, Abernathy, Staff)
5 units, Aut (Skinner) MWF 10
118. Communist Chinese Society
5 units, Win (Skinner)
138(238). Education and Sociocultural
Change—(Same as Education 306C.)
3-5 units, Spr (Textor)
157(257). Law in Radically Different Cultures.
5 units, Win, Spr (Gibbs, Chen)
5 units, Aut (Skinner)
263. Regional Systems in Agrarian Societies.
5 units, Win (Skinner)

ART

2. Theme and Style in Asian Art.
4 units, Aut (LaPlante, Takeuchi)
4 units (Takeuchi) not given 1985-86
20. Introduction to the Art of Asia (to 600
A.D.)
4 units, Aut (LaPlante)
21. Introduction to the Art of Asia (7th to 13th
Century).
4 units, Win (LaPlante)
22. Introduction to the Art of Asia (14th Century
to the Present).
4 units, Spr (LaPlante)
125B(225B). The Art of India.
4 units, Win (La Plante) given 1986-87
128A(228A). Ritual Bronzes of Ancient China.
4 units, Win (La Plante)
128B(228B). Chinese Ceramics.
4 units (La Plante) given 1986-87
128D(228D). Architecture and Gardens of
Japan.
4 units (La Plante) given 1986-87
4 units, Win (La Plante) given 1987-88

ASIAN LANGUAGES

EAST ASIAN STUDIES 351

129A(229A). Arts of Japan I.
4 units, Win (Takeuchi)
129B(229B). Arts of Japan II.
4 units, Spr (Takeuchi)
229J. Colloquium: Japanese Painting in the
18th Century.
4 units, Aut (Takeuchi)

129A(229A). Arts of Japan I.
4 units, Win (Takeuchi)
129B(229B). Arts of Japan II.
4 units, Spr (Takeuchi)
229J. Colloquium: Japanese Painting in the
18th Century.
4 units, Aut (Takeuchi)

ASIAN LANGUAGES

COURSES NOT REQUIRING
KNOWLEDGE OF AN
ASIAN LANGUAGE

46. Introduction to Chinese Philosophy —
( Same as Philosophy 46 and Religious Studies
55.)
4 units, Spr (Nivison) MWF 10 and
1:15 (2 sections)
91. Traditional East Asian Civilization: China.
5 units, Aut (Lyell) MWFThF 10
92. Traditional East Asian Civilization: Japan.
5 units, Win (Hare) MWFThF 10
110. Japanese-Western Literary and Cultural
Interaction.
3 units, Win (Ueda) TTh 1:15
114. Haiku.
3 units, Aut (Ueda) M 2:15-4:05
131. Chinese Poetry and Drama in Translation.
4 units, Aut (Staff) MWF 11
4 units, Win (Staff) TTh 11
133. Modern Chinese Literature in Translation.
4 units, Spr (Lyell) MWF 11
136. Classics of Japanese Literature in Transla-
tion I.
4 units, Aut (Levy) TTh 3:15
plus discussion section by arrangement
137. Classics of Japanese Literature in Transla-
tion II.
4 units, Win (Matisoff) TTh 12:50-2:05
4 units, Spr (Ueda) MWF 1:15
144. Confucianism Since Wang Yang-ming—
( Same as Philosophy 124 and Religious Studies
154.)
4-5 units, Spr (Nivison) given 1986-87
152. Nomad Empires of Inner Asia— (Same as
History 195.)
5 units, Spr (Dien) given 1986-87
5 units, Spr (Dien) TTh 2:15-4:05

154(254). Undergraduate/Graduate Colloquium: The Middle Period in Chinese History—
(Same as History 294/394.)  
5 units, Win (Dien) given 1986-87

156. China from Earliest Times to the 9th Century— (Same as History 192A.)  
5 units, Win (Dien and Kahn) MTWThF 11

4 units, Spr (Wang) given 1986-87

177(277). Classic Japan.  
4 units, Win (Hare) given 1986-87

4 units, Spr (Matisoff) given 1986-87

4 units, Spr (Matisoff) given 1986-87

3 units, Aut (Ueda) given 1986-87

217 (297). Images of Women in Modern Japanese Literature.  
3 units, Aut (Ueda) given 1986-87

254. Graduate Colloquium: The Middle Period in Chinese History—(Same as 154 and History 294.)  
5 units, Win (Dien) given 1986-87

255A. The Nature of Literature: Japanese and Western Views.  
5 units, Win (Ueda) given 1986-87

255B. Chinese and Western Theories of Literature.  
5 units, Win (Liu) given 1986-87

COURSES IN CHINESE

1, 2, 3. First-Year Modern Chinese.  
1. 5 units, Aut (Kao, Shou)  
Section 1 MTWThF 9  
Section 2 MTWThF 10  
Section 3 MTWThF 1:15

2. 5 units, Win (Kao, Shou)  
Section 1 MTWThF 9  
Section 2 MTWThF 10  
Section 3 MTWThF 1:15

3. 5 units, Spr (Kao, Shou)  
Section 1 MTWThF 9  
Section 2 MTWThF 10  
Section 3 MTWThF 1:15

5. Intensive First-Year Modern Chinese.  
12 units, Sum (Staff) MTWThF 8-12

21, 22, 23. Second-Year Modern Chinese.  
21. 5 units, Aut (Chuang) MTWThF 9  
22. 5 units, Win (Chuang) MTWThF 9  
23. 5 units, Spr (Chuang) MTWThF 9

25. Intensive Second-Year Modern Chinese,  
12 units, Sum (Staff) MTWThF 8-12

27, 28, 29. Intermediate Conversation.  
27. 2 units, Aut (Shou) TTh 11  
28. 2 units, Win (Shou) TTh 11  
29. 2 units, Spr (Shou) TTh 11

51. Chinese Calligraphy.  
1-2 units, Spr (Chuang) TTh 1:15

ADVANCED

101, 102, 103. Third-Year Chinese (Modern).  
101. 5 units, Aut (Chuang) MTWThF 9  
102. 5 units, Win (Lyell) MTWThF 11  
103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese.  
12 units, Sum (Staff) MTWThF 9-12

111. 5 units, Aut (Kao) TTh 2:15-4:05  
112. 5 units, Win (Kao) TTh 2:15-4:05  
113. 5 units, Spr (Kao) TTh 2:15-4:05

121, 122, 123. Advanced Conversation.  
121. 2 units, Aut (Chuang) W 2:15-4:05  
122. 2 units, Win (Chuang) W 2:15-4:05  
123. 2 units, Spr (Chuang) W 2:15-4:05

131. 2 units, Aut (Kao, Staff) by arrangement  
132. 2 units, Win (Kao, Staff) by arrangement  
133. 2 units Spr (Kao, Staff) by arrangement

200. Directed Reading in Chinese.  
Number of units to be arranged, Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar.  
201. 5 units, Aut (Dien) W 2:15-4:05  
202. 5 units, Win (Dien) W 2:15-4:05

211, 212, 213. Fourth-Year Modern Chinese.  
211. 5 units, Aut (Staff) MW 11-12:15  
212. 5 units, Win (Staff) TTh 11-12:15  
213. 5 units, Spr (Staff) TTh 11-12:15

221, 222, 223. Advanced Classical Chinese.  
221. Philological Texts.  
5 units, Aut (Nivison) MWF 11  
222. Historical Narration.  
5 units, Win (Dien) MWF 1:15  
223. Literary Essays.  
5 units, Spr (Liu) MWF 11

241. Short Story.  
5 units, Aut (Lyell) given 1986-87
5 units, Win (Chuang) MWF 11

5 units, Aut (Lyell) MWF 9

4 units, Aut (Liu) given 1986-87

261. Chinese Poetry (II).  
4 units, Win (Liu) given 1986-87

262. Chinese Poetry (III).  
4 units, Spr (Liu) given 1986-87

263. Lyrics and Songs.  
4 units, Win (Liu) MWF 10

4 units, Win (Liu) MWF 11

271. Traditional Chinese Fiction.  
4 units, Aut (Wang) TTh 11-12:15

273. Chinese Drama.  
4 units, Aut (Wang) given 1986-87

291. The Structure of Modern Chinese.  
4 units, Spr (Kao) by arrangement

4 units, Spr (Kao) given 1986-87

321. Seminar on Archaic Inscriptions—Bone and bronze inscriptions.  
5 units, Win (Nivison) Th 2:15-4:05

323. Chinese Philosophy of Language.  
5 units, Aut (Nivison) given 1986-87

331. Seminar in Confucian Ethics—(Same as Religious Studies 238, Philosophy 331.)  
5 units, Aut (Nivison) MW 4:15-5:30

334. Seminar in Modern Chinese Literature.  
5 units, Win (Lyell) TTh 1:15

351. Seminar in Chinese Traditional Historiography.  
5 units, Spr (Dien) W 2:15-4:05

361. Seminar in Chinese Literary Criticism.  
5 units, Spr (Liu) T 2:15-4:05

5 units, Spr (Wang) given 1986-87

COURSES IN JAPANESE

1. First-Year Modern Japanese.  
1. 5 units, Aut (Sakamoto, Nebrig)  
Section 1 MTWThF 9  
Section 2 MTWThF 11  
Section 3 MTWThF 1:15  
Section 4 MTWThF 3:15

2. 5 units, Win (Sakamoto, Nebrig)  
Section 1 MTWThF 9  
Section 2 MTWThF 11  
Section 3 MTWThF 1:15  
Section 4 MTWThF 3:15

3. 5 units, Spr (Sakamoto, Nebrig)  
Section 1 MTWThF 9  
Section 2 MTWThF 11  
Section 3 MTWThF 1:15  
Section 4 MTWThF 3:15

12 units, Sum (Staff) MTWThF 8-12

21. 5 units, Aut (Kubota, Staff) MTWThF 9  
22. 5 units, Win (Kubota, Staff) MTWThF 9  
23. 5 units, Spr (Kubota, Staff) MTWThF 9

12 units, Sum (Staff) MTWThF 8-12

27, 28, 29. Conversation I.  
27. 2 units, Aut (Sakamoto) TTh 1:15  
28. 2 units, Win (Sakamoto) TTh 1:15  
29. 2 units, Spr (Sakamoto) TTh 1:15

ADVANCED

101, 102, 103. Modern Written Japanese.  
101. 5 units, Aut (Kubota)  
MWF 11-12:15

102. 5 units, Win (Kubota)  
MWF 11-12:15

103. 5 units, Spr (Kubota)  
MWF 11-12:15

12 units, Sum (Staff) MTWThF 9-12

121, 122, 123. Conversation II.  
121. 2 units, Aut (Kubota) TTh 1:15  
122. 2 units, Win (Kubota) TTh 1:15  
123. 2 units, Spr (Kubota) TTh 1:15

GRADUATE

Number of units to be arranged,  
Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar.  
201. 5 units, Win (Matisoff) Th 2:15-4:05  
202. 5 units, Spr (Hare) W 2:15-4:05

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 (Ueda) MW 2:15-3:30  
213. Fiction.  
5 units, Spr (Matisoff) TTh 11-12:15

246. 5 units, Aut (Hare) MW 11-12:30  
247. 5 units, Win (Hare) MW 11-12:30  
248. 5 units, Spr (Hare) MW 11-12:30

250. Introduction to Kambun.  
4 units, Spr (Ueda) given 1986-87
251. Graduate Seminar: Japanese Historical Texts—(Same as History 498).  
5 units, Spr (Mass) W 2:15-4:05

4 units, Aut (Ueda) given 1986-87

277. Classic Japan—(Same as 177 with additional work requiring knowledge of the language.)  
4 units, Win (Hare) given 1986-87

4 units, Win (Levy) given 1986-87

284. Postwar Japanese Fiction.  
4 units, Win (Levy) M 2:15-4:05

286. The Structure of Japanese.  
4 units, Aut (Poser) given 1986-87

294. Major Haiku Poets.  
4 units, Aut (Ueda) given 1986-87

295. Modern Intellectuals in Japanese Literature—(Same as 195 with additional work requiring knowledge of the language.)  
4 units, Aut (Ueda) given 1986-87

296. Readings in Modern Japanese Literature.  
4 units, Aut (Ueda) given 1986-87

297. Images of Women in Modern Japanese Literature—(Same as 197 with an extra class meeting and additional work requiring knowledge of the language.)  
4 units, Aut (Ueda) TTh 2:15-3:30

298. Translation Workshop.  
4 units, Spr (Ueda) given 1986-87

299. Major Haiku Poets.  
4 units, Aut (Ueda) given 1986-87

306C. Education and Sociocultural Change—(Same as Anthropology 138/238.)  
3-5 units, Spr (Textor) TTh 2:15-4:05

ECONOMICS

120. The Marxian and Radical Tradition.  
5 units, Spr (Gurley)

121(221). Economic Development in China.  
5 units, Aut (Sicular) MW 3:15-5:05

5 units, Win (Aoki)

149. The Modern Firm in Theory and Practice.  
5 units, Spr (Aoki)

161. Introduction to Teaching and Learning in Asia.  
4-5 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, Lusignan, McWhorter, Siegel, Textor) lecture W 7:30-9:30 P.M., workshops by arrangement

FOOD RESEARCH INSTITUTE

148(248). Economic Development in China—(Same as Economics 121).  
5 units, Aut (Sicular) MW 3:15-5:05

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

3 units, Aut (Reynolds, Sicular, Yotopoulos) by arrangement

HISTORY

190. Modern China: Economic History: 18th Century to the Present.  
5 units, Win (Myers)

192A. China from Earliest Times to the 9th Century.  
5 units, Aut (Dien, Kahn)

192B. China from the 9th to the 19th Centuries.  
5 units, Win (Kahn)

193. Science, Technology and Material Cultural in Traditional China—(Same as Asian Languages 153.).  
5 units, Spr (Dien)

194. Early and Medieval Japan to 1336.  
5 units, Aut (Mass)

5 units, Spr (Duus)

290. Undergraduate Colloquium: Japan and America: Conflict and Cooperation.  
5 units, Aut (Duus)

292A. Undergraduate Colloquium: Aspects of Chinese Economic History.  
5 units, Spr (Kahn)
Undergraduate Colloquium: Visions of Utopia: Travellers to China.
5 units, Win (Kahn)

Undergraduate/Graduate Colloquium: Institutions of Medieval Japan.
5 units, Win (Mass)

Graduate Colloquium: Topics in Late Traditional Chinese History.
5 units, Aut (Kahn)

Graduate Colloquium: Early and Medieval Japan.
5 units, Aut (Mass)

Graduate Colloquium: Medieval and Early Modern Japan: 1600-1800.
5 units, Win (Mass)

Graduate Colloquium: Modern Japan.
5 units, Spr (Duus)

Graduate Colloquium: The Institutions of Medieval Japan.
5 units, Win (Mass)

Graduate Seminar: Modern Japan.
5 units, Win (Duus)

Graduate Seminar: Japanese Historical Texts—(Same as Asian Languages 251.)
5 units, Spr (Mass) W 4:15-4:05

Comparative Law. (Open to graduate students in other departments.)
3 units, Aut (Merryman)

Law in Radically Different Cultures—(Same as Anthropology 157/257.)
5 units, Win, Spr (Merryman)

Introduction to Chinese Philosophy — (Same as Asian Languages 46.)
4 units, Win (Nivison) MTWTh 10

Confucianism Since Wang Yang-ming — (Same as Asian Languages 144 and Religious Studies 154.)
4-5 units, Spr (Nivison) given 1986-87

Seminar in Confucian Ethics — (Same as Asian Languages 331, Religious Studies 238.)
3-5 units, Aut (Nivison) MW 4:15-5:30

Theoretical Approaches to Japanese Politics.
5 units, Win (Okimoto)

Government and Politics in China.
5 units, Aut (Staff)

Seminar: Arms Control and Disarmament.
5 units, Win (Lewis, Blacker)

Seminar: Arms Control and Disarmament.
5 units, Spr (Lewis, Blacker)

Arms Control Simulation.
5 units, Aut (Lewis, Blacker) given 1986-87

Topics in Arms Control.
5 units, Aut (Lewis, Blacker)

Chinese Foreign Policy.
5 units, Win (Staff)

Japanese Foreign Policy.
5 units, Aut (Okimoto)

Japan’s Political Economy.
5 units, Aut (Okimoto)

Japan’s Political Economy.
5 units, Win (Okimoto)

Colloquium in Comparative Politics: Japan.
5 units, Spr (Ward)

Colloquium: Chinese Politics.
5 units, Spr (Staff)

Seminar: Chinese Foreign Policy.
5 units, Spr (Staff)

Comparative Religious Thought.
3 units, Aut (Aronson) MWF 9

Religions of the East.
3-4 units, Win (Buswell)

Eastern and Western Conceptions of the Self.
4 units, Win (Yearley) MWF 11

Eastern and Western Conceptions of Virtue.
4 units, Spr (Yearley) MWF 11

Hinduism.
3-5 units, Spr (Aronson) MWF 9

Introduction to Buddhism.
4-5 units

Religion in Japan.
3-5 units, (Staff) not given 1985-86

Zen Buddhism.
3-4 units, Spr (Buswell) MWF 10

Hindu and Buddhist Meditation.
5 units, (Staff) not given 1985-86

Introduction to Chinese Philosophy — (Same as Philosophy 46, Asian Languages 46.)
4 units, Spr (Nivison) MWF 1:15

Japanese Buddhism.
5 units, (Staff) not given 1985-86

Buddhist and the Play of Wisdom.
5 units, Aut (Buswell) MWF 1:15
236A. Seminar: Buddhism and Play of Wisdom.
4-5 units, Win (Klein) MW 2:15
154(254). Confucianism since Wang Yang-ming — (Same as Asian Languages 144 and Philosophy 124.)
4 units (Nivison) given 1986-87
230. Topics in Zen Buddhism.
4-5 units, Win (Buswell) MW 4:15
238. Confucian Ethics—(Same as Asian Languages 331 and Philosophy 331.)
5 units, Aut (Nivison) MW 4:15-5:30
245. Seminar: Comparative Religious Ethics.
5 units, Win (Yearly) MW 2:15
258A. Seminar: Buddhism and the Feminine.
4-5 units, Aut (Klein) MW 4:15-6:05

ECONOMICS

Emeriti: (Professors) Moses Abramovitz, Bernard F. Haley, Tibor Scitovsky, Edward S. Shaw
Chairman: Nathan Rosenberg
Vice Chairman: John Shoven
Associate Professor: Thomas E. MaCurdy
Assistant Professors: Douglas B. Bernheim, Timothy F. Bresnahan, Gregory Clark, George Evans, Stephen R. King, William Novshek, Debraj Ray, Michael H. Riordan, Robert W. Staiger, Guido Tabellini, Jose M. Vinals
Visiting Professors: Amit Bhaduri, Pierangelo Garegnani, Joseph Greenberg, Geoffrey M. Heal
Visiting Associate Professor: Kimio Morimune
Visiting Assistant Professors: Giovanna Mossetti, Russell D. Roberts, Marc Robinson
Instructors: Harry J. Paarsch, William A. Sundstrom
Affiliated Professors: W. Brain Arthur, Roger W. Gray, Bruce F. Johnston, Timothy E. Josling (Food Research Institute), Henry Levin (School of Education), Clark W. Reynolds, Scott R. Pearson (Food Research Institute), Robert B. Wilson (Graduate School of Business), Pan A. Yotopoulos (Food Research Institute)
Affiliated Associate Professors: Carl Gotsch, Reynaldo Martorell (Food Research Institute), Anne E. Peck (Food Research Institute), James L. Sweeney (Engineering-Economic Systems)
Affiliated Assistant Professors: James E. Hodder (Industrial Engineering), Terry Sicular (Food Research Institute)

OFFERINGS AND FACILITIES

The department's purposes are to acquaint students with the economic aspects of modern society, to familiarize them with techniques for the analysis of contemporary economic problems, and to develop in them an ability to exercise judgment in evaluating public policy. There is training for the general student as well as for those who plan careers as economists in civil service, private enterprise, teaching, or 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. Thirty (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 (199D and Food Research Institute directed reading) may be used.
      (2) Courses 212A, B and 214 in Engineering-Economic Systems and courses numbered 205 and above in the Food Research Institute may be used.
      (3) Each year several overseas courses are approved as economics courses in satisfying these requirements, but not all overseas economics courses count. Check 119 Encina Commons for a list of approved courses.

3. Fifteen (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.

OTHER REQUIREMENTS:

4. Courses taken at other universities may be given credit for as many as 35 of the required 60 units. At least fifteen (15) units towards requirement (2) must be taken at Stanford in California, including at least two courses from the list in (2a).
   At least twenty-five (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 Undergraduate Studies for the Economics Department.

9. Students are responsible for seeing that all grades of "incomplete" are cleared within one year after the grade was given. If the "incomplete" grade is not cleared within that
time, no credit will be given for the course toward the A.B. in Economics. Students who expect to undertake graduate study in economics, particularly prospective Ph.D. candidates, are strongly advised to take courses in quantitative methods beyond those recommended for other candidates for the Bachelor of Arts in Economics. In particular a major in Quantitative Economics is strongly recommended.

NEW REQUIREMENTS
A student declaring Economics as a major after July 1, 1984 will choose between two programs.

The program in Quantitative Economics requires a higher level of quantitative proficiency and includes two new courses (103 and 104) using quantitative tools to 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 requirement as listed in (3) above under the old requirements and includes a new course (101) on Economic Policy Analysis and a new requirement for a senior research paper. Its general objective is to teach students to think and write about important economic problems and issues using the basic tools of economic analysis with only minimal use of mathematics.

QUANTITATIVE ECONOMICS
Course Work Requirements
1. Quantitative requirements. Mathematics 43 and Economics 102 plus Mathematics and Statistics prerequisites for these courses. Economics 180 may be substituted for Mathematics 43.
2. Core requirement. Economics 1, 51Q, 52, 103, 104.
3. Upper division requirement. Fifteen (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).
3. Upper division requirement. Twenty-five (25) units, ten (10) units must be selected from the courses listed in item (2a) and (15) units from those listed under item (2a) of the old requirements, 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 requirements and most of the upper division course requirements have been completed. This requirement will be waived for students successfully completing Honors I.

HONORS PROGRAMS
IN ECONOMICS
Two programs are offered which lead to a Bachelor of Arts with Honors in Economics. Both programs are designed to encourage a more intensive study of economics than is required for the normal major, with course and research work of exceptional distinction. The Honors Program I entails an in-depth study of an appropriate question and completion of a thesis of very high quality. The Honors Program II requires an especially high grade average sustained through more than the usual number of units of economics, and also calls for the submission of two term papers of very high quality, in economics, written at any point in the student’s course work. A student should always save graded term papers for possible use in the Honors Program II.

Honors Program II will not be offered to students declaring an Economics major after July 1, 1984.

Both Programs require completion of all requirements of the Bachelor of Arts in Economics.

Additional requirements of the Honors Program I are:
1. An average grade in economics courses of at least 3.5.
2. Submission of an honors thesis of very high quality. This thesis will normally be written under the direction of a member of the Economics Department (or a member of some closely related department). Honors students may take up to 10 units of Directed Reading (199D) for purposes of completing their thesis project. Units of 199D do not count towards the 65 units for the basic economics major.

Additional requirements for the Honors Program II are:
1. Completion of 15 units, of economics courses numbered 100 or above in addition to the units ordinarily required for the Bachelor of Arts in Economics.
2. 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 during the quarter in which the student will graduate, 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 first quarter of their senior year. Application should be made to the Director of Graduate Studies for the Economics Department. Students must satisfy the requirements for the Bachelor of Arts in Economics, and are required to complete the requirements for the Master of Arts Program 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 fails 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 completing 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 to Candidacy—Completion of the Stanford requirements for a Bachelor of Arts degree in Economics, or approximately equivalent training, and mathematical competence equivalent to one year of college calculus is required of students who undertake a program of study for the degree of Master of Arts in Economics. Admission to candidacy for the degree will be restricted to students whose record bears promise of successful graduate work. All programs must be approved by the Director of Graduate Study before filing the Application for Candidacy for the degree of Master of Arts at least four quarters before expected completion of the degree. Programs lacking strength or coherence will not be approved.

Recommendation for the Degree—Students completing programs consistent with the departmental objectives listed in the introductory paragraph above will be recommended to the University Committee on Graduate Studies for the degree of Master of Arts in Economics, provided the following standards are satisfied:

1. Completion of a program of study at Stanford amounting to not less than 45 units of credit.
2. Training in statistics equivalent to the level of Economics 169 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 pro-
gram of study which will satisfy the following set of standards. This summary list is elaborated upon below.

1. Qualification established by comprehensive examination in five fields of study (if no minor subject is offered) or in four fields and a minor subject.
2. Proficiency in either at least two other areas within economics or the minor subject.
3. Qualification in Mathematics.
4. Qualification in Econometrics.
5. Qualification in Economic History.
6. Distinction requirement.
7. Professional competence in a foreign language or course work developing a needed research skill.
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 five fields of study (if no minor subject is offered) or in four fields and a minor subject. All candidates will be expected to qualify in "Price and Allocation Theory" and "Theory of Income and Economic Fluctuations." Evidence of competence shall be at least equivalent to passing comprehensive examinations in each field. Comprehensive field examinations will be scheduled annually, usually at the close of the sequence designed to prepare for them. The minimal standard of qualification in each field will be a grade of "B" on the appropriate examination. Successful candidates are expected to show distinction in at least one field of economics. Comprehensive examination papers become a part of each student's permanent file.

In addition to the two theory fields, students may select remaining fields according to the following options.

a) Option A—Without a Minor Subject—Consistent with the objectives of their program, students may choose to prepare themselves in three of the following fields of study:

- Alternative Approaches to Economic Analysis
- Econometrics
- Economic Development
- Economic History
- International Economics
- Labor Economics
- Mathematical Economics
- Monetary Theory

However, students are required to choose at least one field from outside of Econometrics, Mathematical Economics, and Theory of Choice.

Students should complete at least four comprehensives by the end of their second year in residence. Many complete all five. Normally students exercise Option A unless there are strong reasons leading them to take a program with a minor.

b) Option B—With a Minor Subject—Consistent with the objectives of their program and advance consent of the Director of Graduate Studies, students may choose to prepare themselves in a minor field. Normally, they would also prepare themselves in two of the fields of study listed under Option A. Additional credit elsewhere in the economics part of the program for the minor may be obtained by consent of the Director of Graduate Studies. It is also possible to arrange a special minor in fields where no formal minor program is offered by the relevant department.

2. Distribution Requirement. To achieve a balanced program, students without a minor subject are required to show proficiency in at least two fields other than those in which they will take comprehensive exams under option A. Normally, a total of three five-unit graduate lecture courses offered exclusively at the 200 or above level by the Economics Department, approved by the Director of Graduate Studies, passed by grades "B" or better, will be regarded as evidence of such proficiency. Besides selecting from the remaining fields listed under option A for this purpose, the student may also elect Economics 200.

3. The student demonstrates competence in mathematics at least to the level of successful completion of Mathematics 7 or 43 with a grade of "C" or better or its equivalent (as judged by an examination administered by the department upon entrance). This standard should be satisfied as soon as possible after first graduate registration and those with little previous mathematical background are advised to register their first Autumn Quarter for Mathematics 5 or 41. Those who have more background but are not quite up to the level of Mathematics 7 or 43 may either complete Mathematics 7 or 43, or complete Economics 180, depend-
ing upon their level. Additional preparation in mathematics is strongly suggested, and students should consult with their advisors in choosing courses beyond the level of Mathematics 7 or 43.

4. Students shall submit evidence of competence in econometrics at least by completing Economics 270 and 271 with a grade of "B" or better. Electing econometrics as a comprehensive field automatically satisfies this standard.

5. Students shall submit evidence of competence in economic history either by electing to take the comprehensive exam in the field or by taking a course at the 200 level for five units. Students not offering the comprehensive exam may offer as many as two economic history courses in partial fulfillment of the distribution requirement under 2 above.

In satisfying standards 1 through 4, in unusual circumstances a student may petition the Director of Graduate Studies to substitute economics courses from outside the Economics Department if they demonstrably contribute more to the Ph.D. program.

6. 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 of "distinction." This does not preclude a student from demonstrating "distinction" in some other way, e.g., writing and publishing an article in a scholarly journal.

7. Consistent with the aims of the program, each student shall demonstrate research capability in a relevant foreign language or mastery of a body of specialized research methods other than econometrics. Research competence in a foreign language will automatically satisfy this standard, but evidence of particular skills in other areas may be accepted as an alternative; e.g., computer science (programming, data analysis), statistics (sample theory), psychology test theory of survey technique), mathematical and quantitative methods of demographic analysis and advanced topics in mathematics may be accepted.

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 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:

1. Successful completion of the comprehensive examinations in “Price and Allocation Theory” and “Theory of Income and Economic Fluctuations.”

2. For students without a minor subject, successful completion of comprehensive examinations in at least two other fields of study; for students with a minor subject, successful completion of comprehensive examinations in at least one other field of study and fulfillment of most of the minor requirements.

3. Completion of the econometrics or economic history requirement may be substituted for completion of one field in item 2 above.

4. Qualification in mathematics.

The Dissertation—By the end of the student’s third year, normally encompassing the two dissertation seminars and remaining coursework, students will have selected an advisor and a dissertation subject or area. A short dissertation prospectus written by the student and signed by the advisor will be placed on file with the Director of Graduate Studies. The prospectus is not binding on either party, but advisors should be informed of major changes in research directions.

As soon as a firm thesis proposal is agreed on between student and advisor, the second and third members of a reading committee are to be selected with the advisor’s approval. The principal advisor and one other member of the reading committee must be from the Department of Economics.

When either a first draft of the dissertation is completed, or core theoretical and/or empirical aspects of the dissertation have been developed, a student may petition for an oral exam with the advisor’s approval. The oral committee will normally consist of the three dissertation readers, a chairman drawn from outside the department, and one additional examiner nominated by the department. At least three out of these five examiners must be from the Economics Department.

For the candidate to pass the oral exam, the examining committee must be convinced that (1) the student has mastered the existing literature and professional techniques in the dissertation area, and (2) that no major conceptual or empirical problems remain to be overcome in making a significant contribution.

Ph.D. MINOR IN ECONOMICS

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.

JOINT DEGREE PROGRAM

Attention is called to a joint program. The Department of Economics and the Stanford Law School offer a joint program leading to the Doctor of Philosophy in Economics and the J.D. degree in Law.
In the above case, the student's program objectives must clearly justify such a joint program; decisions by the Departmental Graduate Studies Committee will govern. In this case, a student's program in economics must satisfy the same standards as a Ph.D. degree in Economics taken with a minor in Law. See the Law School catalogue for descriptions of its participation in the joint program. In this case, it is expected that dissertation research will cross departmental lines and that members of the dissertation committee will be drawn from both faculties.

Students would normally spend their first year full time either in Economics or in Law and their second year full time in the other department. After the second year, courses in Economics and Law could be pursued simultaneously.

Other joint programs may be arranged. For example, the Ph.D. in Economics can be combined with one or two years of study in the Law School, leading either to the non-professional Master of Legal Studies (M.L.S.) degree or the non-professional Master of Jurisprudence (J.M.). See the Law School catalogue for the requirements for these degrees. Conversely, a student taking the J.D. in the Law School may apply for a Master of Arts degree in Economics.

Completed forms for graduate application should be filed before January 15 at the Office of Graduate Admissions.

FELLOWSHIPS AND ASSISTANTSHIPS

The attention of prospective graduate students is directed to the fact that the department awards a number of fellowships for graduate study of economics. Current students under these grants range up to $5748 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 $6918 plus an allowance for tuition. In the case of teaching assistants, students are currently receiving $6918 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 (Noll, 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 (Novshek) MTWThF
   Win (Greenberg)

51. Same as 51Q except that calculus is not used. (DR:5)
   5 units, Aut (Sundstrom) MTWThF
   Win (Riordan)
   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. (DR:5)
   5 units, MTWThF
   Section 1. Aut (King)
   Win (Taylor)
   Spr (Tabellini)
   Section 2. Aut (Hall)
   Win (Tabellini)
   Spr (Mossetti)

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)

91. Introduction to Cost Accounting—(Graduate students register for 191.) The use of internal financial data for managerial decision-
making. Students who have had or are now taking a college-level cost accounting course may not enroll. Prerequisite: 90 or IE 133.

5 units, Win, Spr (Staff)

100. Economic Theory in Historical Perspective—Course studies the historical development of economic theory from several perspectives. The main focus is on the progress of analytic clarification and elaboration, although some attention is given to the influence of contemporary economic and political categories with which different economists worked, as well as the relation of the development of economic theory to concurrent developments in European political and social thought. Special emphasis will be placed on the following topics: 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. (DR:3)

5 units, Win (Garegnani)


5 units, Aut (Clark)

Win (Starrett)

Spr (Boskin)

102. Introduction to Econometrics—Review of probability, random variables, distribution theory, theory of estimation, and hypothesis testing. Introduction to simple and multiple regression analysis. Applications to economics. Students without computer experience should plan to acquire it early in the quarter. Prerequisites: Statistics 60 or the equivalent.

5 units, Aut (Paarsch) MTWThF

Win (Pencavel)

103. Applied Macroeconomic 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. In addition to common assignments, students will use computer software to construct and simulate econometric modes as a term project. Assessment will be 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 (King) MTWThF

Spr (Evans)

104. Applied Microeconomic Analysis—Formulation and implementation of econometric models of microeconomic behavior, including the behavior of consumers (demand for goods and supply of labor) and producers (demand for inputs and supply of outputs). Both continuous and discrete choices of demand and supply will be considered. It is shown how alternative economic policies can be appraised based on the results obtained from the implementation of the econometric models. Students use the LOTS computer facilities and will choose a term project of their own in addition to participating in common assignments. Prerequisites: 51Q and 102.

5 units, Win (Lau) MTWThF

Spr (Bresnahan)

105. Economics of the Worker-Managed Firm—Labor managed firm is of interest to economists because of its democratic organization, its relatively lower capital-labor ratios, and recent evidence of productivity advantages relative to more traditional organization. Purpose is to investigate the theory and practice of the worker-managed or participatory firm in its various forms including producer cooperatives, Co-Determination, the Yugoslav version, and the Swedish experiences under industrial democracy. Emphasis on explaining hiring decisions, internal organization, productivity, factor intensities, finance, and the extensions to worker-managed sectors and economics. Prerequisite: 51.

5 units, Spr (Levin)

106. The World Food Economy — (Same as Food Research Institute 103.) Examines the interrelationship 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. Focus 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 related to the design of rural development strategies. Prerequisite: Economics 1 or equivalent understanding of economics; Economics 51 is recommended.

3 units, Spr (Johnston) MWF 10

107. 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 usefulness, market performance issues and measures, and the importance of speculation. Prerequisite: 1, for economic majors.

4 units, Win (Peck) MW 10-11:50

111. Money and Banking—An investigation of financial processes, with an emphasis on the role of the banking sector and monetary policy. Implications for economic growth and stability are developed in the light of modern theory. Prerequisites: 51 and 52.

5 units, Aut, Spr (Tabellini, Gurley) MTWThF

112. Introduction to Financial Decisions—(Same as Industrial Engineering 235.) This course focuses on the models and techniques in financial decision-making under uncertainty. Topics covered include risk measurement, expected utility theory, decision trees, portfolio and capital market theories. The effects of taxation and inflation are also discussed. Prerequisites: 51, 181, Statistics 116; Economics 190, or equivalent required. Enrollment limited and at discretion of instructor.

3 units, Aut, Win (Hodder) MWF 9

113. Technology and Modern Industrial Society—(Same as Values, Technology, Science and Society 107.) The interrelationships between technology and the nature and form of industrial societies over the past 200 years. Technological change as a socio-economic process illuminating the history of industrial societies. Factors influencing the rate and direction of technological change and diffusion. Implications for economic structure and the growth of large-scale organizations. The impact of these changes on modern industrial man as producer and consumer.

4 units, given 1986-87

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 units (Staff)

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, Aut (Wright) MTWThF

117. U.S. Economy in the Twentieth 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 1986-87

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. Course examines the process of economic development in an international perspective. Focal point is the experience of developing countries since World War II. This experience is 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 (Bhaduri) 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 from these studies 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, given 1986-87

121/221. Economic Development in China—(Same as Food Research Institute 148.) (Graduate students register for 221.) Examines the structure and development of China's econ
122. The Theory of Capitalist Development —This course is concerned with theoretical and historical analysis of the process of development of capitalist economies. Emphasis is placed 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 Marxian theory and recent elaborations and extensions of that theory. Reference is made to relevant historical case studies. Prerequisites: 51 and 52.

5 units, Aut (Harris) MTWThF

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, and Central America. Seminar with research papers. Prerequisites: 51 and 52 for economics majors.

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

124. Contemporary Japanese Economic Problems — 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 will be emphasized. Discusses the cultural, social, and international context of contemporary economic problems and policy issues. Elementary knowledge of economic theory is required.

5 units, Win (Aoki)

125. The Political Economy of Development: Comparative Country Experiences — (Same as Food Research Institute 112/222.) Detailed discussion of the process of development and of policy choice in 4-6 countries chosen from among Brazil, Peoples Republic of China, Columbia, Ghana, India, Japan, Russia, Taiwan, and a small Latin American or African country. Course will focus on key factors accounting for the different development experiences across the countries, and how political and economic factors have molded and constrained the choices of strategy and policy.

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

128. Marketing, Consumption, and Price Analysis—(Same as Food Research Institute 120.) Survey of approaches used in the analysis of commodity price behavior. Topics include consumer demand analysis, spatial and temporal aspects of prices, market structure considerations, and complete commodity models. Links to microeconomic theory are drawn and emphasis is placed on a policy context. Readings and discussion use agricultural examples from both developing and developed agriculture. Prerequisite: 51 for economics majors.

Aut (Peck) TTh 10-11:50

129. Analytical Techniques for Development Planning—(Same as Food Research Institute 129/229.) Treats selected analytic techniques used in development planning. Emphasis on cost-benefit analysis and macroeconomic planning methods. Course employs microcomputer homework exercises to develop and simulate actual application of planning tools. Prerequisite: 51 or equivalent.

5 units, Win (Gotsch) MW 1:15-3:05

132. Application of Linear Programming to Agricultural Systems—(Same as Food Research Institute 130.) 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, Spr (Arthur) TTh 10-11:50
139D. Directed Reading—(Graduate students register for 239D.)
1-10 units (Staff)

140. Introduction to Financial Economics—
This course will provide an introduction to modern portfolio theory and corporate finance. Topics will include savings and investment, capital formation, consumer behavior towards risk, financial effects of inflation, properties of various financial instruments, and government policy regarding securities markets. Both theoretical and institutional material will be included. Prerequisites: 51, Statistics 60, and at least one course in calculus. 5 units, Win (Heal) 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 (Robinson) 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, Aut (Josling) MW 11-12:30

144. Economics of American Agriculture: Structure and Policy—(Same as Food Research 144/244.) American agriculture and its historical and contemporary role in the economy. Topics include the structure and characteristics of farming and processing units, the role of agriculture in American economic development, government policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States agriculture. Emphasis is on policy alternatives rather than on farm management. Prerequisite: 1, for economics majors. 4-5 units, Aut (Falcon) MW 9

145. Economics of Labor—Analysis and description of U.S. labor force and labor markets. Wage determination; effects of unions and institutional forces on wages; causes and cures of unemployment. Prerequisite: 51. 5 units, Win (Fencavel) MTWThF

146. Women and the American Economy—Examines impact of American economic system on women workers, consumers, volunteers, housewives. Analyzes theoretical explanations of women’s pattern of low-paid employment, unemployment; relation of unions, advertisers, media, government. Examines economic problems of women family heads, minorities, displaced homemakers. Prerequisites: 51, 52 or consent of instructor. 5 units, Win (Fitzpatrick) MTWThF

147. Economics of Human Resources—Investment in human capital, including investments in education, information, health, and on-the-job training. Role of human capital in the analysis of economic growth. Effects of ability, socioeconomic background and investment in human capital on the distribution of income. Prerequisite: 51. 5 units, given 1986-87

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, Spr (Riordan) MTWThF

149. The Modern Firm in Theory and Practice—Review of elements of the production theory. Decision-making of the firm on product diversification, advertising, 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, Spr (Aoki)

150. Economics and Public Policy—(Same as Public Policy 104.) The relationship between economic analysis and economic policies. Examines the following topics: 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
and the role of information in markets. Prerequisite: 51.

5 units, Aut (Nooshek)

158. Social Control of Industry—Building on the framework developed in Economics 157, this course considers the history, economics and legal background of those institutions under which U.S. industry is subject to government control. The two principal subjects of the course are antitrust law and economics and the economics and practice of public utility regulation in the communications, transportation, and energy sectors. The effects of licensing are also considered. Emphasis is placed on application of economic concepts in evaluating the performance and policies of government agencies. Prerequisite: 157.

5 units, given 1986-87

160. 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. Review some basic concepts of Game Theory: game description, strategies, the role of information, cooperatives vs. non-cooperative games, extensive and normal forms, and coalitions. Provide an elementary exposition of a sample of solution concepts: Minimax, Equilibrium, Core, Bargaining Theory and Shapley value. Concrete examples will be 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, Aut (Kurz) MW 1:15-3:05

165. International Economics—Comparative advantages in production and trade among nations; the international monetary mechanism; domestic monetary, fiscal, and exchange rate policies and their relationship to foreign trade. Prerequisites: 1, 51, in addition 52 for economics majors.

5 units, Aut (Staiger) MTWThF
Spr (Staiger)

166. International Trade Policy — (Same as Food Research Institute 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 devel-
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AND SCIENCES

oping countries. Prerequisite: 165 or consent of instructor.

5 units, Spr (Pearson) MW 11-12:50

167. The Firm in the International Economy
—(Same as Industrial Engineering 237.) The
response of firms to international economic forces. Exposure to exchange rate movements, trade barriers and international taxation. Implications for accounting, financial and production practices. Prerequisites: 112 (required) and 165 (recommended). Enrollment limited and at discretion of instructor (preference given to students with recommended prerequisite).

3 units, Spr (Hodder) MWF 9

169. Intermediate Econometrics I—(Graduate students register for 269.) Introduction to theory of probability, random variables, and distribution. Theory of Estimation and Hypothesis Testing. Prerequisites: Mathematics 43 or equivalent.

5 units, Aut (Morimune)


5 units, Win (Morimune)


5 units, Spr (MaCurdy)

180. Mathematics for Economists—Training in areas of mathematics which have frequent applicability to economic problems. Intended for students who have already had some calculus but lack a strong mathematical background. Topics covered include: functions of several variables; partial derivatives and differentials; mean value theorem and Taylor's theorem, integral calculus; elementary matrix algebra, determinants, and characteristic roots; quadratic forms; 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 (Greenberg) MW 1:15-3:05

181. Optimization and Economic Analysis—The development of optimization techniques, including calculus, linear and nonlinear programming, the calculus of variations, and control theory. Emphasis on concepts and results rather than techniques and proofs. Examples will include static and dynamic theories of the household and the firm, and problems in aggregative planning and control. Prerequisites: 51, 180 or Mathematics 43 or equivalent.

5 units, Win (Lau) MTWThF

188. Senior Research Paper.

3 units (Clark, Evans)

190. Introduction to Accounting—(See 90.)

191. Introduction to Cost Accounting—(See 91.)

193. Topics in Political Economy—Examines certain public policies such as price controls, the military draft, tariffs, minimum wages, rent controls, welfare programs, and social security. Are these policies wasteful of society's scarce resources? If so, why do they persist? Which groups gain and which lose from these policies? These questions will be addressed using concepts such as cost-benefit analysis, externalities, public goods, and models of public choice. Prerequisites: 51 and 52 or equivalent.

5 units, Win (Roberts)

199D. Directed Reading—Honors. Entails an in-depth study of an appropriate question and completion of a thesis of very high quality. This thesis will normally be written under the direction of a member of the Economics Department (or a member of some closely related department). (See description of Honors Program I.)

1-10 units total (Clark, Evans)

1 unit for at least 1 quarter

COURSES PRIMARILY FOR GRADUATE STUDENTS


A. CORE THEORY CURRICULUM


5 units, Aut (Lau)

203. Price and Allocation Theory II—Different forms of competitive and monopolistic...
behavior; their effect on efficiency of economic organization. Prerequisite: 202.

5 units, Win (Noeshek)


5 units, Spr (Starrett)


5 units, Win (Noeshek)


5 units, Win (Hall, King)

212. Theory of Income and Economic Fluctuations III — Macroeconomic growth theory, with applications to growth accounting, productivity analysis, and measurement of potential output. Uses of general equilibrium econometric models for forecasting, business cycle analysis, and policy simulations. Multicountry models, the international transmission mechanism, and the international business cycle. Prerequisite: 211.

5 units, Spr (Starrett)

301A,B,C. Seminar in Microeconomics.
10 units (Staff) by arrangement

310A,B,C. Seminar in Macroeconomics.
10 units (Staff) by arrangement

B. ALTERNATIVE APPROACHES TO ECONOMIC ANALYSIS

200. Topics in the History of Economic Thought — 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 will be studied both in terms of internal development and changing external economic conditions.

5 units, given 1986-87

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 considered. This is the starting point for a systematic examination of the meaning, significance, and analytic solutions of these problems which is the main focus of the course. Some relevant elements of Classical and Marxian economic theory are developed and compared with the approaches of Neo-Keynesian and Neoclassical theories.

5 units, Win (Noeshek)

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, Spr (Garegnani)

395 A,B,C. Seminar in Alternative Approaches to Economic Analysis.
10 units (Staff) by arrangement

C. ECONOMIC DEVELOPMENT

To receive comprehensive credit in the field of Economic Development students must: (1) Complete 215, 216 and 217.


5 units, Aut (Harris)


5 units, Spr (Bhaduri)


5 units, Spr (McKinnon)

10 units (Staff) by arrangement
D. ECONOMIC HISTORY

Requirements for the Field of Economic History: Comprehensive exam in Spring based on material from 226, 225 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 — This course will provide an examination of the roles played by the growth of scientific knowledge and technical progress in the development of industrial societies. Particular attention will be paid to understanding the interactions between science and technology as well as to organizational factors which have influenced their effectiveness in contributing to productivity growth. Upper division undergraduates may attend with consent of instructor.

5 units, Win (Rosenberg)

225. Technology, Economy and Society—Determinants and consequences of the diffusion of technological innovations in the economic history of the West from the ninth to the nineteenth centuries. Selected “clusters” of technical innovations will be examined for the light they throw upon the determinants of the rate and bias of innovative activity, economic and cultural conditions governing diffusion, and the problems of identifying and measuring the primary and second-order economic consequences of new modes of production and warfare. Innovation-clusters considered will include, e.g., the stirrup, horseshoe and horse-collar, 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, Spr (David)

226. Problems in American Economic History—This course covers the history of the American economy from colonial times to the present, with focus on the period 1790 to 1940. It stresses the role of economic history as a distinctive intellectual approach to the study of economics. Topics include Slavery and the Southern Economy, Labor Scarcity and Technological Progress, the Emergence of Oligopoly, and the Coming of the Great Depression.

5 units, Aut (Wright)

227. European Economic History—Economic growth and development in Western Europe from the eleventh to the twentieth centuries, with primary emphasis on the period from the Industrial Revolution to the First World War. The course will concentrate on the experiences of Britain, France, Germany, and other continental countries, roughly with that order of emphasis. Special emphasis will be placed on the interrelations between the growth and distribution of output, demographic trends, technological and organizational changes in the agricultural and manufacturing sectors, and the changing formal and informal institutions governing political and economic activity.

5 units, Spr (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. This course examines 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 examined 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.

given 1986-87

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 (Evans)

234. Monetary Theory and Advanced Macroeconomics II—Theoretical and empirical

5 units, Spr (Taylor)

10 units, (Staff) by arrangement

F. PUBLIC FINANCE

341,242. Public Finance and Taxation I and II—Welfare criteria for optimal government expenditure, taxation and debt; positive analysis of the effects of taxation, expenditure and debt on resource allocation and income distribution; project evaluation; pricing policies in government enterprise; the local public sector and intergovernmental fiscal relations.

241. 5 units, Win (Shoven)
242. 5 units, Spr (Boskin)

341A,B,C. Workshop on the Economics of the Public Sector—Issues in measuring and evaluating the economic performance of government tax, expenditure, debt, and other policies; their effects on private economic activity such as saving, investment, labor supply, etc.; alternative policies and methods of evaluation. A workshop format combining student research, faculty presentations and guest speakers. Prerequisite: 241 or consent of instructor.

10 units (Shoven) by arrangement

354A,B,C. Seminar in Law and Economics.
6 units, Aut, Win, Spr (Polinsky)
by arrangement

G. ECONOMICS OF LABOR


5 units, Aut (Pencavel)


5 units, Spr (MacCurdy)

248. Economic Demography—(Same as Food Research Institute 257.) 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) MW 9-10:50

345A,B,C. Workshop on Economics of Factor Markets
10 units, (Staff) by arrangement

H. ECONOMICS OF INDUSTRY

To receive comprehensive 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 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 of this course 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, Spr (Aoki)
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, Riodan)

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 (Bresnahan, Noll, Riordan)

by arrangement


10 units (David, Landau, Rosenberg)

by arrangement

360A,B,C. Energy Modeling Seminar—Seminar topics cover the economics of the supply and demand of energy in the U.S. and in the world, energy-economy interactions, benefit-cost and welfare analysis of economic and energy policies.

10 units (Lau, Sweeney) by arrangement

I. INTERNATIONAL ECONOMICS

265. International Finance—Exchange rates and use of national monies in international trade. Hedging and speculation. Balance of payments adjustments. Monetary and fiscal policies in open economies. Prerequisites: 204 and 212 or consent of instructor.

5 units, Aut (McKinnon)


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 and the debt problem. 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 272, 273, 274 will satisfy the comprehensive requirement.

270. Intermediate Econometrics—(See 170.)

271. Intermediate Econometrics II—(See 171.)

272. Econometrics I—Includes a review of classical least squares theory, problems pertaining to serial correlation of the residual, autoregressive models, distributed-lag models, and other single-equation methods and problems. Selected applications in economics. Prerequisites: Mathematics 113, Statistics 219 and 220, or the equivalent.

5 units, Aut (Anderson)


5 units, Win (Anderson)

274. Econometrics III—Continuation of 273. Discusses nonlinear models; probit, logit, and Tobit models; disequilibrium models; frontiers in econometrics. Prerequisite: 273.

5 units, Spr (Morimune)

275. Selected Topics in Advanced Econometrics—Covers the current topics not discussed in the sequence 272-273-274. Topics may include spectral analysis, Bayesian analysis, prediction and control, factor analysis, aggregation, etc. Prerequisite: 274.

given 1986-87

370A,B,C. Seminar in Econometrics.

10 units, (Staff) by arrangement

K. MATHEMATICAL ECONOMICS*

Field I: Theory of Choice

280. Welfare Economics—(Same as Operations Research 367.) The course will cover the normative and descriptive theory of social
choice. Alternative axiomatizations of social choice, with special reference to interpersonal comparisons of utility; possibility and impossibility theorems. Measurement of inequality from a social choice viewpoint. Individual rights and social choice. Strategic considerations in social choice procedures; the Gibbard-Satterthwaite theorem on manipulability; demand revelation.

5 units, Aut (Hammond)

281. The Economics of Uncertainty—A systematic examination of the implications of uncertainty on microeconomic behavior using axioms of choice under uncertainty and the expected utility theorem. Topics include optimal static and dynamic portfolio choices, insurance, the effect of uncertainty on savings and production decisions, stochastic stability of markets, and general equilibrium and welfare considerations under uncertainty. Prerequisites: 181, Statistics 116, or equivalents.

5 units, Spr (Starrett)

282. Theory of Information and Organization—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, Spr (Riordan)

Field II: General Theory


5 units, Aut (Kurz)


5 units, Win (Hammond)


5 units, Win (Greenberg)

288. Applied General Equilibrium Analysis—Course develops fundamental theory of general equilibrium including existence proofs and their relationship to computation algorithms and will discuss actual application to the algorithms to a range of problems in both developed and developing economies: tariff effects, tax incidence, and natural resource exploitation policies are among the topics to be examined.

5 units, Spr (Shoven)

Courses which may be used in either Field I or II (approval required).

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,G. Seminar in Mathematical Economics.

10 units, (Staff) by arrangement

386A,B. Interdisciplinary Seminar in Decision Analysis—(Same as Graduate School of Business 494A,B,C, Operations Research 366A,B, Psychology 283A,B.) This seminar aims to study a normative and descriptive decision making particularly in the face of uncertainty. It will examine general studies on the way decisions are made and the problems arising in making decision analyses in applied policy contexts. This seminar will meet once every two or three weeks throughout the academic year. Prerequisite: consent of instructor.

3-6 units, Aut, Win (Arrow, Tversky, Wilson) by arrangement
ENGLISH


Chairman: Albert J. Gelpi
Vice Chairman: Thomas C. Moser
Director of Creative Writing Program: John L'Heureux


Associate Professors: George H. Brown (on leave Autumn and Winter), W. S. DiPiero (on leave Autumn and Spring), Jay Fliegelman (on leave 1985-86), Barbara Charlesworth Gelpi, Arturo Islas, Jr. (on leave Autumn)

Assistant Professors: Terry Castle, Sandra E. Drake (English and Comparative Literature), Regenia Gagnier (on leave 1985-86), Mary F. Wack (on leave Autumn)

Professor (Teaching): Larry Friedlander

Lecturers: Michelle Carter, John Daniel, Ehud Havazelet, Laura Marello, Kent Nussey

Visiting Professors: Morton W. Bloomfield, Carolyn Kizer, H. Eric Solomon, Garrett Stewart

Visiting Associate Professor: Paul Skenazy

Visiting Assistant Professors: Harold Hellenbrand, Teresa McKenney, Peter Smith

Andrew W. Mellon Fellow: Joseph Grigely

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 requirement for the bachelor's degree. Any two of the requisite courses may be taken on a pass/no credit basis at the discretion of the instructor, but students intending to go to graduate school should weigh the fact that a grade of pass will provide little evidence of their abilities.

MAJOR IN ENGLISH

English majors are required to demonstrate proficiency in a foreign language. "Proficiency" means that the student is able to read at least at the level of facility expected in second-year college courses in a foreign language. As a minimum, the requirement may be fulfilled by passing a fourth-quarter foreign language course other than a "conversation" course or by demonstrating equivalent knowledge. English majors are strongly urged to continue with literature courses in whatever language or languages they study. English majors who already possess the necessary language skills are strongly urged to satisfy this requirement by taking 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, 205, Linguistics 1, 70, 73.
B) Medieval: English 171A, 171B, 211, 270A.
C) Renaissance: English 113, 160C, 172, 202B.
G) American Literature before 1900: English 120,* 121, 122, 160C, 239,* 256, 266, 284.
P) Poetry: English 92, 150, 250

*May be used to satisfy one area only.

In addition, students must elect two additional courses in English or American literature from those offered by the English Department (excluding only English 1-2-3 or advanced composition courses). In place of one of these courses, students may choose one 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 one of the following: for fiction writers, "Fiction Writing" (English 90), "Development of the Short Story" (English 137), plus two quarters of "Advanced Fiction Writing" (English 190) or of a more advanced writing course, all with grades of B or better; for poets, "Reading and Writing Poetry" (English 92), one course in poetry (to be approved by the person in charge of the poetry program of creative writing), plus two quarters of "Advanced Poetry Writing" (English 192) or of a more advanced writing course, all with grades of B or better.

**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, approved 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 Liter-
ature. 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 Seminars—two courses
Senior Honors Essay—10 units

The Director of the Honors Program may, in special cases, modify these requirements.

Students electing the major in English with an Interdisciplinary Emphasis will substitute the Junior Honors Seminar for one of the courses in 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" under
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. Students wishing to take the Comparative Literature option within the Honors Program in Humanities should see the section "Comparative Literature."

**VISITING STUDENTS**

Students who do not wish to become candidates for a graduate degree, but who are qualified to meet the standards of admission to a master's or Ph.D. program, may apply to the Graduate Admissions Office, Stanford University for admission as non-matriculated students for a period of not more than three consecutive quarters. Each quarter they may take up to three English courses numbered 101 to 299, or two such courses and (with the permission of the instructor) one English course numbered above 300. Such students are not eligible to apply for admission to the Ph.D. program.

**TEACHING CREDENTIALS**

1. Single Subject Teaching Credential (Secondary). For information concerning the requirements for this credential, consult the School of Education. Undergraduates who are interested in preparing to teach English in public secondary schools should give first priority to the departmental requirements for the A.B. with a major in English.

2. Community College Instructor Credential. Candidates who successfully complete the requirements for the A.M. degree in English will thereby qualify for the State of California Community College Instructor Credential.

**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.

Candidates for a coterminal master’s degree must fulfill all requirements for the Master of Arts in English, as well as General Requirements and Major Requirements for the A.B. or B.S. A minimum of 3.5 grade point in the major is required of those applying for the co-terminal master’s degree. See description of programs under the “Degrees” section of this bulletin.

Candidates for the Master of Arts in Teaching must complete a minimum of two-thirds of their specified work in the English Department.

Candidates for the master’s degree in Creative Writing must submit a sample of their writing with their application. Should this sample be approved, the candidate will be provisionally admitted to the program, but will not be finally accepted until he or she has demonstrated ability through one quarter’s work in an advanced writing course. A candidate may then earn the master’s degree by passing satisfactorily nine courses of specified work (including the qualifying advanced writing course) and one foreign language, and by submitting a piece of imaginative writing of substantial length and merit. This must be submitted at least four weeks before the close of the quarter in which the degree is to be granted.

Candidates for the master’s degree in Creative Writing who, after a quarter’s work, are not accepted as degree candidates in the writing program may earn the master’s degree in English by completing satisfactorily nine courses of specified work and by passing one foreign language.

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 required part of the Ph.D. program.

A candidate may take the Ph.D. degree in English Literature, in English and American Literature, in English and Comparative Literature, in English and Humanities, in English and Linguistics, in English Philology, or in English Medieval Literature.

Requirements of the Ph.D. program in English literature are as follows:

1. A five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.

2. A minimum of six courses for a letter grade, from the graduate colloquia and graduate seminars, of which at least three must be graduate seminars. These colloquia and seminars should be from different genres and periods as approved by the advisor.

3. A two-unit course introducing the new graduate student to the various opportunities and
Requirements of the Ph.D. program in English and Comparative 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. An oral qualifying examination based on a Reading Guide, to be taken at the end of the summer after the first year of graduate work. The final decision as to qualification is made by the Graduate Studies Committee in consideration of the student's course record in conjunction with his or her performance in the examination.

A student coming to the doctoral program who has done graduate work at another university must petition in the first week of the first quarter at Stanford for transfer credit for course work completed elsewhere and for exemption from the Stanford Qualifying Examination. The petition should list the courses and grades and describe the nature, scope, and result of the qualifying examination taken elsewhere. The Graduate Studies Committee will meet the first week of Winter Quarter to consider these petitions in conjunction with the students' grades for the first quarter here. If the Committee cannot make a decision at that time, it will meet the first week of Spring Quarter to make a decision after two quarters of Stanford grades. If a student's petition is not granted, he or she will have the option of taking the Stanford Qualifying Examination either in the Spring Quarter of the first Stanford year or at the regular time at the end of the Summer 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.

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 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.)

2. 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 re-
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 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 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 as a second 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 reestablish 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.

COURSE 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, 270-289, 370-389
Seminars for English Majors: 160A-J
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
COURSES NUMBERED 1 THROUGH 99 ARE INTRODUCTORY COURSES 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.

1, 2. 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,2A. 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.

1B,2B. Writing Workshops: Prose Writing—These courses focus directly on student writing with special texts used as examples of different kinds of writing.

1C,2C. 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.

1D,2D. Critical Reading and Writing—(Same as Center for Teaching and Learning 8.) These courses focus on reading as well as writing and each week students meet four times in class and once in tutorial.

3. 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.

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)

7,8,9. Literature and the Arts in Western Culture—This Western Culture sequence emphasizes literature and the creative imagination as part of the Western tradition. The lectures explore literature in its cultural context and include sessions on art, music, and drama. Students meet three times weekly for lectures and once weekly in two-hour seminar discussion groups. The course moves chronologically from antiquity to the present day, setting works in their original historical and intellectual perspective. Besides developing critical and analytical skills, this course stresses the techniques and practices of good writing. All seminar instructors are experienced writing teachers, and student essays receive close attention. Students who elect other courses to satisfy the Writing Requirement are eligible to request this Western Culture track for the usual 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. (DB:1)

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)

9. The Modern World—Modern thought and literature from the English Romantics, through Austen and Dickens, to Mar...
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.) This course is designed as an introduction to the works of three of the greatest English writers: Chaucer, Shakespeare, and Milton. (DR:2)

3 units, Aut (Rebholz)

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, Win (Polhemus)

12. Masterpieces of American Literature—(English majors and other students taking the course for 5 units, register for 112.) This course is designed as an introduction to major literary works by American writers. Works by such authors as Hawthorne, Melville, James, and T.S. Eliot will be read. (DR:2)

3 units, Win (Islas)

39. The Novel—(English majors and other students taking the course for 5 units, register for 130.) The objectives of this course are to present the novel as a significant, distinct genre, and by close, sympathetic reading to increase the student’s appreciation of individual novels. (DR:2)

3 units, Aut (Packer)

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, Win (L'Heureux)

50. Poetry and Poetics—(English majors and other students taking the course for 5 units, register for 150.) An introduction through the careful reading of a variety of poems, with emphasis on modern poems, and through the study of language and technical elements of verse. There will be opportunity for the writing of poems. (DR:2)

3 units, Win (Stone)

Spr (Middlebrook)
112. Masterpieces of American Literature—(See 12.)
5 units, Win (Islas)

113. The Renaissance. (Area C)  
5 units, Win (Ryan)

117. Romantic and Victorian Literature—A survey of some of the most important English writers of the nineteenth century, including Wordsworth, Keats, Dickens, Hardy, Browning, Tennyson, and Hopkins. (Area: F)  
5 units, Aut (Smith)

119. Modern British Literature. (DR:2)

120. American Historical Novel—Introduction to the historical novels of Cooper, Hawthorne, Melville, James, Twain, Wharton, Cather, Faulkner, and Janet Lewis. (DR:2) (Area: G or H)  
5 units, Spr (Dekker)

121. American Literature and Culture to 1855—(Same as American Studies 50.) (Area: G)  
5 units, Aut (Hellenbrand)

122. American Literature, 1855-1917. (Area: G)  
5 units, Win (Moser)

123. American Literature, 1917 to the Present—(Area: H)  
5 units, Aut (Fields)

5 units, Aut (Skenazy)

130. The Novel—(See 30.)  
5 units, Aut (Packer)

131A. The Eighteenth-Century English Novel. (Area: E)  
5 units, Aut (Bender)

131B. The Eighteenth-Century English Novel. (Area: E)  
5 units, Spr (Castle)

132. The Nineteenth-Century English Novel. (Area: F) (DR:2)  
5 units, Spr (Polhemus)

133. The Twentieth-Century English Novel. (Area: H) (DR:2)  
5 units, Win (Stone)

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, Win (Packer)

140. Drama—(See 40.)  
5 units, Win (L'Heureux)

150. Poetry and Poetics—(See 50.) (Area: P)  
5 units, Win (Stone) Spr (Middlebrook)

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 (Ruotolo)

155. Modern British and American Poetry—A close study of the poems of Crane, Graves, Bogan, Roethke, Larkin and others, with particular attention to their prosody. (Area: H)  
5 units, Spr (Kizer)

160A-J. For English Majors Seminars—Seminars on the scholarly and critical study of literary texts; given each quarter and strongly recommended for English majors. English 160A-H 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: Bender, Castle, Grigely, Islas, McKenna, Ruotolo, Saldivar) Consult the Time Schedule for specific openings. (Area: As indicated)  
5 units, Aut, Win, Spr

161A. The Afro-American Novel—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)

161F. The Harlem Renaissance—The literary activity of Afro-Americans in the 1920’s will be studied through writings of the authors of the period. Questions considered will include: reasons for setting this period apart in African American literary history; relation to such phenomena in U.S. cultural life as the “Lost Generation” and the “Jazz Age”; and relation to literary and cultural activity of communities of the Black Diaspora (of African descent) living in...
162A. Chicano Literature—(Same as Chicano Studies 182, Spanish and Portuguese 162A.) Introductory survey of Chicano prose, fiction and non-fiction. Students will be instructed in critical and analytical reading as well as introduced to innovative narrative strategies in the works of Mexican writers who have been born and educated in the United States. (Area: H) 5 units, Spr (McKenna)

163. Third World Women In Literature—(Same as Chicano Studies 181.) Course will examine the images of women as portrayed in the literature of the Third World as well as in the ethnic literature of the United States. The psychological, sociopolitical and literary implications of these images will be critically discussed. 5 units, Win (McKenna)

168. American Indian Mythology, Legend, and Lore—(See 68.) 5 units, Aut (Fields)

171A. Chaucer's Canterbury Tales. (Area: B) 5 units, Win (Wack)

171B. Chaucer's Troilus and the Dream Poems. (Area: B) 5 units, Spr (Howard)

172. Milton. (Area: C) 5 units, Spr (Evans)

173A. Shakespeare—(Same as Drama 159.) Intensive study of the following plays: Richard III, The Merchant of Venice, Sonnets, Romeo and Juliet, Henry IV: Part I, As You Like It, Julius Caesar, Hamlet, The Tempest. (Area: D) 5 units, Aut (Ryan)

173B. Shakespeare—(Same as Drama 159.) The Merchant of Venice, Twelfth Night, Henry IV: Part I, Henry IV: Part II, Measure for Measure, Romeo and Juliet, King Lear, Winter's Tale. (Area: D) 5 units, Win (Rebholz)

173C. Shakespeare—(Same as Drama 159.) Twelfth Night, Hamlet, Othello, Macbeth, As You Like It, Antony and Cleopatra, The Tempest. (Area: D) 5 units, Spr (Orgel)

177. Virginia Woolf. (Area: H) 5 units, Spr (Ruotolo)

179D. Conrad and Faulkner. (Area: H) 5 units, Spr (Moser)

190. Advanced Fiction Writing—Intermediate course. May be taken twice. Prerequisite: 90. 5 units, Aut, Win, Spr (Carter, Havazelet, Marello, Nussey, 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 (Ablanese)

191B. Writing About Social Sciences. 3 units, Aut (Lloyd)

191C. Writing About Business. 3 units, Spr (S. Harvey)

191D. Writing About Law. 3 units, Win (Johnstone)

191E. Advanced General Composition. 3 units, Spr (Staff)

192. Advanced Poetry Writing—Intermediate course. May be taken twice. Prerequisite: 92. 5 units, Spr (Daniel)

192A. On Poets and Poetry—A lecture course on eight to ten poets ranging from "major" to some lesser-known writers. 1 unit, Win (Levertov)

192B. Advanced Poetry Workshop—In this course for undergraduates (to be selected by the instructor) promising student poets will write poetry in an atmosphere of mutual aid. Students must also enroll in 192A, a lecture course, for 1 unit of credit. In the workshop students work on assignments relating to each week's lecture, attempting to explore themes and craft ways found in the work of the poet therein discussed. Manuscripts must be submitted to the Creative Writing secretary by December 15. 4 units, Win (Levertov)

193. Technique for Fiction Writers—Aim is to engage the student in critical reading, from the perspective of the writer as apprentice. Focus will be 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: English 90 and submission of a manuscript. 5 units, Spr (Carter)

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 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 (Moser)

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 198 and/or English 195 in any one quarter. English 198 may not be used to fulfill departmental area or elective requirements without permission. Group seminars are not considered appropriate to English 198.

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)

COURSES NUMBERED 200-299 ARE MAINLY COURSES ON SPECIFIC TOPICS AND AUTHORS: FOR UNDERGRADUATE AND GRADUATE STUDENTS

Note—Graduate students in other departments who wish to broaden their programs will find many of these courses useful.

200A. Old Norse-Icelandic—(Same as German 205A and German 305A.)
5 units, Spr (Andersson)

202B. Colloquium: English Culture from More to Milton—(Same as English 302B, History 242/342.) (Graduate students register for 302B.) Readings will trace the idea of the commonwealth from More's Utopia to Milton's The Ready and Easy Way to Establish a Free Commonwealth. Emphasis on prose fiction and discursive essays. (Area: C)
5 units, Spr (Riggs, Sharpe)

205. Old English—Elements of Old English grammar; critical reading of short poems and selected prose in Old English. (Area: A)
5 units, Win (Wack)

207A. Autobiography and Literature: Gender and Genre—(Enroll in Modern Thought and Literature 208.)
5 units, Win (M. Yalom, S. Bell)

207B. Sense of Identity in Modern Women Writers—(Enroll in Modern Thought and Literature 207.)
5 units, Spr (M. Yalom)

208. Post-Classical Latin—(Same as Classics 118.) Careful reading of Latin texts of graded difficulty, beginning with the Vulgate Bible, working through various patristic writings and medieval literature to the Latin of the Renaissance.
4 units, Win (McCormack)

211. Readings in Middle English. (Area: B)
5 units, Spr (Brown)

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, Win (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, Spr (B. Gelpi)

239. American Short Fiction—(Area: G or H)
5 units, Win (Fields)

245. Drama of the Restoration and Eighteenth Century—(Area: E)
5 units, Aut (Fifer)
250. Poetry and Poetics—An advanced inquiry into the evolution of one or two poetic genres, from the Renaissance to the modern periods. Some of the forms that might be explored: the sonnet, the ode, the verse letter, the long poem. (Area: F)
5 units, Spr (Fields)

256. Emerson, Whitman, Dickinson—(Area: G)
5 units, Win (A. Gelpi)

5 units. Win (Gagnier)

262B. Victorian Cultural Debate: the Relations of Morality and Beauty—An examination of the ways that the Victorian moral imperative was modified. Mill's response to Wordsworth and Carlyle's to Goethe take their place in the large dialectic of repudiation and assertion, of which Pater's calculated amorality is as much a part as Ruskin's shift from artistic to political criticism. Everywhere sons deny fathers (Matthew Arnold, Samuel Butler, and Edmund Gosse, not to mention Mill) at the call of what we shall begin by describing as the beautiful. (Area: F)
5 units, Aut (Smith)

263G. Feminist Literary Criticism: Theory and Practice—(Same as Feminist Studies 170/270.) The development of feminist approaches to the study of literature with emphasis on the significance of feminist theory to the practice of criticism.
5 units, Spr (B. Gelpi)

264A. Contemporary Narrative Theory: an Introduction—A close reading of selected texts from the classic period of British and American fiction in light of narrative models developed by such theorists of fictional form as Vladimir Propp, A. J. Greimas, Roland Barthes, Tzvetan Todorov, René Girard, Peter Brooks, and Shoshana Felman. Background reading and classroom discussion of recent trends in structuralism, deconstruction, and post-Freudian psychoanalysis will set the stage for our study of such exemplary texts as Fielding's Joseph Andrews, Brontë's Wuthering Heights, Dickens's Great Expectations, Poe's The Case of M. Valdemar, James's The Turn of the Screw, and Conrad's Heart of Darkness.
5 units, Spr (Stewart)

266. The American Enlightenment—An examination of such major figures of the American Enlightenment as Franklin, Edwards, and Jefferson; some attention to European contemporaries and American antecedents. (Area: G)
5 units, Aut (Hellenbrand)

267. Freud and Literary Criticism—The application of Freudian and post-Freudian psychological theory to the study of literature. Reading of several works by Freud (e.g. The Interpretation of Dreams) and examination of recent adaptations of Freudian ideas by literary critics. Enrollment limited; permission of instructor required. (Area: H)
5 units, Aut (Castle)

270A. Beowulf. (Area: B)
5 units, Spr (Wack)

281. Keats and His Circle—A detailed examination of Keats's poetry and the literary milieu in which he lived and wrote. Emphasis will be on the longer poems and the Odes, but special treatment will be given to the so-called 'minor' poems and letters. Related readings will include the poetry of Leigh Hunt and John Reynolds; the critical prose of Hunt, Hazlitt, and Reynolds; Haydon's Journals; and selected critical texts. (Area F)
5 units, Aut (Gagnier)

284. Hawthorne and James—(Area: G)
5 units, Win (Dekker)

290A. Reading for Fiction Writers—A practical workshop in the close analysis of fictional texts in an attempt to define different authors' strategies of style, structure, technique. Partly a writing course, partly a fiction course for writers. Prerequisite: an advanced course in fiction writing, at Stanford or elsewhere, and submission of a manuscript ten days before registration.
5 units, Win (Sorrentino)

COURSES NUMBERED 300 THROUGH 309 ARE GRADUATE COLLOQUIA; COURSES NUMBERED 310 THROUGH 399 ARE GRADUATE SEMINARS AND WORKSHOPS

Note: Some of these courses are relatively broad in scope; some focus on a single theme or genre. Students should consult the instructor before registering for any course in this category.

5 units, Win (Howard)

302B. Colloquium: English Culture from More to Milton—(Same as English 202B, History 242/342.) Readings will trace the idea of the commonwealth from More's Utopia to Milton's The Ready and Easy Way to Establish a Free Commonwealth. Emphasis on prose fiction and discursive essays.
5 units, Spr (Riggs, Sharpe)
   5 units, Aut (Carnochan)

303B. Colloquium: Sexuality and Terror: Gothic and Fantastic Literature of the Eighteenth Century—Focus will be on classics of Gothic fiction by Walpole, Radcliffe, Lewis, Beckford and others. The role of women in Gothic fiction and the genre’s treatment of terror and sexuality will be major themes.
   5 units, Win (Castle)

304A. Colloquium: Love and Passion in Nineteenth-Century Fiction.
   5 units, Win (Polhemus)

304B. Colloquium: Theories of Romanticism—Major statements on Romanticism from Arnold to the present, together with readings of major Romantic texts. Changing attitudes to the period will be treated as representative of the development of modern criticism as a whole.
   5 units, Spr (Lindenberger)

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, Win (Lindenberger)

307B. Colloquium: Post-Modern Fiction: American and European—Discussion and investigation of works by writers who have extended the classic modern tradition. Readings of such authors as William Burroughs, Robert Creeley, Samuel Beckett, Aidan Higgins, Claude Mauriac, Robert Pinget, Italo Calvino, Juan Goytisolo, Claude Mauriac, and Milan Kundera.
   5 units, Win (Sorrentino)

308. Seminar: Nature and the Natural in Victorian Culture—Study of the interaction between abstract ideas of nature and its physical manifestations, as expressed in literary, scientific, and popular texts. Attention to such themes as evolution, domestication, and human irrationality.
   5 units, Aut (Ritvo)

331. Seminar: Major Twentieth-Century American Novelists—Dreiser, Wharton, Anderson, Fitzgerald, Hemingway, Dos Passos, Cather, Faulkner, and several contemporary novelists, who may provide appropriate research topics.
   5 units, Aut (Solomon)

361. Seminar: The Modern Tradition—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)

   5 units, Spr (Bloomfield)

363. Seminar: Victorian Masters: from Apprenticeship to Late Experimentation—A comparative study of early and late works by four writers whose careers in fiction spanned considerable stretches of the Victorian period. We will read Dicken’s The Old Curiosity Shop (1840-41) together with Our Mutual Friend (1864-65), Eliot’s Ordeal of Richard Feverel (1859) with Diana of the Crossways (1884), and Hardy’s The Return of the Nattle (1878) with Jude the Obscure (1895).
   5 units, Spr (Stewart)

364B. Seminar: The Bloombury Group.
   5 units, (Ruotolo)

   5 units, Win (Orgel)

373. Seminar: Shakespeare.
   5 units, Aut (Rebholz)

385A. Seminar: Ezra Pound and the Pound Tradition—A close reading of The Cantos for six weeks, with a week on H.D.’s Helen in Egypt, Zukofsky A, Olson’s Maximus Poems, and Duncan’s Passages.
   5 units, Spr (A. Gelpi)

385B. Seminar: Melville.
   5 units, Spr (Fliegelman)

390. Graduate Fiction Writing — A workshop designed primarily for graduate students enrolled in the Writing Program. May be repeated for credit. Prerequisite: consent of instructor.
   3-5 units, Aut (L'Heureux) Win (Packer) Spr (Sorrentino)

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) Win (Levertov) Spr (Kizer)
394. Independent Study—Preparation for qualifying examination and for the Ph.D. oral examination. Pass/No Credit only.

by arrangement

395. Ad Hoc Graduate Seminars—In any quarter, a group of graduate students (at least three but preferably more) who wish in the following quarter to study a subject or an area not covered by regular courses and seminars may plan an informal seminar and approach a suitable member of the department to supervise it, either on a graded or Pass/No Credit basis.

any quarter, by arrangement

396. Introduction to Graduate Study—A two-unit required course for first-year graduate students in English and Modern Thought and Literature and for those students in Comparative Literature who will be teaching in the Freshman English program. The course provides instruction in teaching—especially leading a section and evaluating essays and examinations—and a broad introduction to the opportunities and responsibilities of graduate study. The class will meet weekly. The instructors will assign brief readings and a short final paper. The course is offered on a Pass/No Credit basis only.

2 units, Aut (Fifer, and the Director of Graduate Studies)

397A. Rhetoric and Teaching Composition—A required course for second-year graduate students in English and Modern Thought and Literature and students in Comparative Literature who will be teaching in the Freshman English Program. The course will be conducted both as a seminar and as an apprenticeship. Each student will be assigned as an apprentice to an experienced teacher. At the beginning of the quarter, the apprentice will sit in on classes, conferences, tutorials; at the end, the apprentice may be given responsibility for conducting a class, grading papers, holding conferences. Class meetings will be devoted to discussing rhetoric, composition, and teaching of writing. Readings will be assigned in both rhetoric and pedagogy. Each student will design a two-quarter syllabus in preparation for teaching English 1 and English 2. The course is offered on a Pass/No Credit basis only.

5 units, Aut (Fifer)

397B. Teachers Workshop I—A seminar for second-year students who will be teaching composition. (Second-year students are advised to enroll in this course and to take during their first quarter of teaching only one literature course.) The course has a strong pragmatic emphasis: discussion of writing assignments, evaluation of essays, coordination of reading and writing, conduct of conferences. Occasionally experienced teachers of composition will be invited to discuss particular problems in teaching. No written work will be required. The class meets one hour a week, at noon.

5 units, Win (Fifer)

397C. Teachers Workshop II—A seminar for second-year students teaching the second quarter of composition. The focus of discussion will be the second-quarter syllabus. Students will share good assignments, problems, solutions they have encountered in their teaching.

5 units, Spr (Packer)

398. Research Course—Student pursues a special subject of investigation under supervision of some member of the department. Thesis work not to be registered under this course.

any quarter, by arrangement

399. Thesis.

any quarter, by arrangement.

See Overseas Studies section for English courses given at overseas centers.

COURSES REGULARLY OFFERED BUT NOT DURING 1985-86

63. Twentieth-Century American Women Poets.

64. The English Bible as Literature.

79. Fitzgerald and Hemingway.

105. Linguistic Approaches to Point of View in Fiction—(Same as Linguistics 72.)

115. Restoration and Eighteenth-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.)

139. Detective Fiction.

142. Medieval and Renaissance Drama.


153. Visions and Transformations.

158A. Plath, Sexton, Rich.

160A. Seminar for English Majors: Language.

160B. Seminar for English Majors: Medieval Literature.

160D. Seminar for English Majors: Shakespeare.
SCHOOL OF HUMANITIES
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161. Afro-American Literature.
161B. Afro-American Poetry.
162B. Chicano Literature: Creative Writing for Bilingual Students.
162E. Introduction to Caribbean Poetry: English, French, Spanish.
162F. Modern Literature of the Caribbean.
163A. Twentieth-Century American Women Poets.
163C. English Women Writers.
163D. The Female Experience: Victorian Heritage.
163E. Women’s Situation.
163F. Women Writers: The Literary Tradition.
163H. Contemporary Issues in Feminist Theory—(Same as Feminist Studies 105.)
164. The English Bible as Literature.
165A. Literature of the Holocaust.
165C. The Reciprocal Vision.
166. Modern Literature in English from Africa.
167A. The Literature of Fantasy.
167B. Modern British Comic Fiction.
169B. Toward an Understanding of Modernism.
174. Swift.
175. Swift and Pope.
177A. The Brontes and Elizabeth Gaskell.
179. Hawthorne and Melville.
179A. Fitzgerald and Hemingway.
200B. Advanced Old Norse—(Same as German 205B/305B.)
201. Old Saxon—(Same as German 207/307.)
202. Topics in the History of the English Language.
209. Introduction to Paleography and Codicology.
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 Eighteenth-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.
255A. Modern British Poetry.
259A. Symbolist Poetry, French and American.
263B. Gender and Interpretation.
269C. The Poet and the Artist in American Modernism.
269E. American Modernist Poets.
273. Advanced Study of Shakespeare.
280. Tennyson and Browning.
281A. Dickens and Trollope.
285A. Foe and Hawthorne.
285B. Twain and James.
288A. Joyce.
288C. Yeats and T.S. Eliot.
290B. The Writing and Criticism of Fiction.
291. Generative Devices in Fiction Writing.
293. Verse Translation Workshop.
305. Colloquium: Twentieth-Century British Literature.
313. Seminar: Methods and Materials for the Study of Renaissance Literature.
315A. Seminar: The British Enlightenment.
316A. Seminar: Studies in Romanticism.
355. Seminar: Shelley and His Circle.
360A. History of Literary Theory (Ancient).
360B. History of Literary Theory (Medieval/Renaissance).
360C. Neoclassicism and Aesthetics: The Plotinian Construction.
365. Topics in American Literature.
365A. Seminar: The American Historical Romance.
365B. Seminar: American Literature and Culture in the 1840's.
368. Seminar: Psychoanalysis and Feminism.
371. Seminar: Chaucer.
374. Seminar: Ben Jonson.
376. Seminar: Milton.
385C. Seminar: Wallace Stevens, Poetry and Influences.
385D. Seminar: Henry James.
388. British Authors of the Nineteenth and Twentieth Centuries.
388A. Seminar: Virginia Woolf.
388G. Seminar: Joyce, O'Brien, Beckett.

FEMINIST STUDIES 393

Feminist Studies is an interdisciplinary program that investigates the significance of gender 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 by the program and in existing departments.
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 gender or women.

UNDERGRADUATE PROGRAM

INDIVIDUALLY DESIGNED MAJOR

The major should normally be declared by the beginning of a student’s third year. Individually Designed majors must be proposed to, and approved by the Undergraduate Studies Dean's Advisory Committee on Individually Designed Majors (see general guidelines under “Dean of Undergraduate Studies Special Programs”). Further information on Individually Designed majors is available at the Undergraduate Advising Center, Old Union 306 (497-2426).

The Individually Designed major in Feminist Studies may be taken as a single major, as one of multiple majors, or as a secondary major. If the student wishes to take the Individually Designed major in Feminist Studies as one of multiple majors, none of the 60 units counted toward the major in Feminist Studies may overlap with the units counted toward the major in another department or program. But if the student wishes to take the Individually Designed major in Feminist Studies as a secondary major, then at least thirty of the units counted toward the Feminist Studies major may also be counted toward fulfilling the major requirements in another department or program, if that department or program consents.

Students interested in an Individually Designed major in Feminist Studies should consult with the director of the program several months before submitting a plan of study to the Dean’s Advisory Committee. The Feminist Studies Office is at CROW, Serra House, 497-2412. Students should choose three faculty advisors from the list of resource faculty (see above) and may consult with peer advisors. Faculty advisors will work closely with the student in helping design an appropriate program of study. They will also oversee work for the student practicum.

CURRICULUM

For an Individually Designed major in Feminist Studies, the following course of study is recommended: each student should take a minimum of twelve 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 twelve 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. Women’s Situation (Feminist Studies 101.)
2. Contemporary Issues in Feminist Theory (Feminist Studies 105).
3. Senior Seminar (Feminist Studies 198).

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 (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 focus 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 Nineteenth Century  
Women and Society: the Twentieth 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 ARLO project, or by undertaking supervised work in a department.

COURSES
Approved courses in the Feminist Studies Program are divided into (1) feminist studies courses and (2) approved courses in other departments. 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.

GROUP 1: FEMINIST STUDIES

CORE COURSES

101. Women's Situation—An introduction to issues, perspectives, methods and findings of feminist scholarship on the historical and cultural construction of gender. Topics include: health and reproductive technology; theories of domination; sociobiology and scientific views of women; mothering, the family, the home and work world; construction of sexuality; women, war and violence; gender and ethics.  
5 units, Aut (Schiebinger)

105. 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, (Gagnier) given 1986-87

108. Senior Seminar—A weekly seminar in which majors and concentrators design and implement a senior project.  
5 units, (Staff)

SOCIAL SCIENCE COURSES

121. U.S. Women's History 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 the state; changing ideals on 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 and slavery; female reform, and the early women's rights movement. (DR:5)  
5 units, Win (Freedman) given 1986-87

122. U.S. Women's History Since 1870—(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 twentieth-century women's lives; and the rebirth of feminism. (DR:5)  
5 units, Spr (Freedman) given 1986-87

124. Women and the Mass Media—Examines media images of women and women's issues, women's employment and policy-making status within media institutions; traces the developing impact of feminism on the mass media and evaluates women's present status in light of recent changes.  
4 units, Aut (Staff)

126. 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

130. Sex and Education—(Same as Education 170, Sociology 112.) Examines gender as a critical variable in educational institutions and labor markets. Interdisciplinary approach to issues such as the distribution of power in schools, the determinants of occupational choice, the relative payoff of schooling for women and men, the causes of differential behavior and treatment between the sexes in schools and in the work force, and the legal redress of inequalities.  
4 units, (Cohen) alternate years, given 1986-87

133. Women, Madness and Sanity—(Same as Psychology 169.) Concepts of mental health and mental illness as applied to women. Theory of psychotherapy, both traditional and feminist. Alternative approaches to mental health.  
3 units, Win (Matteo) TTh 10-11:30

138. Women and Development in Africa—(Same as Education 175X, African and Afro-American Studies 175X, Anthropology 109.) 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.  
4 units, (Samoff) TTh 4:15-6:05

139. Women, Family and the Law—(Same as Sociology 139.) An analysis of changing legal
perspectives on women and the family. Readings and class discussion will examine the legal regulation of marriage, unwed co-habitation, marital property, divorce, child support, child custody, abortion, family violence, marriage contracts, and remarriage. Laws and policies in the United States will be compared with selected examples from England, Sweden and France.

3-5 units, Win (Weitzman) MWF 10

140. Sex Roles and Society—(Same as Anthropology 11.) Course purpose is to develop 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:2)

5 units (Gel Herdt 1985-86,
Jane Collier 1986-87)

142. Women in Cities—(Same as Anthropology 145.) A series of hypotheses about women's experiences in cities, which have emerged primarily from research in North America and Western Europe, will be critically evaluated in light of research on women in Latin American, Asian, and African cities. Topics to be covered include women and migration, changing forms of the sexual division of labor, changing family and kinship structures, women's access to 'public' space in cities, urbanism, and political activism.

5 units, Aut (Yanagisako)

145. Feminist Perspectives on Birth Control —(Same as Human Biology 150C.) In most societies where human fertility control is practiced the responsibility rests predominantly with women. Is this desirable and realistic, or should changes be instituted? Participants in this seminar will be free to choose specific aspects of this problem and to address themselves in the form of research papers to possible answers. Admission limited to 15 seniors after completing special questionnaires available from the Human Biology office. Under exceptional circumstances junior standing may also be considered.

5 units, Win (Djerassi)

HUMANITIES COURSES

150. The Virgin Mary and Images of the Feminine in Western Christianity— (Same as Religious Studies 134B.) The Virgin Mary and her role as feminine ideal for men and women during the Middle Ages, Renaissance, and beyond.

5 units, (Gelber)
alternate years, given 1986-87

161. Representations of Women in 18th Century Literature—(Same as English 160E.) Examination of the various literary incarnations of the "Eighteenth-Century Woman": virgin, harlot, matron, monster, feminist. General topics of discussion include the role of sexuality in eighteenth-century visions of femininity, the link between erotic experience and contemporary plots of female destiny, and the cultural and philosophic reasons for the preeminence of "Woman" in classic eighteenth-century literary discourse.

5 units (T. Castle)

163. Women In the Ancient World—(Same as Classics 9.)

3 units (S. Stephens)

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. Will include works by Simone de Beauvoir, Violette Le duc, Marguerite Duras, Sylvia Plath, Tillie Olsen, Maxine Hong Kingston, Paule Marshall, and Margaret Atwood.

5 units (Yalom)

167. Japanese Women Writers—(Enroll in 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 read in translation.

4 units, (Matisoff)
alternate years, given 1986-87

168. Images of Women in German Film— (Same as German 35A/135.) Feminist analysis of images of women in selected German films. Lab screening of films discussed in class. Supplementary materials in German for students taking the course for German credit.

5 units, Spr (Strachota)

170/270. Feminist Literary Criticism: Theory and Practice—(Same as English 263G.) Development of feminist approaches to the study of literature and practice of criticism.

5 units, Spr (B. Gelpi)

COURSES FOR UNDERGRADUATES

197. Directed Reading.

3-5 units (Staff)

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

201. Feminist Theory and Research—A course for advanced undergraduates and grad-
uates that will root contemporary feminist theory in its historical context, tracing its origins to mainstream theory (e.g. nineteenth century liberalism). A range of contemporary theories will be discussed, their developments will be charted, and students will explore how their theoretical premises and origins shape their political implications.


GROUP 2: APPROVED COURSES IN OTHER DEPARTMENTS

AFRO-AMERICAN STUDIES/SWOPSI

132. Black Women's Literature.

ASIAN LANGUAGES

197. Images of Women in Modern Japanese Literature.

ANTHROPOLOGY

141. Feminist Theory in Anthropology.
143. Kinship and Social Organization.
231. Hierarchy and Gender in Chiefdoms—Seminar.

EDUCATION

332. Curricular Response to Education Equity.
276. Feminist Perspectives on Ethics and Education.

ENGLISH

158A. Plath, Sexton, Rich.
163A. Twentieth Century American Women Poets.
163J. Third World Women in Literature.
177. Virginia Woolf.
367. Freud and Literary Criticism.
303B. Colloquium: Gothic and Fantastic Literature of the 18th Century.
304. The Late Victorians.

GROUP 3: APPROVED COURSES IN OTHER DEPARTMENTS

AFRO-AMERICAN STUDIES/SWOPSI

132. Black Women's Literature.

ASIAN LANGUAGES

197. Images of Women in Modern Japanese Literature.

ANTHROPOLOGY

141. Feminist Theory in Anthropology.
143. Kinship and Social Organization.
231. Hierarchy and Gender in Chiefdoms—Seminar.

EDUCATION

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GROUP 3: APPROVED COURSES IN OTHER DEPARTMENTS

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132. Black Women's Literature.

ASIAN LANGUAGES

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304. The Late Victorians.
"Women and Men in Modern Britain." Designed to make maximum use of the Stanford campus at Oxford as a site for study and field trips, the curriculum will be based on discussions of gender difference in British history, literature, arts and institutions. Faculty will include Diane Middlebrook, Professor of English, and Susan Groag Bell, Historian, Affiliated Scholar at the Stanford Center for Research on Women.

FOOD RESEARCH INSTITUTE

Emeriti: (Professors) Roger W. Gray, William O. Jones, Dudley Kirk, S. Daniel Neumark, Holbrook Working
Director: Walter P. Falcon
Associate Director: Anne E. Peck
Professors: W. Brian Arthur, Walter P. Falcon, Bruce F. Johnston, Timothy E. Jolsting, Scott R. Pearson, Clark W. Reynolds, Pan A. Yotopoulos
Tinker Visiting Professor: R. Albert Berry
Associate Professors: Carl H. Gotsch, Reynaldo Martorell, Anne E. Peck
Assistant Professors: Sandra O. Archibald, A. Meredith John, Terry Sicual
Librarian: Charles C. Milford

OFFERINGS AND FACILITIES

The Food Research Institute, a research and teaching unit in the School of Humanities and Sciences, was founded in 1921 to study problems of food supply, distribution, and consumption on a world-wide scale. The range of its investigation comprises the world food and agricultural economy, domestic and international trade in primary products, agriculture and economic development, and world population problems.

The Institute’s specialized library contains some 75,000 items, including up-to-date series of periodicals from over 50 countries. It is open for reference use to students and other scholars.

Food Research Institute Studies, published three times a year, reflects the research interests of the Institute.

THE INSTRUCTIONAL PROGRAM

Graduate teaching leading to either the Master of Arts or Doctor of Philosophy degree is an integral part of the Institute’s program. The program is designed primarily for students with solid undergraduate training in economics or agricultural economics, who possess a special interest in problems lying within the Institute’s areas of research.

The Institute does not undertake supervision of studies leading to a bachelor’s degree, though certain of its courses may be counted toward majors in other undergraduate programs including economics, sociology, political science, and human biology.

The University requirements for advanced degrees, as set forth under “Degrees” in this bulletin, should be consulted by all prospective graduate students.

UNDERGRADUATE PROGRAMS

COTERMINAL A.B./A.M. PROGRAM

The Food Research Institute offers a limited number of coterminal degrees for undergraduate students in Economics (and occasionally other departments). For admission a student must have a minimum letter-grade 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 of coursework is designed at the outset of the program 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 IN FOOD RESEARCH

Qualified doctoral candidates in other schools and departments may apply for a minor in Food Research. Requirements for this option include successful completion of two Institute fields, plus approval by the Chairman of the Graduate Instruction Committee of the overall program of work.

FELLOWSHIPS

The Food Research Institute has available a limited number of University fellowships for qualified students, ranging in amount of support to $5748 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.) Examines 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. Focus 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 related to the design of rural development strategies. Prerequisite: Economics 1 or equivalent understanding of economics.

3 units, Spr (Johnston) MWF 10

105. 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 of hedging, the evolution of hedging practice, determinants of the level of market use, and the relationships between level of use and market usefulness, market performance issues and measures, and the importance of speculation.

5 units, Win (Peck) MW 10-11:50

119. Human Nutrition—(Same as Human Biology 120.) An introduction to human nutrition including the function, digestion, absorption and metabolism of nutrients, dietary recommendations and standards, and a general overview of national and international nutrition problems. Prerequisite: Human Biology core or consent of instructor.

4 units, Aut (Bray, Martorell, Taylor) MWF

120. Marketing, Consumption, and Price Analysis—(Same as Economics 128.) (Graduate students register for 220.) Survey of approaches used in the analysis of commodity price behavior. Topics include consumer demand analysis, spatial and temporal aspects of prices, market structure considerations, and complete commodity models. Links to microeconomic theory are drawn and emphasis is placed on a policy contexts. Readings and discussions use agricultural examples from both developing and developed agriculture.

5 units, Aut (Peck) TTh 10-11:50

121. Development and Population Interactions in the Third World—(Same as Economics 119.) Historical and contemporary examina-
tion of the record of economic development and of population growth suggests a 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 from these studies 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

129. Analytical Techniques for Development Planning—(Same as Economics 129.) Graduate students register for 229. Treats selected analytical techniques used in development planning. Emphasis on cost-benefit analysis and macroeconomic planning methods. Course employs microcomputer homework exercises to develop and simulate actual application of planning tools. Prerequisite: Economics 51 or equivalent.

5 units, Win (Gotsch) MW 1:15-3:05

130. Application of Linear Programming to Agricultural Systems—(Same as Economics 130.) 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, Spr (Arthur) TTh 10-11:50


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

144. Economics of American Agriculture—(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

146. European Agricultural Policy—(Same as Economics 146.) 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) TTh 3:15-5:05

148. Economic Development in China—(Same as Economics 148.) 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 3:15-5:05
166. International Trade Policy—(Same as Economics 166.) (Graduate students register for 366.) 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. 3 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) by arrangement

COURSES PRIMARILY FOR GRADUATE STUDENTS

201. Seminar: Applications of Research Methods — Focuses on the uses of economic methods in the analysis of agricultural problems. Lectures and student presentations will be used to develop skills in both model building and estimation. Emphasis is placed on the empirical implications of a model's structure and the choice of estimation technique. Prerequisite: Economics 202 or Business 403 and consent of the instructor. 5 units, Spr (Archibald) by arrangement

205. Commodity Futures Markets and Prices — (See 105.)

421. Economics of Production—An examination of production theory with emphasis on agriculture. Topics include: production, cost and profit; technological change; risk and uncertainty in models of production. Readings complemented with problem sets emphasizing econometric estimation of production relationships. These exercises plus a final exam, constitute major requirements for the course. Prerequisites: Economics 202 or Business 403 or consent of instructor. 5 units, Win (Archibald) TTh 8-9:50

222. The Political Economy of Development — (See 122.)

224. Economic Development: Theory and Empirical Research—Differences between competing paradigms in economic development, such as the orthodox and the disequilibrium, 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 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—Course will cover selected aspects of rural/agricultural development, sources of agricultural growth, economics of farm households, risk and uncertainty in agriculture, technical change, mechanization, 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 1:15-3:05

229. Analytical Techniques for Development Planning—(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—(See 144.)

246. European Agricultural Policy—(See 146.)

248. Economic Development in China—(See 148.)

250. Nutritional Problems of Developing Nations—(Same as Anthropology 250.) The vari-
ous malnutrition syndromes common in developing countries will be described, with emphasis upon protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations will be reviewed. Detailed consideration will be given to effects of malnutrition throughout the life cycle, from fetal growth to fertility, with assessment of societal cost of malnutrition and its effects on learning, productivity, and other aspects of national development. Prerequisite: Food Research 119 of equivalent; open to graduate students and to seniors in Human Biology and Anthropology.

5 units, Win (Martorell) TTh 10-11:50

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 10-11:50

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 151-152 or equivalent.

5 units, Win (Josling) given 1986-87


5 units, Win (John) TTh 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) MW 9-10:50

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: Food Research 205 and Food Research 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) by arrangement


3 units, Spr (Falcon, Josling, Pearson) by arrangement

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

Emeritus: (Professor) Roberto B. Sangiorgi
Chairman: Alphonse Juilland
Vice Chairman: Marc Bertrand (French Division), John Freccero (Italian Division)

FRENCH DIVISION


Associate Professor: Brigitte Gazelles
Assistant Professor: Pierre Saint-Amand (on leave Autumn, Spring)
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)

ITALIAN DIVISION

Professor: John Freccero (on leave Autumn & Winter)
Associate Professor: Jeffrey Schnapp (Undergraduate Advisor)
Assistant Professor: Beverly Allen (on leave Winter, Spring), Carolyn Springer
Senior Lecturers: Maria Devine, Leda S. Mussio, Annamaria Napolitano, Leopoldina Viggiano
Visiting Professors: Guelfo Frulla (Autumn), Robert Harrison (Autumn, Winter, Spring)

The department accepts candidates for the degrees of Bachelor of Arts and Master of Arts in French and in Italian, and Doctor of Philosophy in French.

FRENCH UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS IN FRENCH

Candidates should normally have completed the series of first- and second-year courses through French 24 or its equivalent. Regular placement tests enable students who have begun their study of French elsewhere to be granted advanced standing.

Candidates specializing in literature or language are expected to take at least three advanced language courses (123, 124, 125), the introductory series to French literature (130, 131, 132) and three advanced courses (numbered above 132) in different periods of literature. Students may then select one of the three following areas of specialization to complete their A.B. in French.

SPECIALIZATION IN LITERATURE

Majors concentrating in literature must take in addition a minimum of six literature or civilization electives numbered above 132. Students who intend to pursue graduate studies are urged to take courses in all periods of French literature. They should note that most graduate schools require proficiency in at least one additional modern language.

SPECIALIZATION IN LANGUAGE

Majors primarily interested in language and culture must take in addition six of the following courses:

- Séminaire sur des problèmes contemporains
- Prononciation et Phonétique
- Civilisation I: 17e-18e siècles
- Civilisation II: 19e-20e siècles
- French Historical Grammar
- Old French
- Stylistics
- 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 PROGRAM IN FRENCH

In addition to the basic undergraduate program, qualified French majors in their junior year may apply for admission to an Honors Program in French. A "B" average in French courses is required; other prerequisites include...
having completed at least two courses of the language-composition series, French 123, 124, 125, and two of the literature series, French 130, 131, 132. Juniors may apply while still taking the second course of these two series. Ideally, then, the Honors program could be established by Spring Quarter of the junior year. The student's application must include a proposal and general outline of a senior essay, which will be accredited between 9 and 12 academic units, at the student's option: it may be either in English or French depending upon the student's preference and his or her advisor's recommendation. Honors program students also fulfill all regular requirements for the A.B. in French.

HONORS PROGRAM IN HUMANITIES

For majors who wish to supplement their departmental major by a related program of studies. See the “Humanities Special 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.

FRENCH 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
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
(TERMIAL 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:

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<tr>
<th>Units</th>
<th>Course</th>
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<tbody>
<tr>
<td></td>
<td>French 200. Stylistique</td>
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<tr>
<td>4</td>
<td>French 291. Prononciation et Phonétique</td>
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<tr>
<td>4</td>
<td>French 203. Grammaire historique de la langue française: phonologie</td>
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<td>4</td>
<td>French 210. Old French</td>
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<td>4</td>
<td>French 290. Civilisation I: 17th-18th siècles</td>
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<tr>
<td>4</td>
<td>French 291. Civilisation II: 19th-20th siècles</td>
</tr>
<tr>
<td>4</td>
<td>French 293. Methods of Teaching French</td>
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<tr>
<td>4</td>
<td>Education 393. Recent Developments in Foreign Language Education</td>
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</tbody>
</table>

Total: 36 units

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.

MASTER OF ARTS IN FRENCH
(Ph.D. PROGRAM)

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.

DOCTOR OF PHILOSOPHY IN FRENCH

Normally the Ph.D. program should be completed in four years. The first and second years should be devoted to full-time study; the third and fourth years to study, teaching, and dissertation work.

The Ph.D. graduate in French Literature is expected to have attained a reasonable mastery of the literature and the language. Students will emphasize some areas or centuries rather than others, but knowledge of the whole field should be well advanced at the time of graduation. A primary goal of the program is excellence in the art of writing scholarly articles and books. The department also emphasizes competence in the teaching of language and literature.

All candidates, regardless of their field of specialization, are expected to fulfill the following general requirements:
1. Course requirements. A total of no fewer than 72 units of graduate work, preferably to be completed by the end of the second year. Additional units of graduate courses, seminars, or individual work in the candidate's major or minor field are strongly recommended and will be determined according to the advisor's (or advisory committee's) judgment and the candidate's needs. French 200, stylistics, and one philology course are to be among the 72 required units.

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. Satisfaction 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 discussion of one or more representative works of a genre, a comparative study, etc.

4. Teaching experience. Ph.D. Candidates, whatever their sources of financial support, are expected to demonstrate pedagogical proficiency by teaching under supervision three quarters at one-half time.

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 UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS IN ITALIAN

This major is oriented toward Italian Studies and offers students an opportunity to bring together in a unifying program a broad cross-section of disciplines other than language and literature having their common denominator in Italian culture and civilization. To allow maximum flexibility, pertinent courses taken in other fields, such as classics, humanities, comparative literature, history, philosophy, architecture, romance literatures, English, German, anthropology, social sciences, political science, drama, art, and music, will count toward satisfying the major requirement.

Upon completion of the first-year language courses, Italian 1, 2, 3, and two second-year language courses, Italian 51, 52, or 53 (or equivalent courses taken at the Florence center), students wishing to concentrate in Italian Studies may, under the guidance of a departmental advisor, select a course of study best suited to their individual needs and cultural interests.

At least 60 additional units of courses are required, including:

1. 45 units of Italian courses beyond five quarters of Italian language courses. Students are required to take the sequence of Italian 127, 128, and 129 (or in Florence 110A, B, C), one course on Dante, as well as at least one course in each of the following areas: Middle Ages, Renaissance, Eighteenth or Nineteenth Century, and Twentieth Century. A Dante course may fulfill the Middle Ages requirement.

2. Up to 15 units of courses outside the department but in related fields.

In this perspective, the program at the Florence campus will offer students a selection of courses taught in Italian that are acceptable toward the fulfillment of the degree in Italian Studies. Further alternatives may be provided at the Florence center through directed work (in Italian and/or in the above mentioned disciplines) arranged by the students with their advisors. Although attendance at the Florence center is particularly advisable, valid alternative programs will be accepted.

Courses in Italian literature taken at Stanford in Italy may count, with the approval of the Italian Division, toward the fulfillment of the requirements for combined majors.

Students are encouraged to structure their program individually in consultation with a departmental advisor.

EXTENDED MAJORS

Italian and English Literatures—In addition to the 45 units (beyond five quarters of Italian language courses) required for the A.B. in Italian, candidates should complete four English literature courses numbered 100 and above and related to their field of concentration in Italian literature.

Italian and French Literatures—In addition to the 45 units (beyond five quarters of Italian language courses) required for the A.B. in Italian, candidates should complete four courses in French literature related to their field of concentration in Italian literature. Reading proficiency in French is required.

HONORS PROGRAM IN HUMANITIES

This program is offered for majors who wish to supplement their departmental major by a related, carefully guided program of studies. See the "Humanities Special Programs" section.

LA CASA ITALIANA

La Casa Italiana, located at 562 Mayfield, is an undergraduate residence which offers students a wide variety of opportunities to expand their knowledge, understanding, and appreciation of Italian language and culture. Assignment is made through the regular undergraduate housing draw.

INTENSIVE AND ACCELERATED WORK AT STANFORD IN ITALY

Students attending Stanford in Italy, in Florence, have the opportunity to take courses in Italian language, literature, conversation, and civilization. All students will be required to take a language course for the first quarter and possibly the second quarter of the session overseas. All courses in language bear the designation Italian 70, 80, or 90. Assignment to a particular level is made by the Director and language faculty at the campus.

ITALIAN 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.

FRENCH DIVISION COURSES

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 COURSES

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 20.

Auditing is not permitted in participation language courses.

1. First-Year French (Part 1)—Systematic acquisition of basic French grammar and vocabulary in the immediate reality of the classroom. Only French is used by both the instructor and students. Multiple approach: listening-comprehension, oral expression, original oral and written composition.
   5 units, Aut, Win, Spr (Staff) MTWThF

1R. First-Year French (Part 1 accelerated)—A first-quarter French course for students who have some previous knowledge of the language, but who must begin their study of French over again. Equivalent to French 1. Language Laboratory required.
   3 units, Aut, Win (Staff)

   5 units, Aut, Win, Spr (Staff) MTWThF

2C. First-Year Conversation—Cours de conversation au niveau linguistique du Français 2. Prerequisite: 1 or equivalent. Course offered on a Pass/No Credit basis only.
   2 units, Aut, Win, Spr (Staff)

   5 units, Aut, Win, Spr (Staff) MTWThF

3C. First-Year Conversation—Le français dans les situations de la vie de tous les jours. Prerequisite: French 3 or equivalent. Course offered on a Pass/No Credit basis only.
   2 units, Aut, Win, Spr (Staff)

5. Intensive French for Beginners—An accelerated first-year French course in which either 2 or 3 quarters of French may be covered. Course offers preparation in speaking, writing, and reading the language. An all in French method is used. 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)

10. Reading French—An accelerated course designed specifically for the acquisition of reading ability. Primarily intended for graduate students seeking to meet the University reading requirement for advanced degrees. Also open to seniors. No auditors permitted.
   4 units, Aut (Staff)

20C. Second-Year Conversation—Le français dans les situations de la vie de tous les jours. Prerequisite: French 3 or equivalent. Course offered on a Pass/No Credit basis only.
   2 units, Aut, Win, Spr, Sum (Staff)
21R. Grammar Review—Basic French grammar with specific emphasis on written expression with some training in speaking. Offered for students with previous training in French either in high school (3-5 years) or in other universities, whose progress would be best served by a concentrated review of first-year material.

3 units, Aut, Win (Staff) MWF


4 units, Aut, Win, Spr (Staff) MTWTh


4 units, Aut, Win, Spr (Staff) MTWTh


4-5 units, Aut, Win, Spr (Staff) MTWTh

26. Intensive Intermediate French—(Equivalent to both French 22 and 23.) A complete grammar review will be offered in conjunction with reading of selected French texts. Classroom discussions, entirely in French, will focus both on the reading material and on topics of current interest. Written exercises, oral reports, written compositions, and work in the language laboratory are also included. Prerequisite: one year of college French or equivalent preparation. No auditors permitted.

6-8 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 (Staff)

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—Grandes tendances de l'histoire sociale et culturelle de la France du Moyen Age à nos jours.

3 units, Win (Staff)

62. French Films—Études et discussions de films en conjonction avec la série de films français.

3 units, Spr (Staff)

63. French Theater Workshop—Réalisation d'une pièce; interprétation, techniques, mise-en-scène, décor.

3 units, not given 1985-86

STANFORD PROGRAM IN TOURS

70, 80, 90. Intensive and Accelerated French—Given only at Stanford in France.

5 or more units, Aut, Win, Spr (Staff)

THIRD- AND FOURTH-YEAR LANGUAGE COURSES

Auditing is not permitted in participation language courses except in special cases.

120. Séminaire sur des problèmes contemporains—Conversation et discussion sur des problèmes actuels à partir de journaux, revues ou films français. Prerequisite: 24 or 82 through 86 or equivalent. May be repeated once for credit after an interval of two quarters.

3 units, Aut, Win, Spr (Staff)

121. Prononciation et Phonétique—(Graduate students register for 201.)

4 units, Aut (Juilland)

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 (Staff)

124. Langue, style et écriture—Continuation du Français 123. Le commentaire littéraire, les styles de la critique, composition.

4 units, Win (Cazelles) 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 (Staff)

LITERATURE COURSES

For literature courses in English, see also General Courses section.
130. French Literature I—Middle Ages & Renaissance—Etude générale de la littérature française de l’époque médiévale jusqu’à l’essai philosophique du 16e siècle (Chanson de Roland, Chrétien de Troyes, poètes du 16e siècle, Rabelais, Montaigne). Prerequisite: 24 or equivalent. (DR:2)  
4 units, Aut (Cazelles)

131. French Literature II—17th and 18th Centuries—Etude 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, Spr (Frederickson)

Note: prerequisites for the following courses are normally 130, 131, or 132, or equivalent.

134. Poésie médiévale.  
4 units, Spr (Cazelles)

140. Renaissance I—Poètes et prosateurs de la première moitié du 16e siècle: Rabelais, Calvin, Scève, Ronsard, du Bellay, etc.  
4 units, Win (Hester)

151. Le Théâtre classique.  
4 units, Win (Weinstein)

161. Le Roman au 18e siècle—(Graduate students register for 241.)  
4 units, Win (Saint-Amand)

4 units, Aut (Giraud)

181. Le Théâtre de 1945 au présent—(Graduate students register for 281.) Sartre, Camus, Ionesco, Obaldia, Beckett.  
4 units, Win (Bertrand)

185. Simone de Beauvoir—(Graduate students register for 285.) A study of her fictional, philosophical, political and autobiographical writings, with stress on the radicalization of a feminine consciousness in contemporary French bourgeois society. Lectures and discussions in English; reading in French or English.  
4 units, Aut (Giraud)

194. The European Novel—(Graduate students register for 294.)  
4 units, Win (Girard)

196. The Literature of Decolonization—(Graduate students register for 296.)  
4 units, Win (Giraud)

198. Language Specials—With special permission of the department only.  
1-5 units (Staff)

199. Individual Work—Open only to majors in French and with special permission of the department. May be repeated for credit. See instructor for section number.  
1-4 units (Staff) by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

4 units, Aut (Cazelles)

201. Prononciation et Phonétique—Etude théorique et travaux correctifs, articulation, rythme, intonation, quantité, graphie traditionnelle et voyelle instable, liaisons, enchaînement, graphie phonétique.  
4 units, Aut (Juilland)

203. Grammaire historique de la langue française: phonologie.  
4 units, Win (Saint-Amand)

241. Le Roman au 18e siècle—Approches de la séduction. Etude des romans des Lumières à partir de la problématique de la séduction. Notre travail concernera surtout les œuvres de Marivaux, Diderot et Crébillon. La séduction sera étudiée d’un point de vue à la fois sémiologique, rhétorique et psychanalytique.  
4 units, Win (Giraud)

243. Voltaire et l’idéologie bourgeoise—Etude des écrits et de la pensée de Voltaire en tant que porte-parole de l'idéologie de la bourgeoisie progressive de son temps.  
4 units, Win (Saint-Amand)

281. Le Théâtre de 1945 au présent.  
4 units, Win (Bertrand)

285. Simone de Beauvoir—(See 185.)  
4 units, Aut (Giraud)

293. Methods of Teaching French—(Same as Education 293.) Second language acquisition with specific reference to French: theory and practice, including frequent observations of demonstration class at 10 a.m.  
4 units, Aut (Hester)

294. The European Novel—Self and other in the European novel from Chrétien de Troyes to Virginia Woolf (The Waves). The novel and the end of the philosophical subject; Sartre, phenomenology and beyond.  
4 units, Win (Girard)
96. The Literature of Decolonization—Course studies the work of some of the most distinguished African and Caribbean writers who have confronted the phenomenon of colonialism and contributed to the struggle for liberation. Readings from Aimé Césaire, Léopold Senghor, Frantz Fanon, Albert Memmi and Jean-Paul Sartre, among others. Readings in French, lectures and discussions in English.
   4 units, Win (Giraud)

CIVILISATION FRANÇAISE
Approches: civilisation matérielle et modes de vie; État et classes sociales; culture savante et traditions populaires; idéologies et mentalités.

290. Civilisation I—17e-18e siècles. (DR:3)
   4 units, Spr (Bertrand)

GRADUATE COURSES

315. The Grail.
   4 units, Win (Cazelles)

323. Montaigne.
   4 units, Aut (Girard)

336. Pascal.
   4 units, Win (Girard)

360. Baudelaire.
   4 units, Aut (Cohn)

390. Le Nouveau Roman et après.
   4 units, Spr (Bertrand)

   4 units, Win (Bertrand)

391B. La Littérature et la sculpture d’après des textes classiques.
   2 units, Aut (Serres)

391C. La Littérature et la sculpture d’après des textes romantiques.
   2 units, Spr (Serres)

396. Freud and Literary Theory—Freud on individual desire, crowds and social organization. The Oedipus complex and the Father of the Horde. The influence of Freud on contemporary French and American theory.
   4 units, Aut (Girard)

397. Colloquium on Research Methods in French and Italian Studies—The aim is to acquaint graduate students with general and specialized resources for French and Italian studies. While the emphasis is on overall strategy for research, there will be an opportunity to explore bibliographical sources in particular fields of interest to each student. (See full description under “Libraries and Information Services.”)
   2 units, Aut (Parrine)

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

FRENCH COURSES OFFERED
BUT NOT DURING 1985-86

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.
114B. The Modern French Novel.
114C. The Contemporary French Novel.
115. Introduction to Existentialism.
117A,B/297A,B. Mythology and Christianity.
122/202. Poetry Translation as Art Form.
135. Le Roman arthurien.
139. Chrétien de Troyes.
141. Renaissance II.
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.
173. Symbolism.
175. Le Théâtre au 19e siècle.
180. La Poésie française - 20e siècle.
182. Le Roman au 20e siècle.
186. Sartre: Literature and Politics.
191. The Idea of Revolution in Modern French Literature.
192/292. French Women Poets.
204. Introduction to Rumanian.
210. Old French.
211. Old Provençal.
212. Littérature médiévale I: 11è—13è siècles.
214. L’Epopée.
216. Medieval Drama.
219. Special Topics on Medieval Literature.
230. Introduction au 17è siècle.
234. Racine.
237. Les Moralistes français.
240. Grands Texes des lumières.
244. Rousseau.
262. The Symbolist Poets.
270. Le Roman 1808-1950.
275. Le Surréalisme.
280. Individu et société dans le roman contemporain.
282. Structuralism and Post-Structuralism.
283. Le Théâtre contemporain.
286. Sartre: Literature and Politics.
287. Roland Barthes.
291. Civilisation II.
312. Fabliaux.
313. Courtly Love.
314. French Epics.
316. French Lyric Poetry.
317. French Medieval Drama.
318. Chronicles.
319. Special Topics on Medieval Literature.
320. Poésie de la Renaissance I.
321. Poésie de la Renaissance II.
322. Rabelais.
324. Renaissance Prose.
330. Le 17è siècle.
331. Le Théâtre classique.
332. Poésie de Malherbe à la Fontaine.
334. Racine.
335. Molière.
346. Diderot.
351. Le Romantisme.
352. Balzac.
353. Stendhal.
354. Flaubert.
355. Zola.
356. Rimbaud.
362. Ideology of Literature from Romanticism to the Present.
363. Mallarmé.
365. Théories critiques au 19è siècle.
371. La Grande Génération.
372. Proust.
373. Apollinaire—Alcools et Calligrammes.
374. Valéry.
383. La Querelle des Anciens et des Modernes.
390. Théorie de la poésie.
393. La Poésie au 20ème siècle.

ITALIAN DIVISION COURSES

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.

GENERAL COURSES

The courses in this section are open to all students and have no prerequisites. All readings and discussions are in English.

131. Italian Romanticism.
4 units, Spr (Springer)
138. Seminar on Italian Baroque.
4 units, Win (Harrison)
146. Divine Comedy in Translation.
4 units, Aut (Schnapp)
152. Seminar: Medieval Italian Literature.
4 units, Win, (Freccero)
FIRST- AND SECOND-YEAR LANGUAGE COURSES

Coordinator: Annamaria Napolitano
Assistant Coordinator: Leopoldina Viggiano

Note—Students registering the first time in a first- or second-year course must see their Italian instructor for proper placement if they have had any training in Italian before entering Stanford.

1. First-Year Italian (First quarter)
   5 units, Aut, Win, Spr (Staff) MTWThF

2. First-Year Italian (Second quarter)—(Continuation of 1.)
   5 units, Aut, Win, Spr (Staff) MTWThF

3A. L'Italia d'oggi—Introduction to Italian life. Conversation and lectures on various aspects of contemporary Italy (politics, art, cinema, press, customs). Especially designed for students who plan to go to Italy. May be taken concurrently with Italian 2. Prerequisite: Italian 1.
   3 units, Win, Spr (Staff) MWF

3. First-Year Italian (Third quarter)—(Continuation of 2.) A grammatical and linguistic approach to Italian through contemporary readings (short stories or novels).
   5 units, Aut, Win, Spr (Staff) MTWThF

5. Intensive Italian for Beginners—An accelerated first-year Italian course in which either 2 or 3 quarters of Italian may be covered. Italian 5A, 8 units, will cover Italian 1 and 2, 5½ weeks. For 4 additional units, take 5B, the equivalent of Italian 3, 2½ weeks. An all-in-Italian method is used, developing listening, speaking, writing and reading skills.
   12 units, Sum (Staff) MTWThF 9-11:50

10. Reading Italian—An accelerated course designed specifically for acquisition of reading ability. Primarily intended for graduate students seeking to meet University reading requirement for advanced degrees. Also open to seniors. No auditors.
   4 units, Win (Devine) MWF

30. Italian Conversation—This course is geared to students returning from Florence. For those students who did not go to Florence, minimum prerequisite is Italian 3. May be repeated for credit up to three times.
   2 units, Aut, Win, Spr (Staff)

51. Second-Year Italian—Linguistic and literary introduction to contemporary Italian authors and review of essential linguistic and grammatical points. Prerequisite: 3 or equivalent.
   3 units, Aut (Staff) MWF

52. Second-Year Italian—Logical progression of Italian 51 with more emphasis on written work. Prerequisite: 51 or consent of instructor.
   3 units, Win (Staff) MWF

53. Second-Year Italian—Sequential progression of 51 and 52. Prerequisite: 52 or consent of instructor.
   3 units, Spr (Staff) MWF

   4 units, Aut (Viggiano) TTh

115. Advanced Grammar and Translation—(Continuation of 114.)
   4 units, Win (Viggiano) TTh

116. Advanced Grammar and Translation—(Continuation of 115.)
   4 units, Spr (Viggiano) TTh

Note: Italian 51, 52, 53 are offered for 3 units. May be taken for 4 units by arrangement with instructor.

THIRD- AND FOURTH-YEAR LANGUAGE COURSES

   4 units, Spr (Mussio)

CULTURE AND CIVILIZATION

127. Introduction To Italian History—Historical and cultural background through the study of specific events, movements, figures, and artifacts.
   4 units, Spr (Napolitano)
128. Survey of Italian Literature I: 13th to 16th Century—Reading of major works from Dante to Machiavelli, Ariosto, Tasso, and other significant representatives of Italian "Civiltà comune" and Renaissance. (DR:2) 4 units, Aut (Harrison)

129. Survey of Italian Literature II: 17th to 19th Century—Close study of selected works by Goldoni, Parini, Alfieri, Foscolo, Leopardi, Manzoni, and Verga against their historical and cultural background. (DR:2) 4 units, Win (Harrison)

131. Italian Romanticism—A study of the romantic movement in Italy. 4 units, Spr (Springer)

137. Introduction to 20th Century Italian Poetry. 4 units, Aut (Allen)

138. Seminar on Italian Baroque: Vico and Nietzsche—A close study of Vico’s New Science and its influence on Nietzsche’s philosophy. 4 units, Win (Harrison)

143. Boccaccio: The Decameron. 4 units, Aut (Frulla)

146. The Divine Comedy in Translation—For students unfamiliar with the poem or the Italian language. (DR:2) 4 units, Spr (Schnapp)

152. Seminar on Medieval Italian Literature. 4 units, Win, (Freccero)

161. Machiavelli: The Prince — An introduction to the Renaissance civilization in Italy through the readings of one of its greatest Florentine writers. 3 units, Aut (Frulla)

165. Seminar on Italian Renaissance Epic. 4 units, Aut (Springer)

175. Fascism and Culture: The Fascist Avant-Garde. 4 units, Win (Schnapp)

180. The Modern Italian Novel. 4 units, Win (Springer)

199. Individual Work—Open to all students with special permission of the department. See instructor for section number. May be repeated for credit. 1-3 units, any quarter (Staff) by arrangement

GRADUATE COURSES

231. Italian Romanticism. 4 units, Spr (Springer)

237. Introduction to 20th Century Italian Poetry. 4 units, Aut (Allen)

238. Seminar on Italian Baroque. 4 units, Win (Harrison)

243. Boccaccio. 4 units, Aut (Frulla)

246. The Divine Comedy in Translation. (DR:2) 4 units, Spr (Schnapp)

252. Seminar: Medieval Italian Literature. 4 units, Spr (Freccero)

261. Machiavelli: The Prince. 3 units, Aut (Frulla)

265. Seminar: Italian Renaissance Epic. 4 units, Aut (Springer)

275. Fascism and Culture: The Fascist Avant-Garde. 4 units, Win (Schnapp)

280. The Modern Italian Novel. 4 units, Win (Schnapp)

297. Colloquium on Research Methods in French and Italian Studies—The aim is to acquaint graduate students with general and specialized resources for French and Italian studies. While the emphasis is on overall strategy for research, there will be an opportunity to explore bibliographical sources in particular fields of interest to each student. (See full description under "Libraries and Information Services.") 2 units, Aut (Parrine)

299. Individual Work—Exclusively for graduate students working on thesis or engaged in special work. See instructor for section number. 1-12 units, any quarter (Staff) by arrangement

ITALIAN COURSES OFFERED BUT NOT DURING 1985-86

130/230. Dante, Petrarch, Boccacio.


134/234. La poesia lirica.

135/235. The Italian Lyric.


139/239. Italy’s Women Poets: 13th Century to the Present.

140/240. Dante: Inferno.


144/244. Petrarch and Petrarchism.

147/247. The 19th Century Novel in Italy and France.
GERMAN STUDIES

Emeriti: (Professors) Helmut R. Boeninger, Gertrude L. Schuelke; (Adjunct Professor) Gertrude Mahrholz
Chairman: Orrin W. Robinson III
Associate Professors: Russell A. Berman, David Wellbery
Senior Lecturer: Kathryn Strachota
Lecturers: Nancy Chadburn, Peter Frank, William E. Petig, Brigitte Turneaure
Visiting Professors: Gerhard Botz (Universität Salzburg) Winter, Spring; Volker Rittberger (Eberhard-Karls-Universität, Tübingen) Winter, Spring
Consulting Professor: J. Alan Pfeffer

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 Hildebrandt 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.

STANFORD TÜBINGEN
GRADUATE EXCHANGE

Annually one or two Stanford graduate students in German Studies are accepted as exchange students by the University of Tübingen, and their counterparts from Tübingen participate in academic programs at Stanford.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin or inquire at the Degrees Program Office, School of Education.

CERTIFICATION OF PROFICIENCY IN GERMAN

In accordance with standards developed by the American Council on 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
302. Methods of Teaching German

A minimum of four courses, with at least one course in each of the three areas of concentration: language and linguistics, literature, and thought.

In addition, students must take graduate level courses in German and/or approved courses in related fields such as linguistics, comparative literature, philosophy, history, or art history.

Students concentrating in German 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 following the first year; (2) a reading knowledge of one language other than English and German; and (3) the writing of a dissertation. Students in medieval studies must also have a reading knowledge of Latin.

The first year of graduate work, which leads to the A.M. degree, is designed to introduce each student to the three major areas of study. During the Spring quarter of their first year of study, all students must take an oral A.M. examination. They will then devote the summer to writing a qualifying paper, which will be evaluated by the department in the following Autumn Quarter. When the qualifying paper has been submitted and approved, the department will recommend that the student be admitted to candidacy for the Ph.D. Students who do not qualify for the Ph.D. may continue through the second year.

The qualifying paper, although ordinarily not meant to represent an original contribution to scholarship, should demonstrate the candidate's ability to grasp complex subject matter with sufficient competence, to organize materials, and to present arguments in a clear and concise manner commensurate with scholarly standards. The necessary research and the writing of the paper must be completed by the beginning of the Autumn Quarter. Procedural details are available from the department.

All students, regardless of their future field of concentration, are expected to acquire near-native proficiency in German and a thorough knowledge of the grammatical structure of German. The department expects all Ph.D. candidates to demonstrate teaching proficiency in German; 302 (Methods of Teaching German) is required. The teaching requirement is six quarters during the second and third years of study.
The department expects all Ph.D. candidates to demonstrate research skills appropriate to their special areas of study. The research requirement can be fulfilled in the capacity of either a University Fellow or a Research Assistant.

All graduate students are also strongly advised to start developing skill in the teaching of literature by participating in the teaching of undergraduate literature courses. Students can earn up to three units of graduate credit for practice teaching in literature.

During the first year, all graduate students planning to continue through the Ph.D. take essentially the same core program, as shown in the following specific suggestions of appropriate work in language and linguistics, literature, or German thought. This flexibility permits students to change direction at some later stage, as they develop their intellectual identity on the basis of actual experience.

Under any concentration, electives chosen from graduate level courses in German or approved courses in related fields must be added to accumulate the 36 units of study required for the A.M.

For basic University requirements see the "Degrees" section of this bulletin.

**INTERDISCIPLINARY PROGRAMS**

The department participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in German Studies and Humanities. For a description of that program, see the section "Humanities Special Programs" in this bulletin.

Students may work toward a Ph.D. in German Studies with minors in such areas as Comparative Literature, Modern Thought and Literature, Medieval Studies, or Linguistics. 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
- 312. Linguistics and the Analysis of German
- 313. Transformational Grammar of German
- 314. Phonology 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 351-390 series. Lectures and colloquia will require final examinations but not term papers. Seminars, of which the student is expected to take a minimum of two after the first year, will require research papers. Students are advised to take some electives outside the department, related to their field of interest.

During the first year, students normally take the following program:

- 201 and 202. Language and Style
- 203. History of the German Language or
- 311. Syntax of Modern German or
- 313. Transformational Grammar of German
- 241. Deutsche Geistesgeschichte I
- 242. Deutsche Geistesgeschichte II
- 243. Deutsche Geistesgeschichte III

Three courses in German Literature, one of which should be from the 351-359 series, and
from the 360, 370, or 380 series. One seminar in German Thought (349, 449).

COURSES

OVERVIEW OF COURSES

A. General Courses (given in English)

B. Introductory Courses (1-99)

C. Intermediate Courses (100-199)

Language (100-119)

Culture (130-139)

Literature (150-179)

D. 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)

E. Courses for Advanced Graduate Students (400-499)

Seminars and colloquia on special topics; interdepartmental courses

F. Independent Study:

Undergraduates (199)

Graduates (298)

A.M.-level qualifying paper (301)

Dissertation research (400)

GENERAL COURSES

(GIVEN IN ENGLISH)

The courses in this section are given in English and do not require a knowledge of German. They are open to all students. German majors taking these courses as a part of their requirements must do the assigned readings in German.

19A. Introduction to the Germanic Languages—(Same as 119; Linguistics 75.) Survey of the oldest attested stages of the Germanic language family, including Gothic, Old Norse, Old Saxon, Old English, Old High German, Old Dutch, Old Frisian. Presentation both of external history and internal relationships. (DR:4)

3 units, Aut (Robinson)

31A-33A. German Culture and Civilization I-III—(See also 131-133.) These courses provide a survey of different aspects of modern society and culture in the countries of German-speaking Europe: social processes and institutions, modernism in literature and the fine arts, central concerns of philosophical and social thought. There are no prerequisites, and students may elect to enroll in any part of the series without participating in the full series.

31A. Central Europe: Geography, Institutions, and Society —This course surveys geography, people, and institutions of the German-speaking areas of Central Europe focusing on the contemporary situation and historical origins. Topics include governmental structure of the BRD, the DDR, Austria, and Switzerland; population; stability and migration; social structure of East and West Germany; the educational system; communications systems; urbanization and its consequences since World War II. (DR: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 (Staff)

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 (Staff)

35A. Images of Women in German Film —(Same as 135, Feminist Studies 168.) Feminist analysis of images of women in selected German films. Lab: Screenings of films discussed in class. Supplementary materials in German for students taking the course for German credit.

3-4 units, Spr (Strachota)

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)

4 units, Aut (Andersson)
245A. Marxism and Literary Criticism—
(Same as 245/345, English 245.) An introduction to
important issues and figures in Marxist liter-
ary criticism. Themes such as ideology, aliena-
tion, commodity exchange, and the social func-
tion of culture will be discussed with reference
to the works of figures including Lukács,
Adorno, Benjamin and Brecht. The contempor-
ary debate on the institutional character of liter-
ature (Bürger) as well as the contributions of
critics outside the German tradition (Gold-
mann, Eagleton, Jameson) will be treated.
3-5 units, Win (Berman)

273A. European Novel I: Renaissance Heri-
tage—Theory and practice of prose fiction in
Europe from Rabelais and Cervantes to the
Enlightenment period, study of the evolution of
form, subject matter, and terminology in the
romance and novel; special attention to the
humoristic, encyclopedic, picaresque, quester,
and adventure modes in British, French, Ger-
man, Spanish, and Italian literature. The rele-
vance of post-Romantic theory (e.g., Todorov,
Barthes, Warning, Genette, Bakhtin, Meyer) to
pre-Romantic fictions.
3-5 units (Gillespie) given 1986-87

274A. European Novel II: Sentiment, Educa-
tion, and the Crisis of Development—The
emergence of psychological and confessioanl
models from Mme de La Fayette to Goethe;
special attention to the novel as vehicle for the
concept of Bildung (formation, education) in
such major authors as Fielding, attacks on eigh-
teenth-century norms by radicals such as de
Sade, pre-Romantic anxieties as experienced by
Rousseau and others, and the revolution of
fiction in Sterne. The eighteenth century in the
light of modernist and contemporary critiques
of Western “consciousness” and the archeology
of knowledge (e.g., Nietzsche, De Man, Foucault).
3-5 units, Win (Gillespie)

275A. European Novel III: The Romantics
—Readings from American, English, French,
German, and Italian romantic authors. Roman-
tic theory and practice of the novel, with special
emphasis on genres and modes (sentimental,
confessional, educational, arabesque, gothic,
horrific, etc.) in relation to major concepts
(anthropic, artist problem, ego, “double,” the
detective story, oversoul, romantic irony, etc.)
Applications of semiotic analysis and discourse
theory to Romantic writing and Romantic self-
criticism.
3-5 units, Spr (Gillespie)

276A. European Novel IV: The Realists—Spe-
cial attention to the longterm repercussions of
Romanticism and the struggle to establish a
Realist approach in fiction. Such topics as the
transition from Romantic Realism to Positivism
and Naturalism, the rise of the historic 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, Dostoievski, Gogol, Turgenev,
Tolstoy, Meyer, Stifter, Fontane, Schnitzler,
Dickens, Eliot, Trollope, Howells, Caldós.
3-5 units (Gillespie) given 1986-87

284A. Joyce, Proust, Mann—(Same as 384A.)
Themes, structures and mythopoetic dimen-
sions of the novel in the context of Modernism.
Views on Joyce, Proust, and Mann as synthe-
sizers 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 (Gillespie) given 1986-87

291 A. Literature of Decadence—Symbolist,
fin de siècle, and modernist understandings of
the evolution of civilization; the themes of intel-
lectual 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,” “Jugendsül,”
and neo-Rosicrucianism, Wagnerism, “dissocia-
tion of sensibility,” “superman,” etc.)
3-5 units (Gillespie) given 1986-87

384A. Joyce, Proust, Mann—(Same as 284A.)
3-5 units (Gillespie) given 1986-87

INTRODUCTORY COURSES

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 place-
ment test if they have studied German before
entering Stanford.

FIRST-YEAR COURSES

1,2,3. German Language and Culture
—These comprehensive courses provide a bal-
anced introduction to listening and speaking as
well as reading and writing.
5 units, Aut, Win, Spr (Staff)

2C. Conversational German—This course
aims to enable the student to understand, and to
express himself in, simple spoken German.
Especially recommended for students going to
Vienna or Berlin. Prerequisite: at least one
quarter of first- year German.
2-3 units, Aut, Win, Spr (Staff) MWF 10
1D, 2D, 3D. Beginning Dutch—Introduction to written and spoken Dutch-Flemish (Algemeen Bescaatd Nederlands).

4 units Aut, Win, Spr (Chadburn)

1P, 2P, 3P. Individually Programmed Beginning German—These courses are particularly suited to students who wish to complete more or less than five units a quarter, or have a spotty background in German, or have scheduling conflicts, or simply prefer to work independently. Students proceed at their own pace, working on their own with the text and tapes. The instructor is available for consultation on a regular basis. Conversation classes may be attended for listening and speaking practice.

1-15 units, Aut, Win, Spr (Staff)

1. 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

2. Intensive First-Year German—Equivalent of 1, 2, and 3 combined. Enrollment limited. Summer Quarter only.

12 units, Sum (Staff) MTWThF 8-9:30 and 10:30-12

10. Elementary German for Seniors and Graduate Students—This intensive course is designed for students who need to acquire reading ability in German for the Ph.D. and/or for advanced research in their own field. No auditors permitted.

4 units, Win (Petig) MTWTh 9

Sum (Petig) MTWThF 9

IN-HOUSE SEMINARS

30A. Beginning Conversation.

1 unit, Aut, Win, Spr (Staff)

30B. Singrunde.

1 unit, Aut, Win, Spr (Staff)

30C. Advanced Conversation.

1 unit, Aut, Win, Spr (Staff)

Other in-house courses will be announced.

SECOND-YEAR COURSES

11. 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)

11C. 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, Win, Spr (Staff)

52A. Readings in Economics.

3-4 units, Aut (Staff)

52B. Readings in History.

3-4 units, Win (Staff)

52C. Readings in Art History.

3-4 units, (Staff)

55. Business German—Reading and discussions in German of texts dealing with the business world, i.e., economics, banking, stock market, import-export trade, Common Market, 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 COURSES

100C. Advanced Listening and Speaking Skills—This course increases fluency and precision in speaking and building 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 176.) 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) 3 units (Robinson) given 1986-87
119. Introduction to the Germanic Languages—(Same as 19A, Linguistics 75.) (DR:4)  
3 units, Aut (Robinson)

130. German Newspapers—Articles of current interest in German newspapers are read and discussed in German. This course may be taken twice for credit. Prerequisite: 22 or 51 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 51 or consent of instructor. (DR:5)  
4 units, Aut (Lohnes)

132. The Culture of Modernism in Austria and Germany—Prerequisites: 22 or 51 or consent of the instructor. (DR:2)  
4 units, Win (Staff)

133. Democracy, Protest, and Political Culture in German-Speaking Europe—Prerequisites: 22 or 51 or consent of the instructor. (DR:3)  
4 units, Spr (Berman)

134C. The Evolution of European Fascist Movements—(Same as History 134C.)  
5 units, Win (Botz)

134R. Problems and Prospects of European Security—(Same as Political Science 194R.)  
5 units, Aut (Rittberger)

135. Images of Women in German Film—(Same as 35A, Feminist Studies 168.)  
4 units, Spr (Strachota)

150. Introduction to German Literature—Texts (short prose, poetry, and drama) ranging from the classical to the modern period are read. Introduction to key concepts of major literary periods and of literary criticism. Readings by Goethe, Schiller, Hölderlin, Hoffman, Eichendorff, Büchner, Heine, Thomas Mann, and Kafka.  
4 units, Win (Turneaure)

151-157. Courses in the 150 series introduce the student to German literature in various genres. Prerequisite: 22 or 51 or equivalent.
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 (Staff) given 1986-87

171-178. These courses introduce the student to specific developments and topics of German literature and culture with some emphasis on methods of literary interpretation. Prerequisites: 22 or 51 plus 2 additional courses or consent of instructor.

179. Special Topics—These courses explore the possibility of interdisciplinary studies and research in areas of special interest: e.g., women authors, social satire, political speeches, Freud and literature. Literature in the German Democratic Republic.

180R. Science and Technology and Change in the International Systems—(Same as Political Science 247R.)

5 units, Spr (Rittberger)

189. 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 51 or consent of instructor.

1-2 units, Aut, Win, Spr (Petig) by arrangement

COURSES FOR ADVANCED UNDERGRADUATES AND FOR GRADUATE STUDENTS

201. Language and Style I—Writing exercises on different levels of style; discussion of grammatical problems; introduction to literary stylistics. Prerequisite: qualifying examination.

2 units, Win (Lohnes)

202. Language and Style II—Continuation of 201.

2 units, Spr (Lohnes)

203. History of the German Language—(Same as Linguistics 276.) 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 (Robinson) given 1986-87

204. Gothic—(Same as 304.) Introduction to grammar and texts of the Gothic language. The grammar of Proto-Germanic will also be treated.

3-5 units, Win (Robinson)


5 units, Spr (Andersson)

206. Old High German—(Same as 306.) Introduction to the grammar and documents of the earliest attested stage of High German.

3-5 units (Robinson) given 1987-88

207. Old Saxon—(Same as 307.) Introduction to grammar and documents of the earliest attested stage of Low German.

3-5 units (Robinson) given 1986-87

208A. Introduction to Middle High German—Emphasis on basics of grammar and rapid reading.

3-5 units, Spr (Andersson) by arrangement

211. Syntax of Modern German—(Same as 311.) Contrastive analysis of English and German syntax.

3-5 units, Spr (Lohnes)

212. Linguistics and the Analysis of German—(Same as 312; Linguistics 175.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.

3-5 units, Spr (Robinson)

218. Introduction to German Dialects—(Same as 118; Linguistics 176.) (DR:4)

3 units (Robinson) given 1986-87

230. Kant’s Critique of Judgment—(Same as Philosophy 130/230.) A study of both parts of Kant’s *Critique of Judgment*, with concentration on its philosophical content and its subsequent influence, both on philosophy and literature.

4 units, Spr (Hampshire, Förster) MWF 10

234R. The Two Germanies in International Affairs—(Same as Political Science 234R.)

5 units, Spr (Rittberger)

237. Twentieth-Century Austria—(Same as History 237.)

5 units, Win (Botz)

239B. Nazism’s Austrian Heritage—(Same as Political Science 239B/339B.)

5 units, Spr (Botz)

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 English 1985-86).
241. Deutsche Geistesgeschichte I — From Lessing to Romanticism. The course will delineate the conceptual field within which from the middle to the end of the eighteenth century the problems of human knowledge, of history, of the nature of man and of art were revolutionized and given a new basis. In the center of the course are readings and detailed interpretations of selected texts by Lessing, Kant, Herder, Schiller, and Fichte.
3-5 units, Aut (Wellbery)

242. Deutsche Geistesgeschichte II — From Hegel to Nietzsche. The outlines of Hegel’s phenomenology and his model of historical development as the becoming-conscious of freedom. The transformations of this model in the cultural criticism of Heine, the anthropology of Feuerbach and the dialectical materialism of Marx and Engels. Nietzsche’s radical critique of the idea of the nature of man and of his historical self-actualization.
3-5 units, Win (Wellbery)

243. Deutsche Geistesgeschichte III — From Nietzsche to the present. Texts by Nietzsche, Husserl, Freud, Heidegger, Benjamin, Adorno, and Habermas 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 be discussed in order to indicate possible applications to literary theory.
3-5 units, Spr (Staff)

245. Marxism and Literary Criticism— (Same as 245A/345, English 245.)
3-5 units, Win (Berman)

248. Topics in Contemporary Criticism— (Same as 348.) Discussion of current debates in literary theory and methodology.
3-5 units, Spr (Berman, Wellbery)

250. Readings in Medieval Latin Literature. 3-5 units, Aut (Andersson) by arrangement

251. German Literature and Culture I-IX — (Same as 351-359.) These courses treat the major periods of German literature from the early Middle Ages to the present. Open to undergraduates by consent of instructor only.

255. German Literature and Culture V — Eighteenth Century (1750-1800) — (Same as 355.)
3-5 units, Win (Mommsen)

256. West German Literature of the Sixties — (Same as 356.) The politicization of literary culture in the context of the student movement. Issues include: the establishment of literary authority and the constitution of reception, the critique of institutions (literary criticism), the influence of the Frankfurt School, the appropriation of working-class cultural traditions, the post-auratic work, deautonomization and documentary literature, intellectuals and social modernization.
3-5 units, Aut (Mommsen)

257. German Literature and Culture VII — (Same as 357.) Nineteenth 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 (Mommsen) given 1986-87

260-269. Major Authors— In-depth study of a major writer in his literary creativity, relation to his age, or special achievements and significance. Courses will deal with such writers as Walther von der Vogelweide, Grimmshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht, etc.
3-5 units (Staff)

269. Georg Büchner— (Same as 369.) Sein dramatisches, erzählerisches und politisch-publizistisches Werk. Büchners lebendige Auswirkung auf Büchner-Freisträger wie Peter Handke, Martin Walser, Heinrich Böll, Manès Sperber, Christa Wolf, Peter Weiss u.a.
3-5 units, Spr (Mommsen)

270-279. Genres— These courses treat the development, contents, and formal characteristics of such kinds of writing as lyric poetry, epic, drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focuses on such matters as medieval drama, baroque “metaphysical” poetry, the diary as a literary form, autobiography.

283. Goethe Faust II — (Same as 383.) Goethes dichterisches Hauptwerk im geistesgeschichtlichen Zusammenhang; Geschichte der Faustkritik; Einheit und Uneinheitlichkeit der beiden Faust-Teile; der Tragödiencharakter, Unsterblichkeitsmythos im Rahmen der Goetheschen Naturphilosophie; sprachliche Formgebung (Versrythmik, Wortwahl, Peribdenbau, Metrik etc.) Gegenwartsbedeutung des Werks.
3-5 units, Aut (Mommsen)
290-299. Special Subjects and Problems—Variable topics.

296. Goethe und die Weltliteratur—(Same as 396.)
3-5 units (Mommsen) given 1986-87

298. Individual Work—Open only to German majors and to students who are working on special projects. Students taking honors in German will use this number for the honors essay. May be repeated for credit.
1-15 units, each quarter (Staff) by arrangement

GRADUATE COURSES

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 1986-87

300A. Introduction to German Studies—Bibliographical research is a time-consuming task until one acquires the necessary skills to find, to know, and to handle the essential bibliographies, reference works, etc., in the vast field of German Studies—culture, literature, history, political science, and so on. It is the aim of this course to enable students to find all facts and information needed for study and research by themselves and in the shortest possible time.
2 units, Aut (Frank) 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)

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 will also be treated.
5 units, Win (Robinson)

305A. Introduction to Old Norse-Icelandic—(Same as 205A, English 200A.)
5 units, Spr (Andersson)

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 (Robinson) given 1986-87

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 175.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.
3-5 units, Spr (Robinson)

345. Marxism and Literary Criticism—(Same as 245A, 245, English 245.)
3-5 units, Win (Berman)

348. Topics in Contemporary Criticism—(Same as 248.)
3-5 units, Win (Berman, Wellbery)

3-5 units, Win (Mueller-Vollmer)

349G. The Young Goethe—Course will consider the works of Goethe prior to the Italian journey with special emphasis on Werther, Götz von Berlichingen, the Urfaust, and lyric poetry. Attention will be given to new developments in Goethe research and to the relevance of current methodological debates to the study of Goethe’s work.
3-5 units, Aut (Wellbery)

349M. Seminar: Thomas Mann.
3-5 units (Gillespie) given 1986-87

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, 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 1986-87

350. Methods of Teaching Literature—Students may enroll for practice in literature teaching on a voluntary basis.
1-3 units, Aut, Win, Spr (Staff) by arrangement
SCHOOL OF HUMANITIES AND SCIENCES

351-359. German Literature and Culture I-IX—(Same as 251-259.) These courses treat the major periods of German literature from the early Middle Ages to the present. They are intended to convey to the student a sense of the developing traditions that have shaped German literature. By focusing on a specific period, the literary and non-literary (cultural, social, political, philosophical) contexts can be established within which individual authors, works, and movements are situated.

3-5 units, Win (Mommsen)

356. West German Literature of the Sixties—(Same as 256.)
3-5 units, Aut (Berman)

357. German Literature and Culture VII —(Same as 257). Nineteenth Century (1830-1900).
3-5 units (Mommsen) given 1986-87

360-369. Major Authors—In-depth study of a major writer in his literary creativity, relation to his age, or special achievements and significance. Courses will deal with such writers as Walther von der Vogelweide. Grimmelshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht.

369. Georg Büchner—(Same as 269.)
3-5 units, Spr (Mommsen)

370-379. Genres—These courses treat the development, contents, and formal characteristics of such kinds of writing as lyric poetry, epic, drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focuses on such matters as the following: medieval drama, baroque "metaphysical" poetry, the diary as a literary form, autobiography.

383. Goethe, Faust II.—(Same as 283.)
3-5 units, Aut (Mommsen)

384A. Joyce, Proust, Mann—(Same as 284A.)
3-5 units (Gillespie) given 1986-87

390-399. Special Subjects and Problems.

391A. Madame de Staël and the Discovery of Germany—(Same as Comparative Literature 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, Spr (Mueller-Vollmer)

396. Goethe und die Weltliteratur—(Same as 296.)
3-5 units (Mommsen) given 1986-87

ADVANCED GRADUATE COURSES

400. Dissertation Research—Exclusively for graduate students in German working on dissertations.
1-12 units, Aut, Win, Spr, Sum (Staff) by arrangement

449. Seminars.

449C. Seminar: Literary Hermeneutics—(Same as 349C.)
3-5 units, Win (Mueller-Vollmer)

449H. Hauptfiguren der deutschen Literaturgeschichte—Seminar.
3-5 units (Mommsen) given 1986-87

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. Knobes, John C. Miller, Wayne S. Vucinich, Gordon Wright; (Associate Professor), Rixford K. Snyder

Chairman: Paul A. Robinson


Associate Professors: Judith C. Brown, Albert M. Camarillo (on leave 1985-86), Clayborne Carson (on leave Spring), Frederick P. Bowser, Estelle B. Freedman (on leave 1985-86), Kennell A. Jackson, Jr. (on leave Winter and Spring), Harold L. Kahn, Carolyn C. Lougee, Sabine MacCormack, Jack N. Rakove

Assistant Professors: Joel Beinin, Herrick Chapman (on leave 1985-86), Stephen C. Ferruolo, Nancy S. Kollmann, Richard Roberts

Courtesy Professors: Paul David, Michael Jameson, Susan M. Treggiari

Affiliated Professor: Albert E. Dien

Modern Europe Lecturers: Ruth Gladden, Lawrence Klein, Carl Landauer, Lee Palmer Wandel, Stewart Weaver

Visiting Professors: Gerhard Botz, Michael Confino, Norman Davies, Hans Guggisberg, A. F. Thompson

Visiting Associate Professors: Lawrence Bryant, Richard Gillam

Visiting Assistant Professor: George K. Behmer, John D’Amico, Michael Kazin, Catherine Le Grand

Visiting Lecturers: Susan Bell, Ramon Myers, Karen Offen

Mellon Fellows: J. Prasenjit Duara, Walter Jackson

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 small-group courses—undergraduate colloquium (reading and discussion involving an explicit historical research) or undergraduate seminar (research and writing on an explicit historical topic); and (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 IN HISTORY

For a limited number of undergraduate majors, the department offers a special program leading to Honors in History. Students accepted for this program, in addition to fulfilling the general requirements stated above, will complete an honors essay, the work for which will normally begin in Spring Quarter of the junior year and be completed by the end of Winter Quarter of the senior year. To enter this program the student must be accepted by a member of the department who will agree to advise him or her on the essay. In considering an applicant for such a project, the advisor and the Director of the Honors Program will take into account the student's general preparation in the field of the project, and will expect at least a "B" average in the student's previous work, both in history and in the University. Prospective Honors students are urged to take an undergraduate seminar sometime in the junior year. Students satisfactorily completing the program will be eligible for Honors in History, depending upon the quality of their work. To enter the Honors program, apply at the History Department Office.

James Birdsall Weter prizes are awarded each year for the outstanding Honors essay.

HISTORY IN THE SECONDARY TEACHER'S CREDENTIAL

Applicants for the Single Subject Teaching Credential (Secondary) in the social studies may get details of the requirements by applying to the Credential Administrator, School of Education.

COTERMINAL A.B. AND A.M. PROGRAM IN HISTORY

The department admits each year a limited number of undergraduate History majors to work for a coterminous A.B. and A.M. degree in History. Applications for admission to this program should be submitted during the Spring Quarter of the student's junior year and must be submitted no later than November 1 of his or her senior year. Applicants are expected to meet the same general standards as those seeking admission to the A.M. program; they must submit a written statement of purpose, a transcript, and three letters of recommendation, at least two of which should be from members of the History Department faculty. The decision on admission rests with the Graduate Admissions Committee. Students must 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.

**MASTER OF ARTS IN TEACHING (HISTORY)**

The department cooperates with the School of Education in offering the Master of Arts in Teaching degree. For the general requirements, see description under section “School of Education” in this bulletin. For certain additional requirements made by the Department of History, contact the Department Office. Candidates must possess a teaching credential, 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.

The following requirements must be met:

1. In consultation with the advisor, students will select a major field of study from the list below in which to concentrate their study and later take the University oral examination. The major fields are:
   - Europe, 300-1400
   - Europe, 1400-1789
   - Europe since 1700
   - Russia
   - Eastern Europe
   - Middle East
   - East Asia before 1600
   - East Asia since 1600
   - Africa
   - Britain and the British Empire since 1460
   - Latin America
   - The United States (including Colonial America)

2. The department seeks to provide a core colloquium in every major field, in which the students will normally enroll in the first year of graduate study.

3. Students are required to take two research seminars, at least one in the major field. Normally, research seminars should be taken in the second year.

4. Each student, in consultation with his or her advisor, defines a secondary field. This requirement may be met in one of three ways: (a) a field selected from the list below; (b) a European national history of sufficiently long time to span chronologically two or more major fields—for example, students may elect to offer the history of France from about 1000 to the present; (c) a comparative study of a subject across countries or periods.

The secondary fields are as follows:

- The Ancient Greek World
- The Roman World
- Europe, 300-1000
- Europe, 1000-1400
- Europe, 1400-1600
- Europe, 1600-1789
- Europe, 1700-1871
- Europe since 1848
- Russia to 1800
- Eastern Europe to 1800
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.

**INTRODUCTORY COURSES**

**1. 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 post-doctoral fellows. Enrollment is limited; students intending to apply the sequence toward their Requirement are given priority.

1. Europe from the Middle Ages to the Reformation — A survey of the eclipse of classical culture, the ordering of Christendom in the Middle Ages, humanism and classical revival in the Renaissance, and theological controversies in the Reformation. Assigned texts include works of Plato, Aristotle, Cicero, Augustine, Aquinas, Dante, Machiavelli, More and Luther. (DR:1; three-quarter sequence)
   5 units, Aut (Lounge, Ferruolo, Staff)
   lectures plus a two-hour colloquium

2. 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. This course will 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, Win (Paret, 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. This course will 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 (Behlmer, 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, Kahn)

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 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. Recommended background course: History 21. (DR:5; also satisfies Area 3 when taken in sequence with History 21.)
   5 units, Win (Abernethy, Collier, Duus)

24B. Russian Civilization II: Society, Culture, and Politics in Imperial Russia—An interdisciplinary approach to Russian history and cul-
ture; examines literature, society, institutions.
5 units, Win (Emmons)

65. Introduction to Medieval Society and Culture—(Same as Art 65, Medieval Studies 65.) The development of medieval culture through study of some salient religious, philosophical, literary, artistic, social and political sources with emphasis on their interrelationships.
5 units, Win (Emmons, Ferruolo, Lewis, Staff)

80. 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. This is a basic introduction to the Latin American courses within several departments.
5 units, Win (Ferruolo, Lewis, Staff)

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".

5 units, Win (Brown)

41S. Introductory Seminar: Aspects of Modern Britain—Through the study of selected problems of modern British history, the course attempts to introduce the student to both the subject and historical techniques.
5 units, Aut (Stansky)

42S. Introductory Seminar: London 1500-1700: The Growth of the City and the Transformation of Its Culture—An introduction to social and cultural history by means of an examination of parish and guild records and contemporary plays, sermons, letters, and pamphlets. Topics will range from immigration and family structure to religion and popular entertainment.
5 units, Spr (Seaver, Smail)

51S. Introductory Seminar: Power and Imagination in the 1940s—How did American intellectuals, writers, and critics respond to an age of total war? Did the 1940s represent a major turning point in American thought and sensibility? What do primary and secondary sources (novels, newspapers, periodicals, memoirs) tell us about the "spirit" of the 1940s?
5 units, Aut (Gillam)

5 units, Win (Rakove)

55S. Introductory Seminar: California Controversies—A discussion of key issues in the history of California through the examination of primary documents. Topics include the fate of the native population, vigilante violence, the political role of the Southern Pacific Railroad, the economic growth of Los Angeles, the internment of Japanese during World War II, and the student rebellion of the 1960s.
5 units, Spr (Kazin)

56S. Introductory Seminar: Women in the American West
5 units, Aut (Pascoe)

ADVANCED COURSES

Courses numbered 100 through 199 are primarily lecture courses designed for advanced undergraduates.

THE ANCIENT WORLD

See Classics, Ancient History section, for description of the following courses, all of which are accepted for credit toward a major in History.

101. History of Greece—(Enroll in Classics 101.) (DR:5)
5 units, Aut (Munn)

102. Greek and Roman History from Alexander to Caesar—(Enroll in Classics 102.) (DR:5)
5 units, Win (Treggiari)

103. History of the Roman Empire—(Enroll in Classics 103.) (DR:5)
5 units, Spr (Treggiari)

104. Social and Economic History of Greece—(Same as Classics 111.)
5 units, Spr (de Ste-Croix)

206B. Undergraduate Colloquium: Roman Society in the Age of Cicero and Augustus—(Same as Classics 181.)
5 units, Spr (Treggiari)

303. Graduate Colloquium: Early Christian Attitudes to Women, Sex and Marriage.
5 units, Spr (de Ste-Croix)
305A, B. Graduate Colloquium: Problems in Late Roman Republican History.
5 units, Aut (Treggiari)
2 units, Win (Treggiari)

MEDIEVAL AND RENAISSANCE EUROPE

107. The 12th Century Renaissance: European Society and Culture, 1050-1220—Demographic and economic expansion, social and political change, law, the cities, the crusades, church reform, heresy and religious dissent, learning and the universities, chivalry, courtly love and romance; aesthetics; Gothic architecture. (DR:5)
4-5 units, Spr (Ferruolo)

108. The Christianization of Western Europe, 500-1350—How the Europeans came to believe in a god named Christ; why the thought and conduct associated with that belief changed so radically; why different forms of religiosity and dramatic conflicts developed; how religious beliefs affected social organization; and how social changes modified religiosity. 5 units, Win (Langmuir)

109. The Age of the Renaissance—Examines the artistic and intellectual breakthroughs of the age in relation to the economic, social, and political institutions of Renaissance Italy. (DR:5)
5 units, Aut (Brown)

110. The Age of the Reformation—(Same as Religious Studies 126). The religious phenomenon in the general setting of European developments during the 16th century, relating the Reformation to the urban setting and the economic and social forces of the rising territorial and national states. (DR:3)
5 units, Win (Spitz)

112A. Art, Religion and Society in Late Antiquity (284-717 A.D.)—(Same as Classics 107.) 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 be deployed to explain how and why this happened. (DR:5)
5 units, Aut (MacCormack)

EASTERN EUROPE AND RUSSIA

118A. Poland and Lithuania, 1569-1795.
5 units, Win (Davies)

120C. Russia in Revolution, 1861-1930—A survey of Russia from an agrarian-rural to an industrial-urban society (from the abolition of serfdom to the Soviet Five-Year Plans), and the Russian Revolution of 1917 considered in this broader context.
5 units, Spr (Emmons)

122B. Soviet Foreign Policy—(Same as Political Science 136.) Foreign and domestic determinants of policy, intentions and capabilities, continuity and change since 1917, institutions and personnel, war and peace, perceptions, priorities, and attitudes, and alternative futures. (DR:5)
5 units, Win (Dallin)

123A. The Soviet Union: Politics and Society Since 1917—(Same as Political Science 119A.) Major trends and events: political leadership, political process, social change and stratification, legitimacy and dissent, major conceptual frameworks used to explain the Soviet experience; alternative approaches and conflicting points of view.
5 units, Spr (Dallin)

124. Russian Thought and Society in the 19th Century—Survey of the main currents of ideas, their origins and dissemination; interplay of ideas and the major social issues and developments; interplay of western influences and Russian cultural tradition; thinkers, writers, and ideologists; the social role of literature and literary criticism in 19th century Russia.
5 units, Aut (Confino)

126A. Eastern Europe in the 20th Century.
5 units, Aut (Davies)

WESTERN EUROPE

133A. War and Society.
5 units, Spr (Paret)

134C. The Evolution of European Fascist Movements—(Same as German Studies 134C, Political Science 126G.) Beginning with societal preconditions and precursor phenomena in Austria and Germany, this course emphasizes the Italian and German Model of fascism which spread in two waves over many European countries, ending up with Hitler's seizure of power.
5 units, Win (Botz)

136A. European Thought in the 19th Century—Great thinkers and major movements of the 19th century, particularly romanticism, liberalism, Marxism and the origins of modern irrationalism, seminal writings of Burke, Mill, Marx, Ruskin and Nietzsche. (DR:3)
5 units, Spr (Robinson)

137C. The History of Early Modern Spain, 16th to 18th Centuries.—The Habsburg Dynasty and the Spanish preponderance in Europe, the Counter-Reformation in Spain,
the discovery, conquest and settlement of Latin America, the rivalry with France and England, the Spanish Armada, the Wars of the Spanish and the Austrian Succession, the Seven Years War, and Spain’s decline as a world power.
5 units, Win (Guggisberg)

HISTORY OF SCIENCE

4 units, Win (Knorr)

138B. Middle Ages to Newton— (DR:3; DR:3 and DR:6 when taken in sequence with History 138A.)
4 units, Spr (Knorr)

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, Bacon and Harvey. 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, Spr (Galison)

139A. History of Modern Physics— (Same as History of Science 168, Philosophy 168, VTSS 133.) History of the development of fundamental physics from Maxwell’s time to the present. Will discuss the mechanical and electrodynamic world views, special relativity, atomic models and the now-standard model of elementary particle physics. The changing nature of the physics profession will be addressed as well as the rise of Nazi physics, the atomic bomb project and the growth of large-scale experimentation in the United States. Readings: original scientific texts, archival material and secondary sources.
4 units, Aut (Galison)

140. England to 1460— The integration of English society with emphasis on the relation between social and political structure and the limitation of monarchy by law and Parliament. 5 units, Aut (Langmuir)

141. Yorkist and Tudor England— The transition from the late medieval realm to the Renaissance monarchy of Henry VIII, to the English Reformation, and to the new conservatism of the Elizabethan regime. (DR:5) 4-5 units, Aut (Seaver)

144. Britain: 1688-1851— Through a consideration of political, social, literary material, this course explores the creation of the first modern nation as it becomes the most powerful country in the world. (DR:5) 5 units (Stansky) not given 1985-86

144A. Modern Britain. 5 units, Win (Thompson)

145. Britain 1851-1986— Using similar material to History 144, this course attempts to touch on all aspects of a society at the height of its power and then will discuss its slow and colorful decline during the 20th century. (DR:5) 5 units (Stansky) not given 1985-86

AFRICA

148. Introduction to African History— Survey of African cultures, societies, economies and politics from earliest times to the present; state building, the slave trade, colonialism, nationalism and independence. 4-5 units, Aut (Jackson)

148C. Africa in the 20th Century— Transformation of African societies during colonial rule. Resistance to colonial conquest; decline of the old elite and rise of the new one; conflicting ideologies and consciousness; nationalism; decolonization. (DR:5) 5 units, Spr (R. Roberts)

THE UNITED STATES

150. Emergence of American Society, 1607-1760— The development of the markedly different colonies of British America emphasizing the major themes of social history: migration, demography, religion, slavery, family, community, and the contact of peoples. 5 units, Win (Rakove)

151A. American Culture Since the 1850s— Historical and interdisciplinary perspectives on American life and character from the mid-19th century to the present. Topics range from race relations and class conflict to music, movies, and popular culture. 5 units, Win (Gillam)

effects on phenomena such as immigration/migration, the development of an urban culture, ethnicity and race, machine politics, education, poverty and welfare, and the family.

5 units, Spr (Kazin)

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, immigration and urbanization.

3 units, Spr (Tyack)

158B. American Education and Public Policy—(Same as Education 105, Political Science 186K.)

3 units, Aut (Tyack)

161. American Intellectuals and Afro-American Life, 1890-to the Present.

5 units, Aut (W. Jackson)

163. 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, Win (Gillam)

165A,B,C. United States History From the Revolution to the Present—An articulated sequence, general in focus, but with special attention given to political and institutional history. The series as a whole is designed to give students a broad foundation in United States history on which to base further work in history, literature, economics, political science, religious studies, art history, etc. Though the three parts of the series are intended to form an integrated whole, any portion may be taken independently of the others.

165A. 18th Century America. (DR:5)

5 units, Aut (Rakove)

165B. 19th Century America. (DR:5)

5 units, Win (Degler)

165C. The United States in the 20th Century—1896-Present. (DR:5)

5 units, Spr (Kennedy)

175A. History of Canada—Survey, with emphasis since Confederation in 1867, including major themes such as the frontier and nation-building; government role in the economy; the federal system and the regions; Canada’s role as a middle-range power with emphasis on the Western Hemisphere and membership in international organizations.

5 units, Spr (Wirth)

176. Spanish America to World War I—From the Spanish conquest to the apogee of economic and cultural dependency; the relationships between colonial developments, political independence, and modern conditions and problems. (DR:5)

5 units, Spr (Bowser)

178. The Historical Roots of the Crisis in Central America.

5 units, Aut (LeGrand)

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, Win (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

190. Modern Chinese Economic History: 18th Century to the Present—An examination of the markets, economic organizations, state policies and performances of the Chinese economy from the 18th century to the present. Comparisons will be made with other economic systems.

5 units, Win Myers)

192A. China from Earliest Times to the 8th 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)

192B. China from the 9th to the 19th Century—(192A recommended as a prerequisite.) From the late Tang to the Opium War. Emphasis on socio-economic rather than political history to expose students to a sophisticated society very different from their own. (DR:5*)

5 units, Win (Kahn)
193. Science, Technology and Material Culture in Traditional China—(Same as Asian Languages 153.) 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)

194. Early and Medieval Japan to 1336—Prehistoric origins of the people and culture, emergence of the first polity, Chinese influences, flowering of the native culture, the samurai, and feudal government. 
5 units, Aut (Mass)

194B. The Rise of Modern Japan—A survey of Japanese history from 1840 to the present. The Meiji Restoration and its background; building modern state; industrialization of the economy; emergence as an imperialist power; the reorientation of postwar Japan; the creation of "Japan, Inc." Attention will be given to socio-economic change as well as political developments. (DR:5*)
5 units, Spr (Duus)

195. Nomad Empires of Inner Asia—(Same as Asian Languages 152.) (DR:5*)
5 units, Spr (Dien)

UNDERGRADUATE SEMINARS AND COLLOQUIA

During 1985-86, 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 1985-86. 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)

200W. Undergraduate Directed Reading. 
units by arrangement (Staff)

200X. Undergraduate Directed Research. 
units by arrangement (Staff)

202. Undergraduate Colloquium: Introduction to Problems of Historical Interpretation and Explanation. 
5 units, Spr (Emmons)

208A. Undergraduate Colloquium: Renaissance Intellectual History. 
5 units, Aut (D'Amico)

5 units, Spr (Langmuir)

212. Undergraduate Colloquium: Augustine and the City of God. 
5 units, Spr (MacCormack)

213A. Undergraduate Colloquium: Luther and the Radicals—(Same as Religious Studies 241A.) 
5 units, Spr (Spitz)

214A. Undergraduate Colloquium: The Crusades. 
5 units, Win (Ferruolo)

5 units, Spr (Brown)

222A. Undergraduate Colloquium: Soviet Nationalities. 
5 units, Spr (Vucinich)

224. Undergraduate Colloquium: Nationalism and Communism in Eastern Europe. 
5 units, Win (Vucinich)

237. Undergraduate Colloquium: Austria in the First Half of the 20th Century—(Same as German Studies 232.) 
5 units, Win (Botz)

237B. Undergraduate Colloquium: The Novel and History. 
5 units, Aut (Robinson)

238. Undergraduate Colloquium: The Woman Question in Western Thought 1750-1950. 
5 units, Spr (Bell, Offen)

239B. Undergraduate Colloquium: Nazism's Austrian Heritage—(Same as German Studies 239B.) 
5 units, Spr (Botz)

242. Undergraduate Colloquium: English Culture from More to Milton—(Same as English 202B/303B.) 
5 units, Spr (Riggs, Sharpe)
248A. Undergraduate Colloquium: The End of Slavery in Africa and the Americas.  
5 units, Spr (Roberts)

248S. Undergraduate Seminar: The Colonial State and Society in Africa.  
5 units, Win (Roberts)

264. Undergraduate Colloquium: America in Vietnam—(Same as American Studies 222.)  
5 units, Spr (Rakove)

269S. Undergraduate Seminar: U.S. Foreign Policy in the World War II Era.  
5 units, Win (Kennedy)

272. Undergraduate Colloquium: Medicine, Expertise, and Democracy—(Same as VTSS 144.)  
5 units, Spr (Gillam)

274. Undergraduate Colloquium: Local and Community History in the U.S.  
5 units, Spr (Kazin)

279A. Undergraduate Colloquium: Mexico as Intellectual Creation.  
5 units, Win (Bowser)

279B. Undergraduate Colloquium: Spanish America as Non-Western Culture.  
5 units, Spr (Bowser)

288. Undergraduate Colloquium: Palestine and the Arab-Israeli Conflict.  
5 units, Aut (Beinin)

290. Undergraduate Colloquium: Japan and America, Conflict and Cooperation.  
5 units, Aut (Duus)

292A. Undergraduate Colloquium: Aspects of Chinese Economic History.  
5 units, Spr (Kahn)

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)

GRADUATE COURSES

300W. Graduate Directed Reading.  
units by arrangement (Staff)

301. Graduate Colloquium: Historiography of American Education.  
5 units, Aut (Tyack)

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 (Bouwer)

307. Graduate Core Colloquium in Medieval History.  
5 units, Aut (Langumir)

309A. Graduate Colloquium: Renaissance Intellectual History.  
5 units, Aut (D'Amico)

310. Graduate Colloquium: Castellio and the Toleration Debate in the 16th Century.  
5 units, Win (Guggisberg)

312A. Graduate Colloquium: The Crusades.  
5 units, Win (Ferruolo)

313. Graduate Colloquium: The Renaissance.  
5 units, Win (Brown)

315. Graduate Colloquium: Topics in Economic European History.  
5 units, Spr (Brown)

319. Graduate Colloquium: Humanism and the Reformation.  
5 units, Aut (Spitz)

322A. Graduate Colloquium: Soviet Nationalities.  
5 units, Spr (Vucinich)

323A. Graduate Colloquium: Topics in Russian History.  
5 units, Aut (Emmons)

324. Graduate Colloquium: Nationalism and Communism in Eastern Europe.  
5 units, Win (Vucinich)

325A. Graduate Colloquium: Issues and Interpretations in Russian Social History.  
5 units, Win (Confino)

331A,B,C. Graduate Core Colloquium on Modern Europe.  
15 units, Aut, Win, Spr (Spitz, Bryant, Paret)

337A. Graduate Colloquium: Modern European Intellectual History.  
5 units, Spr (Robinson)

339B. Graduate Colloquium: Nazism's Austrian Heritage.  
5 units, Spr (Botz)

341A. Graduate Colloquium: Topics in the Culture and Society of Early Modern England.  
5 units, Aut (Seaver)

342. Graduate Colloquium: English Culture from More to Milton—(Same as English 202B/302B.)  
5 units, Spr (Riggs, Sharpe)
343. Graduate Colloquium: Britain in the 20th Century.
5 units, Win (Thompson)

344A. Graduate Colloquium: Problems in Modern British Society.
5 units, Spr (Stansky)

348A. Graduate Colloquium: The End of Slavery in Africa and the Americas.
5 units, Spr (Roberts)

348C. Graduate Colloquium: Problems in the Economic History of West Africa.
5 units, Aut (Roberts)

349. Graduate Colloquium: History and Anthropology—(Same as Anthropology 246.)
5 units, Aut (K. Jackson, Rosaldo)

351A,B,C,D,E,F. Graduate Core Colloquium in American History.
30 units, Aut, Win, Spr (Rakove, Degler, Carson, Kennedy)

354A. Graduate Colloquium: American Workers in the 20th Century.
5 units, Win (Kazin)

376. Graduate Colloquium: Modern Latin America, Recent Trends in Historiography.
5 units, Aut (Wirth)

389. Graduate Colloquium: Labor and Politics in the Third World.
5 units, Spr (Beinin)

390A. Graduate Colloquium: Topics in Late Traditional Chinese History.
5 units, Aut (Kahn)

395A. Graduate Colloquium: Early and Medieval Japan.
5 units, Aut (Mass)

395B. Graduate Colloquium: Medieval and Early Modern Japan—1600-1800.
5 units, Win (Mass)

395C. Graduate Colloquium: Modern Japan.
5 units, Spr (Duus)

399. Graduate Colloquium: The Institutions of Medieval Japan.
5 units, Win (Mass)

ADVANCED GRADUATE COURSES

Courses numbered 400-499 are intended primarily for second and third year graduate students, but other qualified students may be admitted by consent of instructor.

400X. Graduate Research.
units by arrangement (Staff)
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)

Mellon Fellow: Robert Proctor (Philosophy)

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 social sciences, history, philosophy, medicine, and the science 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


138A. Ancient Period—(DR:3) (DR:3 & 6 when taken in sequence with 138B.) 4 units, Win (Knorr) MWF 1:15

138B. Middle Ages to Newton—(DR:3) (DR:3 & 6 when taken in sequence with 138A.) 4 units, Spr (Knorr) MWF 1:15

138C. Newton to Einstein—(DR:3) 4 units, Spr (Knorr) 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, Spr (Knorr) MWF 2:15

141. History of Psychology—(Same as Psychology 141.) Course will explore the development of psychological theory from an historical perspective. Major systematic positions such as structuralism, Gestalt theory, behaviorism and psychoanalysis will be discussed in some detail. The historical roots of major contemporary positions will be explored. Prerequisites: students should usually have taken 3 courses in Psychology. 4 units, Aut (Hastorf) TTh 11-12:15

145. Scientific Revolution—(Same as History 139, 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, Bacon and Harvey. 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, Spr (Staff) MWF 2:15-3:05

151. Science Under Banners: Introduction to the Political History and Philosophy of Science—(Same as Philosophy 151.) Science under competing political ideologies. 19th century origins of conceptions of objectivity, neutrality, and the freedom of science; history of various attempts to "politicize" science. Historical examples of attempts to plan science, and debates surrounding the nature of scientific freedom. How do values structure the priorities of scientific research? Case studies in the history of Soviet proletarian science; Nazi racial science; and science under liberalism. Recent problems in the history of science politics, including the politics of cancer, "green revolutionary" agricul
ture, the military use of science; science and social movements.

4 units, Aut (Proctor) TTh 8:35-9:50

given 1986-87


4 units, Spr (Proctor) TTh 8:35-9:50

156. Women, Science, and Technology—(Same as VTSS 138.) Introduction to issues concerning gender, science, and technology from 17th century to the present in Europe and America and examination of current theories of the relationship; history of women’s participation in science and technology; women’s access to institutions of science and technology; conceptions of gender in scientific texts; women as the object of scientific research and technological innovation; and “alternatives” in the sciences and technology proposed and/or practiced by women.

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

168. History of Modern Physics—(Same as History 139A, Philosophy 168, VTSS 133.) History of the development of fundamental physics from Maxwell’s time to the present. Will discuss the mechanical and electrodynamic world views, special relativity, atomic models and the now-standard model of elementary particle physics. The changing nature of the physics profession will be addressed as well as the rise of Nazi physics, the atomic bomb project and the growth of large-scale experimentation in the United States. Readings: original scientific texts, archival material and secondary sources.

4 units, Win (Galison) TTh 2:15-3:30

237A,B. Graduate Colloquium: Methods in the History of Science—(Same as Philosophy 237A,B,C.) Contemporary methodological and historiographical problems in the history of science will be discussed based on readings from the history of physics, biology, chemistry, and medicine. Attention will be 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 will pursue an individual research topic in consultation with the instructor.

2 units each quarter, Aut, Win (Galison) T 4:15-6:05

238. Seminar in the History of Science—(Same as Philosophy 238, Classics 238.) Spr (Knorr) given 1986-87

PROGRAM IN HUMAN BIOLOGY

Chairman: H. Craig Heller

Faculty: Brian Arthur (Food Research Institute), Philip Berger (Psychiatry), Merton Bernfield (Pediatrics), Carol Boggs (Biological Sciences), Diane Bray, J. Martin Brown (Radiology), Luca Cavalli-Sforza (Genetics), Roland Ciaranello (Psychiatry), Arnold Davidson (Philosophy), Herbert Denger, Carl Djerassi (Chemistry), Sanford Dornbusch (Sociology), John Dupré (Philosophy), William H. Durham (Anthropology), Franklin G. Ebaugh (Medicine), Anne Ehrlich, Henry Erlich, Shirley Feldman, James Fox (Anthropology), Dolores Gallagher, Albert H. Hastorf (Psychology), H. Craig Heller (Biological Sciences), Leo E. Hollister (Psychiatry), 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), Robert Mnookin (Law) (on leave 1985-86), Lorraine Morgan (Human Biology), Thomas Raffin (Medicine), John Rick (Anthropology), David Spiegel (Psychiatry), Richard P. Thompson (Psychology), Tjerd Van Andel (Geology), Jeffrey Wine (Psychology), Arthur B. Wolf (Anthropology)

Director of Honors, Internship and Teaching Coordinator: Lorraine Morgan

Student Advisors: Jack Alden, Phyllis Hayes, Beth Kneeland, David Matthes, Meg Richman, Nate Selden, Marivern Slaveck

STATEMENT OF PURPOSE

This program is an undergraduate major designed to encourage the convergence of natural and social science in the study of humankind. The program is an interschool, interdepartmental major, utilizing not only those faculty and courses particularly created for the major, but also pertinent areas of instruction available throughout the University. It is concerned with man and woman as an organism, his or her
adaptation to other men and women and to nature, his or her ability to control and to live with the environment, the mechanism by which these factors relate to his or her biological and behavioral evolution, and the ways in which such knowledge can be brought to bear on the design of public policy.

This program examines the complex relationship of people with nature, exemplified by the dilemmas of social policy in health and education, population problems, pollution of the environment, and conservation and development of resources. The program is designed for the general education of policy makers and citizens. It is also a route to advanced study in the established natural and social sciences and related professions.

OFFERINGS AND FACILITIES

The program leads to an A.B. in Human Biology. The curriculum is designed for those students who desire a knowledge of biology, particularly of people, linked with knowledge of the behavioral and policy sciences. The program involves faculty predominantly from the School of Humanities and Sciences and the Medical School, with representatives from other schools as well.

There is no graduate program in Human Biology, but students will be prepared for advanced training and coterminal programs in either biology, the behavioral and social sciences, medicine, law, education, or economics-engineering systems, depending on their choice of advanced courses following the fundamental program.

The office of the Program in Human Biology is located in Building 80 of the Inner Quad.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The degree of Bachelor of Arts in Human Biology requires approximately 64 units or more in the major. The major consists of three parts.

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
   In addition, familiarity with computer science principles is required. This may be obtained via formal coursework, internships, research, or in some other fashion.

2. Foundation Level. Students must take significant foundation coursework designed to prepare them for their areas of specialization. These courses will vary depending on the exact program designed by the student.

3. Specialization Level. At least 20 units in the student's chosen area of specialization. These may be drawn from courses throughout the University; final approval of any selection rests with the student's advisors.

Within these guidelines, students are required to elect three Human Biology upper division courses, one of which may be included in the area of specialization.

As part of designing their curriculum, students should plan to submit a brief one-page proposal of study to their student advisor. This should be prepared beforehand, and be ready for review at the time the major is declared. It will then be reviewed by the faculty advisor. The proposal should contain a statement of the student's goals within the Program and how the course of study fits his/her longer-term goals.

In addition, as noted above all majors must select and successfully complete an approved policy course (3-5 units); the Internship in Human Biology 197, an independent field-experience project (4 units); and an approved course in statistics (3-5 units).

Detailed guidance should be sought at the program office so that the individual student's course of study can be developed to fit her/his particular needs and career goals. Faculty advisor approval is required at least once each year to ensure that a coherent program of study is developed and followed.

The Honors Program provides qualified majors with an opportunity to do research and write a thesis on a subject of individual interest, for which up to 15 units of credit can be earned in the honors candidate's senior year. These units (see Human Biology 198 under "Courses") will be in addition to the approximately 30 upper division units ordinarily required for an A.B. in Human Biology.

Application for admission to the Honors Program should be made by the third quarter of the junior year. Applicants must have completed the Human Biology core requirements including the internship. The submission of the honors thesis is expected by the beginning of the Spring Quarter of the year of graduation.

THE FUNDAMENTAL PROGRAM

The Human Biology Core Courses (2A and 2B, 3A and 3B, and 4A and 4B) are a sequence of courses which introduce the biological sciences, the social sciences, and most importantly, the relationships between the two. The courses...
meet MWF from 9-10:50 throughout the academic year. Students must register concurrently for the A and B series and take the core courses in sequence. Students are advised to initiate the core in the Autumn Quarter of their sophomore year. 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 of the fundamental program courses, the core, a public policy course, and a statistics course, are to be taken for a grade by majors with the exception of the internship (197) which is taken Pass/No Credit exclusively.

2A,B. Human Evolution: Genetics and Culture—2A is devoted to the basic principles of Mendelian and population genetics, and population biology. 2B studies human evolution, the acquisition of language, and the rise of culture. The theme of the courses is the evolution of human populations, with discussion of biological and cultural aspects of such topics as sociobiology, racial differences, and the incest taboo.

2A. Human Evolution: Genetics and Culture—(DR:7 entire sequence 2A, 3A, 4A must be completed.)
4 units, Aut (Durham, Staff) MWF 9

2B. Human Evolution: Genetics and Culture—(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 and the Social Process — 3A concentrates on the basic principles of biochemistry, cell biology and developmental biology. 3B stresses the development of social bonds and social influences on the individual’s perception of the world. The relation between 3A and 3B will be explored in a series of special topics, such as perception, puberty and abnormal behavior. 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. Properties of Society—(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 and Society — 4A concentrates on integrative system physiology, neurophysiology, and the biological basis of behavior. 4B studies the interaction of human populations and their environments. Demographic and economic processes are related to the development of social order. The interaction between 4A and 4B is illustrated by exploring such topics as fertility control and agriculture.

4A. The Human Organism—(DR:7 entire sequence 2A, 3A, 4A must be completed)
4 units, Spr (Heller, Staff) MWF 9

4B. Social Process of Decisionmaking—(DR:4 entire sequence 2B, 3B, 4B must be completed.)
4 units, Spr (Dornbusch, Staff) MWF 10

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. The series aims to provide 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 of this course 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. This course will provide an overview of health policy formulation from several perspectives. Consideration will be given to social, ethical, political, legal and economic implications. A group research project will be a major part of the course. Small sections will meet weekly. Prerequisite: Human Biology Core or equivalent.

4 units, Spr (Staff) MWF 11

41. Public Decisionmaking Regarding the Human Environment—This course has the purpose of introducing and sensitizing the class to the overall complexion of American public decision making in the “environmental” arena, to demonstrate how scientific and technical factors are accommodated in policy-making and how technically-trained people contribute to the policy process, and to introduce systematic decision making skills. Throughout the course, section exercises and policy research projects will be required. Prerequisite: Human Biology Core.

4 units, Win (Staff) MWF 11
ADDITIONAL COURSES

10. Human Sexuality—This course is intended to provide a broad perspective in human sexuality. The first part deals with the biological aspects of sex: anatomy, physiology, endocrinology, pregnancy, contraception, and diseases of the sexual organs. The second part focuses on sexual behavior: its development, patterns, variations and malfunction. In the final portion, the relationship of sex and society is examined in 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) given 1986-87

50. Human Biology Colloquium—Weekly seminar designed for present and potential Human Biology majors. The course will feature 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, Biology 183.) Series of talks by distinguished speakers, introducing students to a wide variety of topics in population studies.

1 unit, Win (Arthur, Feldman)

ADVANCED COURSES

Of the minimum 20 units of upper division credit each Human Biology student is expected to earn, 20 units must be selected from course offerings within departments other than Human Biology. This 20 unit concentration of credit should be designed to enable the student to focus on his/her post-baccalaureate goal. The student's individual design of this advanced program must have approval from a program faculty advisor. At the student's discretion one upper division course in the area of concentration and one upper division Human Biology course may be taken for Pass/No Credit.

Students who plan to pursue graduate work should be aware of admission requirements for graduate programs and the necessity for early planning of their programs, in order to satisfy the requirements of both the program and graduate schools.

Advanced courses presented by the Program in Human Biology are open to 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.) Course covers 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 include consideration of the application of concepts covered in the course 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 (Boggs)

103. The Natural History of the San Francisco Bay Area—The course will consider the influence of physical factors on the development of the major plant associations characteristic of the region and the faunas associated with them; the impact of human activity on these natural communities will also be discussed. A one-hour lecture plus one field trip per week to be arranged. Limited to 12 seniors. For acceptance, application 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 problems faced by older adults will be provided 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 includes the psycho-social aspects of aging and psychological treatment interventions. One field trip.

3 units, Spr (Gallagher)

105. Philosophy of Biology—(Same as Philosophy 167.) Course addresses issues in biology. Current area of focus is sociobiology. First half of the course addresses epistemological issues underlying sociobiology: the nature of human nature; biological determinism; analogies between humans and other animals; and the application of games theory to evolutionary speculations. Second part looks more closely at specific areas of sociobiological theory, and their possible ethical and political significance. Include the biology of altruism, and the biological basis of gender differences.

4 units, Win (Dupré)

111. Human Physiology—(Same as Biological Sciences 112.) Purpose is to present information on the functioning of organ systems with emphasis on mechanisms of control and regulation. Topics will include structure and function of the endocrine and central nervous systems, cardiovascular physiology, respiration, salt and water
balance, immunology, exercise and gastrointestinal physiology. Lectures and discussion/laboratory. Prerequisite: Human Biology or Biology core. Limited to 120. Registration required.

4 units, Win (Heller)

112. Educational Policy — Objective is to provide 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, Linguistics 5.) Lecture course 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. (DR:4)

5 units, Aut (Fox)

114. Research Seminar in Coevolution — (Same as Anthropology 181.) Seminar of the interactions of genes and culture in the evolution of human diversity. Reviews major new works relating biology and culture (e.g. sociobiology, dual inheritance theory, cultural transmission, etc.) with special emphasis on theory and supporting examples. Teams of students conduct original research projects and report to the class. Prerequisites: Anthropology 2 or the Human Biology Core, and a course in statistics.

4 units (Durham) not given 1985-86

116. Eye and Implications of Vision — This course will explain the workings of the eye, and apply 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)

120. Human Nutrition—(Same as Food Research 119.) An introduction to human nutrition including the function, digestion, absorption and metabolism of nutrients, dietary recommendations and standards, and a general overview of national and international nutrition problems. Prerequisite: Human Biology core or consent of instructor.

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 permission 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 will be 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 24 students.

4 units, Aut (McBride)

127. Psychobiology of Learning—Focus 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)

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 evolutionary 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, eugenics, and human welfare.

3 units, Win (Cacalli-Sforza)

134. Ecological Anthropology—(Same as Anthropology 164.) Seminar on the cultural adaptations of human populations to their environments. Evaluates major theories relating cultures and ecosystems in light of examples from diverse habitats (arctic, desert, tropical rainforest, ocean islands, mountain tops, etc.) Topics include adaptation and cultural change, optimal foraging theory, resource management, social demography and population dynamics, resource competition, warfare, social stratification. Prerequisites: Anthropology 1, the Human Biology Core, or consent of instructor.

5 units, Win (Staff) not given 1985-86


5 units, Spr (Arthur)


5 units, Aut (John)

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. It also serves as a vehicle to acquaint the 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 of the seminar. After a general introduction in the workings of climate and its impact on human affairs, students will 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. For 1985-86 the theme will probably be the recent and continuing Sahelian drought and famine in central Africa. Limited to 24 students.

3 units, Spr (van Andel)

143. Early Experience—(Same as Psychology 190A.) Focus on experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function. Material covers both animal and human research and deals with behavioral and physiological function. Prerequisite: Human Biology Core or consent of instructor.

3.5 units, Win (Levine)

148. Environmental Policy — Discussion of important environmental issues of today and the future, how to deal with them technically and politically, and how to resolve conflicts between environmental concerns and other social needs. Focus will be on the U.S. but an international perspective will be used when appropriate. Main points include definition and description of 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 permission of the instructor.

3 units, Spr (Ehrlich, Anne)

150A. Biosocial Aspects of Birth Control—(Same as Chemistry 137A.) The problems of introducing a new, practical birth control agent or procedure involve legal, political, cultural and economic factors in addition to purely biological ones. The subject matter therefore represents a perfect case of illustrating how many components ought to enter into major policy decisions. The course will deal with a critical evaluation of the logistic aspects of human fertility control and will include lectures on "hardware" as well as "software" aspects of birth control. Groups of five to eight students of diverse backgrounds will develop a series of position papers dealing with new birth control
procedures suitable for populations of different cultural and socioeconomic backgrounds. The first portion of the quarter will consist predominantly of lectures, of selecting the population groups and task forces and of individual discussions with each task force. The remainder of the quarter will be dedicated to library and field work, the completion of written task force reports and oral presentations to the class. The selection of students admitted to this class will be based on the desire to create a multidisciplinary student group (approximately equally divided between males and females) so that each position paper will be prepared by task forces consisting of participants with different undergraduate backgrounds (e.g., Pre-Medicine, Pre-Law, Biological Sciences, Anthropology, Chemistry, Economics, Political Science, Psychology, etc.) who will focus on specific logistic aspects of a common topic in the birth control field. Limited to 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 not given 1985-86

150C. Seminar: Feminist Perspectives of Birth Control—(Same as Feminist Studies 145.) In most societies where human fertility control is practiced the responsibility rests predominantly with women. Is this desirable and realistic, or should changes be instituted? Participants in the seminar will be free to choose specific aspects of this problem and to address themselves in the form of research papers to possible answers. Admission 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 may also be considered.

5 units, Win (Djerassi)

152. Pest Control—Technical and Policy Aspects—(Same as Chemistry 139.) Course focuses on technical, operational and especially policy issues in the field of pest control in agriculture and public health. Among topics to be considered will be the following: history of chemical pest control including chemical and biological rationales for these developments; present research on biorational alternatives with special emphasis on recent insect development 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. The first part of the course will consist of lectures on these and related problems and will be given in part with the aid of outside specialists. In the second part of the course task forces consisting of four to six students will investigate a particular pesticide problem using the type of multidisciplinary approach that is being employed in Human Biology 150 (see corresponding course description). Limited to 25 students with at least junior standing. Prerequisite: Chemistry 33 and/or 35 consent of instructor. Pre-registration prior to the Winter Quarter is essential, using special preregistration forms available from the Human Biology or Chemistry Department offices.

5 units, Win (Djerassi) not given 1985-86

154. The Biosocial Aspects of Cancer—(Same as Radiology 154.) This course is concerned with various aspects of cancer as a biological phenomenon and as a clinical, emotional and societal problem. The diagnosis and treatment of human neoplasms, their psychosocial and economic impact, and the organization of cancer care and research will be discussed. There will be detailed consideration of the specific control mechanisms operative in vitro and/or in vivo and delineation of their influence in an attempt to characterize the differences between normal and malignant growth. Prerequisite: Human Biology Core or equivalent.

4 units, Spr (Brown, Staff)

159. The Social Impact of the New Biology—Focus will be on the biological principles underlying genetic engineering (recombinant DNA, monoclonal antibodies, etc.) and exploration of social issues raised by this new technology. Recent discoveries about gene organization, revealed by recombinant DNA analysis; potential applications and biohazards associated with the expression of cloned foreign DNA in bacterial and mammalian cells; social role of the scientific community and the relationship between industry, academia, and public regulatory agencies; relationships between science and morality, with particular emphasis on genetic engineering. Enrollment limited to 20. Prerequisite: Human Biology Core or consent of instructor.

3 units, Aut (Erlich, Henry)

162. The Ecology of Mental Health Care—The course will examine environmental influences on the process of diagnosing and treating mental illness. Psychological, political, philosophical, and legal dimensions of problems will be considered. A variety of techniques will be used to examine the complex relationship between clinical experience and broader social and community mental health interventions. Prerequisite: Human Biology Core or consent of instructor. (Limited to 30 students.)

3 units, Win (Spiegel)
163. Psychobiology: Biological Basis of Psychiatric Disorders—Course focuses on recent developments in psychopharmacology, as they relate to the study of human mood disorders and schizophrenia. Current theories regarding the etiology of mental illness will be discussed. Relationship between hormones and human behavior will be examined. Emphasis in the course will be on student participation, using a seminar format. Limited to 24 senior students. Prerequisite: Human Biology core.

3 units, Aut (Berger)

165. Aspects of Recreational Drug Use—Examines the pharmacological and social consequences of licit and illicit drug use in a series of lectures and discussion sessions. Topics to be covered will include caffeine, tobacco, alcoholic beverages; and cannabis, sedatives, stimulants, opiates, and hallucinogens. Prerequisite: Human Biology Core or consent of instructor.

3 units, Win (Hollister, Staff)

166. Biosocial Aspects of Cardiovascular Disease—Examines epidemiological, biological and behavioral perspectives of cardiovascular disease. The assessment and modification of risk factors relating to cardiovascular disease will be reviewed. Detailed consideration of the potential for disease prevention, and an examination of the major preventive trials. Public policy ramifications will be discussed. Although the course will be primarily didactic in nature, students will be asked to monitor one of their own health risk behaviors and prepare reports of their experiences. Enrollment limited to 35. Prerequisites: Human Biology Core or consent of instructor.

4 units, Aut (Stanford Heart Disease Prevention Program Staff)

167. Neurochemical Aspects of Behavioral Disorders in Children—Course consists of a series of lectures which cover principles of neurotransmitter dynamics as they relate to our understanding of behavioral disorders in children. Current hypotheses concerning the neurochemical and neurobiologic basis of behavior disorders in children will be discussed. Clinical syndromes including infantile autism, childhood schizophrenia, hyperkinetic syndrome and childhood depression will be discussed in terms of disturbed neurochemical or neurophysiologic 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 1985-86

170. Laboratory in Behavioral Neurophysiology—(Same as Psychology 149.) Selected aspects of behavioral neurophysiology will be 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 will then be trained as a group in standard laboratory technique — manufacture of microelectrodes, surgical implantation, recording, behavioral training and histological reconstructions. They will then be divided into smaller groups to conduct a mini experiment. Prerequisites: Human Biology Core or Psychology 107. Class limited to 12.

4 units, Win (Thompson, Staff)

171. Adolescence—The changes that occur during adolescence will be viewed from a variety of perspectives including anthropological, sociological, psychological and psychiatric. Topics include physical and physiological development, cognitive growth, identity, peer group, generation gap, impact of the school, vocational development, among others. Prerequisite: Human Biology Core or Psychology 111, a basic statistics course.

4 units, Spr (Feldman)

172. Adulthood—Course will explore 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, aging. Lectures to be followed by discussion sections. Prerequisite: Human Biology Core or consent of instructor. Preregistration required.

4 units, Spr (Katchadourian)

173. Medical Ethics — (Same as Philosophy 78.) The application of systematic ethical theory to problems in medicine and biobehavioral research. Abortion, euthanasia, justice in the allocation of scarce medical resources. Justifications for experimentation on human subjects. Definitions of death, health, and disease.

5 units, Aut (Davidson)

176. Child, Family, and State—This course will serve as an introduction to a variety of family law issues examining how law distributes power and responsibility among the child, family, and the state. Explores in some detail the moral, philosophical and legal issues relating to newborns, child abuse and neglect; and problems relating to divorce, child custody, and child support; adolescent's-rights with emphasis on policy issues relating to teenage pregnancy, contraception, and abortion. Prerequisites:
study the current state of the art of critical care used in intensive care units. First, the class will investigate the intensive life support systems.

Practice and Moral Issues—This course will be used to determine the similarity of early groups to their modern counterparts. Prerequisite: Human Biology Core or consent of instructor.

4 units, Win (Hastorf) TTh 11-12:15

178. Problems of Aging—Aging will be discussed from the following points of view: (a) the prevention of premature aging of the respiratory and cardiovascular systems; (b) the cellular and immunological aspects of aging; (c) problems in mentation, psychosocial behavior and sexuality; (d) aging of various organ systems; (e) discussion of some of the current theories for the fundamental cause of aging of organisms; (f) discussion of comparative aspects of aging in various societies; (g) economics and public policy. This course will primarily emphasize the biological and medical aspects of aging.

There will be field trips to representative health care systems for the elderly and a discussion of drug use by the elderly. Prerequisite: Human Biology Core or consent of instructor.

4 units, Aut (Mbuen) not given 1985-86

183. Hunter-Gatherers in Archeological Perspective—(Same as Anthropology 187.) Encompasses problems of the organization and subsistence of band-level hunter-gatherers, especially as approached through archeological investigations. Survey of modern hunter-gatherers, providing background for prehistoric groups. The archeological record of Africa, Europe and the New World will provide examples of how archeological data is used to reconstruct the cultural systems of extinct hunter-gatherers. Artifact typology, settlement pattern analysis, modeling approaches, ethnoarchaeological methods, and other techniques will be used to determine the similarity of early groups to their modern counterparts. Prerequisite: Human Biology Core or consent of instructor.

5 units, Spr (Rick)

184. Intensive Life Support Systems: Present Practice and Moral Issues—This course will investigate the intensive life support systems used in intensive care units. First, the class will study the current state of the art of critical care medicine focusing on the function, need, productivity and national costs of intensive care units. Second, selected examples will be given of how our basic understanding of physiology can be translated through bioengineering life support systems. Third, 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” will be discussed. Students will have the opportunity to 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.) Study of the 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. Prerequisite: Human Biology Core or consent of instructor.

5 units (Rick)

189. Endocrines and Behavior—(Same as Psychology 189.) This course focuses on the influences of hormones on behavior. In particular, reproduction and reproductive behavior, maternal behavior, courtship and aggression will be discussed in terms of gonadal hormonal influences. Further, the influences of the pituitary-adrenal system on sensory processes, learning and memory will also be discussed. The neuroendocrine control of hormonal systems will be covered. Limited to 35. Prerequisite: Human Biology Core or consent of the instructor.

3 units, Win (Levine)

190. Advanced Neurochemistry Seminar—This seminar is intended for students with a prior background in neurochemistry. 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 of the course will be on critical reading and evaluation of current literature, and coherent presentation of topic material. Course 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)
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, (Morgan) by arrangement

198. Honors Program—This establishes an opportunity for in-depth research on an appropriate issue or problem by the student. It is necessary to choose a faculty sponsor who will be the advisor to the project and a faculty consultant who will act as second reader of the thesis; at least one of these two must be a member of the Human Biology faculty.

Minimum requirement for the Honors program work and the resultant thesis is the equivalent of 10 units of work; a maximum of 15 units may be awarded. Limited to majors in the Program in Human Biology who have completed the core courses, including the internship. Interested candidates should consult with advisors in the Program in Human Biology and Lorraine Morgan for explicit requirements for the Honors Program.

(Staff) by arrangement

199. Directed Reading/Special Projects—Independent study undertaken with faculty in the Program in Human Biology. Students should consult with Program’s Academic Secretary 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)
Lecturer: 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 IN HUMANITIES

Committee in Charge: Greta Anderson, Helen Brooks, Mark W. Edwards, Gregory Freidin, Edwin M. Good, Kurt Mueller-Vollmer, Paul Robinson Chairman

PURPOSE OF PROGRAM

The Humanities Honors Program aims to heighten the student’s sense of the relations among various humanistic disciplines, and to increase awareness of the basic humanistic values—intellectual, aesthetic, literary, historical, social, and ethical.

ADMISSION

Freshmen and sophomores interested in the Program should consult with the Chairman. The consultation should take place at the earliest opportunity, preferably during freshman year, and in every case before beginning the junior year.

The Program is open to majors in every field, and may be taken in addition to a departmental major.

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 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.

See the Time Schedule each quarter for changes in listings.

**COURSES**

61, 62, 63. Western Thought and Literature—An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.

61. The World of Classical Antiquity—Homer, Bible, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Epictetus, Virgil. (DR:1; three-quarter sequence)
   5 units, Aut (Edwards, McCall, Staff) MTW 11; two hours by arrangement

62. Christian and Secular Europe: Medieval and Renaissance St. Augustine, Boethius, Beowulf, Dante, More, Machiavelli, Luther, Galileo, Shakespeare, Milton. (DR:1; three-quarter sequence)
   5 units, Win (Evans, Staff) MTW 11; two hours by arrangement

63. From the Enlightenment to the Present — Voltaire, Rousseau, Mary Shelley, Flaubert, Marx, Darwin, Freud, T.S. Eliot. (DR:1; three-quarter sequence)
   5 units, Spr (Chace, 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 will be given preference in enrollment. (DR:3)
   5 units, Aut (Harcey) MW 1:15-3:05
   Spr (Ryan) MWTTh 1:15-3:05

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

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 (Robinson) TTh 2:15-4:05
   Win (Mueller-Vollmer)
   MW 2:15-4:05

192. The Arts and the Humanities.
   5 units, Win (Bender) MW 2:15-4:05

193. Philosophy and the Humanities.
   5 units, Aut (Cartwright, Davidson)
   MW 3:15-5:05
   Spr (Pruitt) TTh 3:15-5:05

194. Literature and the Humanities—The critical study of major texts; theory and practice of criticism.
   5 units, Spr (Lindenberger) TTh 1:15-3:05

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

200A, B, C. Honors Essay—A critical essay of about 15,000 words. Limited to Humanities Honors students.

200A. Submission of Essay Proposal—Preliminary planning and study. Approval of proposal by Committee in Charge required for credit and for continuation in the Program.
   2 units, (Staff) by arrangement

200B. Continued Study and Writing—Regular meetings with tutor. Prerequisite: 200A.
   5 units, (Staff) by arrangement

200C. Further Work on Essay—Regular meetings with tutor; submission of complete first draft to tutor by end of quarter. Prerequisite: 200B.
   5 units, (Staff) by arrangement

**GRADUATE PROGRAM IN HUMANITIES**

Committee in Charge: Russell A. Berman, Julius Moravcsik, Kurt Mueller-Vollmer, Phyllis Jestice, Sabine MacCormack, Chairman, Lawrence V. Ryan, Paul Robinson, 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 Committee in Charge, specifying the courses that will be used to fulfill the requirement of three seminars or proseminars in an established field.

The Committee in Charge of the Graduate Program in Humanities will approve each A.M. program on its own merits, to ensure that the proposed three seminars and proseminars in an established discipline are suited to the A.M. in Humanities. Since 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

275. Directed Reading.
2-5 units (Staff) by arrangement

301-306. The Western Traditions—Required of students in the Graduate Program in Humanities. Open to other graduate students only by consent of the Director.

301. The Greek Period.
4 units, Aut (MacCormack) TTh 4:15-6:05

302. The Roman Period.
4 units, Win (Raubitschek) TTh 4:15-6:05

303. The European Middle Ages.
4 units, Spr (Howard) TTh 4:15-6:05

304. From Renaissance and Reformation to the Enlightenment.
4 units, Win (Ryan) MW 4:15-6:05

305. From Enlightenment to Modernism: The 18th and 19th Centuries.
4 units, Aut (Todd) MW 4:15-6:05

306. The Twentieth Century—Normally taken after completion of 301-305.
4 units, Spr (R. Berman) MW 4:15-6:05

353. Theory of the Humanities and the Functions of the University—The history and character of the several branches of the humanities; their methods and approaches; their relation to one another and to the other human studies, especially the social sciences; the articulations of these disciplines in modern universities and learned societies; analysis of the humanities today at Stanford University and their relation to University policies, governance, and administration. Prerequisites: completion of two or more seminars in the sequence, Humanities 301-306, and advance consent of the instructor.
2 or 4 units, Aut (Mueller-Vollmer) by arrangement

INTERNATIONAL POLICY STUDIES

Committee in Charge: Elie Abel (Communication), Walter P. Falcon (Food Research), Stephen D. Krasner (Political Science), Robert E. Ward, Chairman (Center for Research in International Studies), 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) 497-3347.

GRADUATE PROGRAM

MASTER OF ARTS

The master of Arts Program in International Policy Studies in an interdisciplinary curriculum intended to provide both a liberal education 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., 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 TO THE PROGRAM

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 coterminous 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 Coterminous Degree Program,” the “Coterminous Degree Program Yearly Program Sheet” and the “Coterminous 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 university and a 3.4 undergraduate grade point average.

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 abovenoted “Information for Students . . .,” and set forth in tabular form in Appendix I of that document. They involve a total of 104-145 units of specified courses and seminars normally to be completed in the space of five years (four undergraduate and one graduate). Forty-five of these units must be completed while enrolled with graduate standing at Stanford. Twenty-five of the total 104-145 units must be in graduate level courses or seminars (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 "Application for Candidacy for the Degree of Master of Arts" before the last day of January for a degree to be received in June or by the last day of class of the quarter before in which the degree is to be conferred should this occur in the Summer, Autumn, or Winter quarters. When completing this form a student should list no more than 45 of his or her 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.

INTERNATIONAL RELATIONS

Committee in Charge: David Abernethy, (Political Science) (Co-Chairman), Jan Triska (Political Science) (Co-Chairman), Barton J. Bernstein (History), J. Martin Evans (English), Alexander L. George (Political Science), David Kennedy (History), Stephen Krasner (Political Science), Daniel Okimoto (Political Science), Scott Pearson (Food Research Institute), Mary Pratt (Spanish and Portuguese), John Gurley (Economics), Alex Inkeles (Sociology), Kennell Jackson, Jr. (History), Timothy Josling (Food Research Institute), Bruce F. Johnston (Food Research Institute), Hal Kahn (History), David M. Kennedy (History), Stephen D. Krasner (Political Science), John W. Lewis (Political Science), Mark Mancall (History), Gerald Meier (Graduate School of Business), Robert North (Political Science), Daniel Okimoto (Political Science), Robert Packenham (Political Science), Peter Paret (History), Scott Pearson (Food Research Institute), Mary Pratt (Spanish and Portuguese), Jack Bakove (History), Debraj Ray (Economics), Condoleezza Rice (Political Science), Philip Rhinelander (Philosophy), Richard Roberts (History), Paul Robinson (History), Renato Rosaldo (Anthropology), Joel Samoff (Education), Robert Staiger (Economics), Peter Stansky (History), Michael Sullivan (Art), Jan F. Triska (Political Science), Makoto Ueda (Asian Languages), Lyman Van Slyke (History), Jose Vinals (Economics), Wayne S. Vucinich (History), Robert E. Ward (Political Science), Hans N. Weiler (Political Science and Education), John D. Wirth (History), Sylvia Wynter (African and Afro-American Studies)

Visiting Affiliated Faculty: Amit Bhaduri (Economics), Gerhard Botz (History), Norman Davies (History), Jack S. Levy (Political Science), Alex Pravda (Political Science), Volker Rittberger (Political Science), Manfred Vogel (Religious Studies), Pan Yotopoulos (Food Research Institute)

OFFERINGS AND FACILITIES

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, "How Nations Deal with Each Other." After that, prospective majors will develop their own programs, in conjunction with advisors, as outlined below.
The degree of Bachelor of Arts in International Relations requires the completion of at least fifty units in the major, including both Political Science 35 (How Nations Deal with Each Other) 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. 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 consult with prospective honors advisors, choose the courses that will provide academic background in their area of inquiry, demonstrate an ability to conduct independent research, and write a formal thesis proposal. In their senior year, students write the thesis, 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. International Relations 196, Research and Writing Seminar on Scope and Methods in International Relations, is strongly recommended for all students planning to write an honors thesis.

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, particu-
larly 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, How Nations Deal With Each Other counts as a Cluster A course and is a required course for all majors.

CLUSTER A: POLITICAL HISTORICAL EMPHASIS

How Nations Deal With Each Other—(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.

5 units, Aut (Krasner)

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, Duus)


5 units, Spr (Abernethy)

Seminar: The Atomic Bomb in History—(Enroll in History 75S.)

5 units, Win (Bernstein)

Social Groups in Communist Systems—(Enroll in Political Science 112P.) Focuses on society and politics in communist regimes.

5 units, Win (Pravda)

The Politics of Development in Latin America—(Enroll in Political Science 113A.) Survey course on the principal political systems of Latin America. Deals with the three largest countries (Brazil, Mexico, Argentina) and the major socialist country (Cuba).

5 units, Aut (Packenham)

Crises and Crisis Management in Eastern Europe—(Enroll in Political Science 116P.) Focusing on the four major systemic crises there, from Hungary in 1956 to Poland in the 1980s, the dynamics of their development, their sources, and their repercussions.

5 units, Spr (Pravda)

Poland and Lithuania—(Enroll in History 118A.)

5 units, Win (Davies)

Southern Africa: Race, Class and Political Change—(Enroll in Political Science 118B.) Examines the political history of the region's ten countries, with special attention to relations among racial and ethnic groups. Analyzes diplomatic, economic and military interactions among these states and the impacts of movements, corporations, and international organizations based outside the region. Particular attention to domestic politics and foreign policy of South Africa.

5 units, Spr (Abernethy)

Socialism in Latin America—(Enroll in Political Science 119.) An examination of socialist
experiences in Latin America. The interrelationships between political, economic, and cultural change will be stressed. Special attention given to the historical and international contexts relevant in each case. (This course will count for either Cluster A or C.)

5 units, Win (Fagen)

Aristocracy and Absolutism: The International Relations of Eastern Europe, 1300-1800—(Enroll in History 119.) Examines institutions and cultures of early-modern East Central Europe (Bohemia, Hungary, Poland, Ukraine, Belorussia); 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. Analyzes East European culture and society (feudalism, nobilities, serfdom, urbanization, Renaissance, Reformation) as part of a European continuum.

5 units (Kollmann) given 1986-87

Soviet Foreign Policy—(Enroll in History 122B or Political Science 136.) Foreign and domestic determinants of policy; intentions and capabilities; continuity and change since 1917; institutions and personnel; war and peace; perceptions, priorities and attitudes; alternative futures.

5 units, Win (Dallin)

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. (This course will count for either Cluster A or C.)

5 units (Packenham) given 1986-87

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 policymaking processes, their system maintenance and adaptation. Attention will also be paid to Eastern Europe as a region in world politics.

5 units, Aut (Triska)

Eastern Europe in the 20th Century—(Enroll in History 126A.)

5 units, Aut (Davies)

The Evolution of European Fascist Movements—(Enroll in Political Science 126G or History 134C.) Beginning with societal preconditions and precursor phenomena in Austria and Germany, course emphasizes the Italian and German models of fascism which spread in two waves over many European countries, ending up with Hitler’s seizure of power.

5 units, Win (Bots)

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, Aut (Triska) given 1986-87

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 will be one of intellectual exchange. Outstanding scholars will lecture, but only to provide a common underpinning for individual comprehension and mutual discussions.

3 units, Win (Dornbusch, Drekmeier, Moses, Ross)

U.S. and Soviet National Security Policies: The Responsibilities of Empire in the Nuclear Age—(Enroll in Political Science 133R.) Examines the formulation and execution of national security policy in the United States and the U.S.S.R. Special attention is devoted to the 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 formulation and conduct are used to 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, Rice)

Problems and Prospects of European Security—(Enroll in Political Science 134R.) Course seeks to give an overview of major issues of European security, i.e. problems related to crisis and war prevention as well as to political autonomy and socio-economic welfare in Europe. Cold-war and detente aspects of East-West conflict in Europe; interaction among European actors and the superpowers regarding deterrence and arms control (nuclear and conventional); trade, economic cooperation, and technology transfer; transnational communication and contacts; and other issues.

5 units, Win (Rittberger)

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. Political, technological, and conceptual problems of national security policies and arms control are stressed. Time is devoted to analyses of strategic military doctrines and to negotiations on strategic and regional military forces, including SALTB, START, INF, and space-based weapons. The course is taught by an interdisciplinary faculty.

5 units, Win (Lewis, Blacker)

Seminar in Arms Control—(Enroll in Political Science 138B.) Course focusing on both 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, Blacker)

Topics in Arms Control—(Enroll in Political Science 138D.) Research and tutorial course, supervised by members of the arms control faculty. 138A and B are prerequisites.

5 units, Aut (Lewis, Blacker)

Seminar: Accidental or Unintentional Nuclear War—(Enroll in Political Science 138E.) Course examines the likelihood of nuclear war occurring through accident, miscalculation, misunderstanding, or inadvertence. Embodies 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. Explores 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, Spr (Lewis, Blacker)

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)

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 topics such as: 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. Desirable prerequisite: Political Science 130 or equivalent.

5 units (Triska) given 1987-88

Seminar: The Causes of War—(Enroll in Political Science 142L.) In spite of the increasing destructiveness of weapons systems, increasing economic interdependence, growing ecological threats, growing belief that war is no longer a legitimate instrument of foreign policy, and other fundamental changes in the international system, military conflict has persisted in relations among states. The objective of the seminar is to gain a better understanding of the conditions, processes, and events leading to the outbreak and escalation of war. Open to undergraduates who have taken P.S. 35 or its equivalent and to graduate students.

5 units, Aut (Levy)

Seminar: Foreign Policy Decision-making—(Enroll in Political Science 143L.) Seminar will examine the processes through which foreign policy is formulated and implemented. A critical analysis will be made of several alternative models of policymaking including the "rational-uneitary actor," organizational process, and bureaucratic politics, psychological and socio-psychological models. Attention will also be given to the impact on policy of different officials, agencies, and social groups. While the seminar focuses on American foreign policy, a broad theoretical framework is employed to facilitate study of comparative foreign policy. Open to undergraduates who have taken P.S. 35 or its equivalent and to graduate students.

5 units, Spr (Levy)

American Foreign Policy—(Enroll in Political Science 145.) 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 examination of modes of foreign policy analysis and the particular internal and external constraints facing American central decision-makers. Topics covered 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. (This course fulfills the American foreign policy requirement.) Prerequisite: Political Science 35 or its equivalent.

5 units, Aut (Goldstein)

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. Explores the ways in which the competition between East and West affects states and
regions in the Third World as well as the constraints upon the Soviet behavior posed by, and Soviet opportunities in, states and regions in the Third World. Emphasis is on contemporary Soviet foreign policy.

5 units, Spr (Triska)

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)

Social Structure of World Society—(Enroll in Sociology 152 or Education 231.) A sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socio-economic stratification of the world population, and education, science and technology as global systems. (This course will count for either Cluster A or C.)

5 units (Inkeles) given 1986-87

Nomad Empires of Inner Asia—(Enroll in Asian Languages 152.) 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 interchange 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.

4-5 units, Spr (Dien)

America Since 1945—(Enroll in History 172A.) An analysis of America that emphasizes foreign policy and politics, and deals with the intellectual history, social themes, and the political economy. (This course fulfills the American foreign policy requirement.)

4-5 units, Win (Bernstein)

History of Canada—(Enroll in History 175A.) Survey, with emphasis since Confederation in 1867, of major themes such as the frontier and nation-building; government role in the economy; the federal system and the regions; Canada's role as a middle-range power with emphasis on the Western Hemisphere and membership in international organizations.

5 units, Spr (Wirth)

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, Win (Abel)

Spanish America to World War I—(Enroll in History 176.) From the Spanish conquest to the apogee of economic and cultural dependency; the relationship between colonial developments, political independence, and modern conditions and problems.

5 units, Spr (Bowser)

The Middle East, 570-1718—(Enroll in History 187A.) The Middle East from the rise of Islam until the decline of Ottoman absolutism.

5 units, Aut (Beinin)

The Modern Middle East, 1718 to the Present—(Enroll in History 187B.) The Middle East from the emergence of regional Arab entities and the commercial penetration of Europe to the present.

5 units, Win (Beinin)

Colloquium: Soviet Nationalities—(Enroll in History 222A.)

5 units, Win (Vucinich)

Colloquium: Nationalism and Communism in Eastern Europe—(Enroll in History 224.)

5 units, Win (Vucinich)

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 restless, frustrated social forces and obsolete political structures in Eastern Europe and in Central America and the Caribbean. Focus will be on the dilemma of the two regional powers of how to deal with social change without harming their regional interests.

228A. 5 units, Win (Triska, Packenham)

228B. 5 units, Spr (Triska)

Seminar: The Two Germanys in International Affairs—(Enroll in Political Science 234R.) Comparison of the foreign policies of the Federal Republic of Germany (FRG) and German Democratic Republic (GDR). Topics include the division of Germany after 1945; internal and external factors shaping foreign policy; role of FRG and GDR in intra- and inter-bloc relations; relations with the Third World; participation in international organizations.

5 units, Spr (Rittberger)

Seminar: Austria’s Heritage to the Third Reich—(Enroll in History 239B or Political

5 units, Spr (Botz)

Research Seminar: International Conflict—(Enroll in Political Science 242L.) A comprehensive review of theory and empirical research on international conflict: conceptual analysis of different types of war; historical trends; causes of war; analysis of strategic deterrence, limited and sub-limited war; coercive diplomacy and bargaining. Open to graduate students and undergraduates of advanced standing. Admission by consent of instructor. Seminar will meet twice a week.

5 units, Win (Levy) by arrangement

Seminar: International Relations Theory—(Enroll in Political Science 243.) Examines and compares both traditional and some of the more contemporary approaches to international relations theory from an interdisciplinary viewpoint. Realists, idealists, behavioralists, environmentalists, socio-cultural evolutionists, futurists, and others.

5 units, Aut (Goldstein)

Seminar: American Foreign Policy—(Enroll in Political Science 245J.) This is a graduate research seminar in American foreign policy. Emphasis will be on alternative explanations for major tenets of American policy which explain in particular the period between 1950 and 1968. Undergraduates who have taken P.S. 145J will be admitted with the consent of the instructor.

5 units, Aut (Goldstein)


5 units, Win (Roberts)

Colloquium: America in Vietnam—(Enroll in History 284.)

5 units, Spr (Rakove)

Seminar: U.S. Foreign Policy in the World War II Era—(Enroll in History 269S.)

5 units, Win (Kennedy)

Colloquium: Mexico as Intellectual Creation—(Enroll in History 279A.) Mexican self-perception as a response to internal and external influences and its impact on historical events.

5 units, Win (Bowser)

Colloquium: Palestine and the Arab-Israeli Conflict—(Enroll in History 288.) Discussion of the issues involved in the conflict from its origins in the late nineteenth century to the present will be rooted in an effort to understand the modes of argumentation of the various participants.

5 units, Aut (Beinin)

Colloquium: Japan and the United States—(Enroll in History 290.) Examines several key episodes in relations between Japan and the United States: the opening of Japan, the dispute over Japanese immigration to the United States, the outbreak of war between the two countries, and the postwar establishment of the mutual security treaty. Attention will be paid to political, economic, and cultural factors influencing these events.

5 units, Aut (Duus)

Colloquium: Visions of Utopia: Travellers to China—(Enroll in History 298A.) This course may count for either cluster A or B.

5 units, Win (Kahn)

CLUSTER B: HUMANITIES

Emphasis

Zen Buddhism—(Enroll in Religious Studies 18.) A survey course of the history and development of ideas represented in these two forms of Buddhism in China and Japan respectively. In studying and comparing Chan and Zen, emphasis will be given to the cultural transmission of Buddhism from India to China and then from China to Japan. The role of religion as an agent for change will be explored.

3-4 units, Spr (Bielefeldt)

Christianity—(Enroll in Religious Studies 24A.) Ten historic types of Christian religions: martyr and monk, philosopher and prelate, mystic and theologian, pietist and moralist, apologist and activist. The main cultural crises and intercultural transactions in Europe that elicited these life-styles. Christianity as transmitter and transformer of Palestenian, Hellenistic, Germanic, Holy Roman, territorial, and modern national culture.

3 units, Aut (Staff)

Islam—(Enroll in Religious Studies 27.)

3 units, Berman given 1986-87

Religions of Abraham—(Enroll in Religious Studies 29.)

3 units, Berman given 1986-87

Culture, Politics, and Society in Latin America—(Enroll in History 80 or Latin American Studies 80 or 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. This is a basic introduction
to Latin American courses within several departments.

5 units, Spr (Collier, Wirth)

Japanese-Western Literary and Cultural Interactions—(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, Win (Ueda)

Core Seminar: Western Culture and the Black Diaspora—The Semiotics of Self and Other—(Enroll in African and Afro-American Studies 113.) This seminar will use narrative analyses of selected texts in order to examine the significations accorded Africa, the "Negro" and the Black Diaspora in the signification system of Western Culture. It will analyze the deconstruction of these significations both by some schools of modern Western scholarship and by counter-discourse of emancipatory movements in the Diaspora itself.

5 units, Win (Wynter)

Paris and New York: Transatlantic Exchange in Early Modernism—(Enroll in Art 130B.) Study of artistic and cultural exchange between Paris and New York in the early decades of the 20th century. The Franco-American circles around Gertrude Stein, Alfred Stieglitz and Walter Arensberg will be discussed, as well as movements such as Cubism, Expressionism and Dadaism.

4 units, Win (W. Corn)

Political and Ethical Aspects of Foreign Aid—(Enroll in Political Science 132D.) Uses general and case study materials to examine characteristics of bilateral and multilateral "official development assistance"; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems raised in the allocation, monitoring, and evaluation of development assistance. Special attention paid to international disaster relief operations. (This course may count for either Cluster B or C.)

5 units, Win (Abernethy)

European Thought in the 19th Century—(Enroll in History 136A.) Great thinkers and major movements of the 19th century, particularly romanticism, liberalism, Marxism and the origins of modern irrationalism. Seminal writings of Burke, Mill, Marx, Ruskin and Nietzsche.

5 units, Spr (Robinson)

Judaism in the Era of Emancipation—(Enroll in Religious Studies 137.) Description of the process of Jewish Emancipation starting in the 19th century, evaluating the benefits and challenges it presented, and analyzing the crises and problems which it precipitated. Consideration of the main "responses" which the process elicited within Judaism in the scholarship and cultural arenas.

5 units, Spr (Vogel)

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 will concentrate on those Spanish-speaking countries with a sizeable Black population, particularly Colombia and Cuba. Students will also be introduced to other, less-known Afro-Hispanic cultures. Emphasis will be 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, Spr (Wynter)

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 eighteenth century to the middle of the twentieth.

5 units, Spr (Evans) given 1986-87

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. No prerequisites.

4 units, (Samoff) given 1986-87

The Caribbean Americas: An Introduction to Their Literature, Thought and Cultural Worlds—(Enroll in African and Afro-American Studies 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)

Colloquium: Visions of Utopia—Travellers to China—(Enroll in History 298A.) Prerequisite: At least one course in Chinese history. This course may count for either Cluster A or B.

5 units, Win (Kahn)

Western Views of the Non-West Through the Literature of Travel—(Enroll in Spanish and Portuguese.) Study of 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 "re-opening" of China, and works by contemporary
travelers such as Graham Greene, V. Naipaul, S. Naipaul, Paul Theroux, Isak Dinesen and others. No prerequisites.

3-5 units, Win (Pratt)

CLUSTER C: POLITICAL-ECONOMIC ISSUES AND POLICY ANALYSIS

The World Food Economy—(Enroll in Food Research 103 or Economics 106.) Examines the interrelationship 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. Focus 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 related to the design of rural development strategies. Prerequisite: Economics 1 or equivalent understanding of economics.

3 units, Spr (Johnston)

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. This course examines the process of economic development in an international perspective. The focal point is the experience of developing countries since World War II. This experience is discussed with reference to the historical perspective of both developed and less developed countries, and it is 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. Prerequisite: Economics 51 and 52.

5 units, Win (Bhaduri)


5 units, Aut (Samoff)

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 used as a point of departure to illustrate the systematic components of the experience of economic development and those of population growth. The implications from these studies 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.) An examination of socialist experiences in Latin America. The interrelationships between political, economic, and cultural change will be stressed. Special attention given to the historical and international contexts relevant in each case. (This course will count for either Cluster A or C.)

5 units, Win (Fagen)

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 (Gurley) given 1986-87

The Theory of Capitalist Development—(Enroll in Economics 122.) The theoretical and historical analysis of the process of capitalist development: the emergence of the system of capitalist economic relations of exchange and production, the ongoing reproduction and expansion of that system, the determinants and limits of its expansion, and the different stages in the overall process of development. Various theoretical approaches to the analysis are examined, with emphasis on the Marxian theory and the recent elaborations and extensions of that theory. Reference is made to relevant historical case studies. Prerequisites: Economics 51 and 52.

5 units, Aut (Harris)

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
transitional. Particular attention to the analysis of interdependence among countries with different economic and social structures such as the U.S., Mexico, and Central America. Prerequisites: Economics 51 and 52.

5 units, Spr (Reynolds)

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. (This course will count for either Cluster A or C.)

5 units, Spr (Packenham) given 1986-87

Seminar: Development and the International System— (Enroll in Political Science 125F.) Participants will address a number of key issues raised by external constraints and influences on development in the Third World. Emphasis is on the interaction between national and international factors. Prerequisite: Political Science 35. Limited enrollment.

5 units, Win (Fagen)

Political and Ethical Aspects of Foreign Aid— (Enroll in Political Science 132D.) Uses general and case study materials to examine characteristics of bilateral and multilateral "official development assistance"; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems raised in the allocation, monitoring, and evaluation of development assistance. Special attention paid to international disaster relief operations. (This course may count for either Cluster B or C.)

5 units, Win (Abernethy)

Technology Transfer: Silicon Valley to Europe—(Enroll in VTSS 135.) Transfer of electronics technology from the United States to Europe, using for case studies the Silicon Valley, the major source of electronics technology and investment in Europe, and Ireland, the most rapidly expanding European location for the electronics industry. Examination of the role of electronics manufacturing in the development strategies of underdeveloped regions of Europe, including analysis of its social, cultural, political, environmental, and economic impact.

4 units, Spr (Jordan)

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)

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 will be discussed in the context of general economic, political and institutional development. Prerequisite: Economics 51.

3 units, Win (Josling)

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 participation in this course sequence.

1-4 units each quarter Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel, Textor)

Social Structure of World Society—(Enroll in Sociology 152 or Education 231.) A sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socio-economic stratification of the world population, and education, science and technology as global systems. (This course will count for either Cluster A or C.)

5 units (Inkeles) given 1986-87

International Economics I—(Enroll in Economics 165.) Comparative advantage in production and trade among nations, the international monetary mechanism; domestic monetary, fiscal and exchange rate policies and their relationship to foreign trade. Economics 1, 51 and 52 required.

5 units, Aut (Staff)

5 units, Spr (Staiger)
International Trade and Investment Policy—(Enroll in Economics 166 or Food Research 106.) 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 or consent of instructor.

5 units, Spr (Pearson)


215A. 5 units, Aut (Okimoto)
215B. 5 units, Win (Okimoto)

Seminar: International Political Economy—(Enroll in Political Science 241A,B.) Examines 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 readings. 241B provides the opportunity to complete a research paper. Class sessions will be based on work being conducted by students and the lecturer.

241A. 5 units, Win (Krasner)
241B. 5 units, Spr (Krasner)

Seminar: Science and Technology in the International System—(Enroll in Political Science 247R.) Examines the role of science and technology in the development of early industrializing countries and in relations among them; aspects of the scientific-technological dependence and transformation of developing countries; science and technology in North-South negotiations about a new international economic order; and international political-economic consequences of civilian and military applications of advanced technologies.

5 units, Spr (Rittberger)

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. 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.

4 units, Spr (Wetl) given 1986-87

Communication and Development—(Enroll in Communication 251.) A critical review of the literature on the causes of underdevelopment, the nature of development planning, and the potential and practice of mass media in Third World countries as a tool of transformation.

3-5 units, Aut (Staff)

International Agricultural Policy—(Enroll 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 regulation and to the role of international institutions. Prerequisite: Economics 51, 52 or equivalent.

5 units (Josling) given 1986-87

RESEARCH AND WRITING SEMINAR

196. Research and Writing Seminar on Scope and Methods in International Relations—Recommended for majors who wish to improve their research and writing skills, especially for current and future honors theses candidates. Focus is on scope, methods, concepts, and concerns of International Relations. Emphasis on the fundamentals of research design. Examines major types of international relations analysis as well as of research methods associated with particular research problems. Critiques major modes of analysis in the light of theoretical approaches selected from the relevant literature. Selected class sessions are based on research work presently being done by the International Relations Program instructors.

3 units, Aut (Staff)

INDEPENDENT STUDY IN INTERNATIONAL RELATIONS

197. Directed Study in International Relations*.

3-5 units, any quarter (Staff)

198A,B,C. Honors Thesis—Open only to declared I.R. majors with approved honors thesis proposals. *

3-5 units, any quarter (Staff)

*(Obtain section number from International Relations Office.)
IR OVERSEAS COURSES
FOR 1985/86

More detailed descriptions of courses listed may be found in the Stanford University Bulletin for Overseas Studies, 1985/86.

BERLIN

The German Federal Republic in the International System—(Enroll in Political Science 140X) Cluster A.
4-5 units, Win (Gortemaker)

FLORENCE

Mediterranean Problems—(Enroll in Overseas Studies 180.) Cluster A.
5 units, Aut (Giotine)

U.S. and Western Europe after WW II—(Enroll in Political Science 121X.) Cluster A.
4-5 units, Win (Mammarella)

OXFORD

From Colonial Economics to Developmental Economics—(Enroll in Overseas Studies/Oxford 134X.) Cluster C.
5 units, Aut (Meier)

Britain, America and the World Economy—(Enroll in Overseas Studies/Oxford 168X.) Cluster C.
5 units, Aut (Meier)

5 units, Win (Holmes)

British Economic Policy and European Integration—(Enroll in Economics 115X.) Cluster C.
4-5 units, Spr (Crafts)

The British Empire and Commonwealth—(Enroll in International Relations 132.) Cluster A.
4-5 units, Spr (Rizvi)

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 Political Science 140.)
5 units, Win (Billard)

VIENNA

Eastern Europe Since 1945—(Enroll in Political Science 130X.) Cluster A.
4 units, Win (Heinrich)

Poland and Eastern Europe—(Enroll in Political Science 113X.) Cluster A.
4-5 units, Spr (Heinrich)

LANGUAGE LABORATORIES

PARIS

Islam, Imperialism, and Orientalism—(Enroll in Religious Studies 27.) Cluster B.
3-5 units, Aut (Berman)

Director: Andrew Lisac

The Language Laboratory program is an academic support service designed to provide faculty and students with a variety of resources outside the classroom which enhance the acquisition of foreign languages. Resources range from foreign language dictionaries to the most sophisticated video immersion programs.

Situated on the first floor of the Meyer Library building, the laboratories comprise four rooms equipped with drill and practice cassette recorders which students may use for intensive classroom preparation. 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
Cebuano
Chad
Cherokee
Chinese
Cree

Czech
Danish
Dutch
English
Estonian
Finnish
French
Fula
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 disc-
pline, 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 IN LATIN AMERICAN STUDIES 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 focussing 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

* First or second year language courses may not be counted toward these 25 units. Only 5 units of Pass/No-Credit work may be counted.
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 basically Latin American in content. Courses are distributed as follows:
   a) Core Seminar (LAS 250, 251, 252)—an interdisciplinary course required of all A.M. candidates in Latin American Studies. Fifteen units; 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 co-
A 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. This is a basic introduction to the Latin American courses within several departments. (DR:5*)

5 units, Spr (Collier, Wirth) MTWTh 9

133/233. Urbanism and Planning in Latin America—(Same as Urban Studies 133.) Seminar examining phenomenon and problems of rapid urban growth and decentralization in important Third World urban centers including Mexico City, Sao Paulo and Rio de Janeiro. Surveys problems in housing population, social services, transportation and infrastructure. Analyzes planning strategies applied on metropolitan and national levels. Topics include economies and dis-economies of agglomeration, intersectoral competition for urban investment and planning and administrative jurisdiction.

4 units, Win (Campbell) T 3:15-5:05

148/248. Gender and Social Inequality in Latin America—(Same as Sociology 148/249.) Proseminar, exploring recent research and theoretical work concerning dominance, gender, and their interrelationships in Latin America. The Proseminar will meet twice a week for guided discussion of pertinent readings. Participants wishing to meet additionally to develop and discuss research of their own should enroll in 260.

3-8 units, Win (Boldan)

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

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, (Reynolds) Th 3:15-5:05

Win, Spr (G. Collier) M 1:15-3:05

260. Latin American Bibliography—Introduction to research use of Stanford library collections on Latin American topics. Open to all graduate students.

3 units, Aut (Breedlove) Th 12-1:15
LINGUISTICS

Emeritus: (Professor) Joseph H. Greenberg
Chairman: Elizabeth C. Traugott
Professors: Joan Bresnan, Clara N. Bush, Eve V. Clark, Charles A. Ferguson, Paul Kiparsky, P. Stanley Peters (on leave 1985-86), Elizabeth C. Traugott
Associate Professors: Dorothy A. Huntington (by courtesy), William R. Leben, Ivan A. Sag, Thomas Wasow (on leave 1985-86), Terry Winograd
Assistant Professors: Marilyn Ford, William J. Poser (on leave Spring), John Rickford
Affiliated Faculty: Jon Barwise, Herbert H. Clark, James A. Fox, Shirley Brice Heath, Kung-Yi Kao, Mary L. Pratt, Orrin W. Robinson, III, Richard D. Schupbach
Senior Lecturers: Beverley McChesney, Frieda N. Politzer
Consulting Professors: Lauri Karttunen, Martin Kay
Consulting Associate Professors: Philip Cohen, Ronald M. Kaplan
Acting Assistant Professor: Peter Sells (Autumn)
Visiting Emeritus Professor: Dwight Bolinger
Visiting Professor: Arnold Zwicky (Winter)
Visiting Associate Professor: Robert Van Valin
Consulting Assistant Professors: Annie Zaenen
ENGLISH FOR FOREIGN STUDENTS:
Director: Beverley McChesney
Senior Lecturers: Beverley McChesney, Frieda N. Politzer
Lecturer: Michele Fisher
Special Language Program Coordinator: Rosemary Henze
Lecturer in Arabic: Khalil Barhoum
Lecturer in Hebrew: Eilon Naveh

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 is 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, formal (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 consist 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 as both 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.

1. Courses—A total of 45 units is required, including 120L, 130L, and either 105L, 110L, or 110L (100-level course 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 linguistics.
b) **Formal Linguistics**—Formal Linguistics 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 105L, 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.

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 either 105L or 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 either 105L or 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).

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 either 105L or 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. 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 will serve on the candidate’s University oral examination committee and may request that up to one-third of the examination be devoted to the minor subject.

DOCTOR OF PHILOSOPHY

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, socio-
   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).

GRADUATE PROGRAM IN 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 will receive a special designation in Linguistics and the Cognitive Science requirements will receive a special designation.
Cognitive Science along with the Ph.D. in Linguistics. To receive this field designation, students must complete 30 units of approved courses, 18 of which must be taken in two disciplines outside of Linguistics. The list of approved courses can be obtained from the Cognitive Science program located in the Psychology Department.

FOREIGN LANGUAGES

The Department of Linguistics administers a number of different foreign language programs, including African Languages, Mideastern Languages, the Special Language Program and the Program in English as a Foreign Language. Course offerings for each of these language programs are presented immediately following the linguistics courses in this section of the bulletin.

LINGUISTICS COURSES

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
- 45-54 Language Change, Language and Culture
- 40-49 Language Acquisition and Psycholinguistics
- 50-59 Sociolinguistics
- 60-69 Language Change, Language and Culture
- 70-84 Linguistic Analysis of a Language
- 85-94 Methods
- 95-99 Directed Work, Theses, Dissertations

1. Introduction to Linguistics—A general introduction to the nature of human language and the methods of modern linguistics. Topics include: comparisons between human language and animal communication, how children acquire language, non-verbal communication, language change, universals, the relationship between language and society, and the application of linguistic science to social, educational, and political problems. (DR:4)
   4 units, Aut (Ferguson, Rickford)
   Win (Clark, Sag)

5. Biology and Evolution of Language—(Same as Anthropology 5, Human Biology 113.) 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. No prerequisites.
   5 units, Aut (Fox)

25L. Mathematics for the Study of Language — Introduction to mathematical methods and results relevant to the analysis of natural language syntax and semantics. Topics will include elementary logic, set theory, and the Chomsky hierarchy of grammars. No prerequisites.
   (DR:6)

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. No prerequisites. Computer background not required. (DR:4) or (DR:8)
   5 units, Spr (Winograd)

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)

   (DR:5)
   4 units, Aut (Heath)

51L. Language Minorities in Modern Nations—Social, historical, and linguistic aspects of language minorities in a number of nations, comparing patterns of language use and national language policies. Deals with the rise of language nationalism in Europe, the spread of English and other languages of wider communication, and the world-wide resurgence of ethnicity and language loyalty.
   alternate years, given 1986-87
60L. Language, Past and Present—Change and diversity as the natural state of language. Language as a window on prehistory, exemplified by the reconstruction of Indo-European culture. The techniques of comparative historical linguistics, and why they work. Explaining language change; the role of structure, acquisition, production, and perception; implications for rational language policy in multilingual societies.
4 units, Aut (Kiparsky)

70L. The Structure of English Words—Course is devoted to analyzing English vocabulary words in order to determine their meanings. There are 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, Win (Leben)

71L. Linguistics and Literature—(Same as English 101.) An introduction to English linguistics and applications of linguistic concepts to literary analysis. Emphasis on the phonological, syntactic, semantic, and pragmatic structure of English, with some attention to regional and social dialects.
5 units, Win (Monroe)

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’) will also be considered, and its educational implications will be 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)
3 units, Win (Robinson)

80L. Indigenous Languages of North and South America—(Same as Anthropology 172.) Survey of American Indian languages, their history, classification, structure, and possible Old World relationships. The relationship between American Indian languages and the development of anthropological and linguistic theory. Native American writing systems. Problems of language, culture and world view.
5 units, Aut (Fox)

85L. 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. Course 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.
I or more units, any quarter
(Staff) by arrangement

100L. Typology and Universals of Language— (Same as Anthropology 174.) Characteristics of human language, as suggested by structural comparisons of the world’s languages. Basic grammatical categories, preferred sound systems; methods of description and classification. Implications of cross-linguistic comparisons for language history, language learning, and language disorder. Prerequisite: an introductory linguistics course.
4 units, Win (Ferguson)

105L. Phonetics—(Doctoral candidates in Linguistics enroll in 205.) Introduction to phonetics with emphasis on aspects of phonetics of more general scientific interest and 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. No prerequisites.
4 units, Aut (Poser)

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. No prerequisites; designed for students desiring a broad background in the field; others who need more specialization in phonetics should register in 105.
4 units, Win (Poser)
115L. Speech Perception—(Same as Hearing and Speech Sciences 231.) Perceptual and physiological correlates of the acoustic constituents of speech. Prerequisite: course in phonetics, Linguistics 105 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) by arrangement

120L. Introduction to Syntax—(Same as 230.) Introduction to syntactic theory. The course deals with 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, Aut (Sells)

120L. Introduction to Semantics and Pragmatics—Meaning in language from the perspectives of speaker, sentence, and word, with an analysis of the implications of each perspective for theories about linguistic meaning. 4 units, Win (Clark)

125L. Basic Concepts of Mathematical Logic—(Same as 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, Aut (Barwise, Etchemendy)

126L. First-order Logic—(Same as 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) will be discussed and applied. Prerequisite: 57 and basic knowledge of set theory for students with no mathematics or computer science background. 4 units, Win (Staff)

127L. Language and Cognition—(Same as Philosophy 181.) Issues in the philosophy of language, with special reference to the views of Frege, Russell, and Wittgenstein and problems connected with giving a formal semantics for natural language. Prerequisite: 80 or consent of instructor. (DR:4) 4 units, Win (Moravcsik)

131L. Meaning and Experience—(Same as 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 to be discussed will include W. V. Quine and Donald Davidson. The lectures will presuppose acquaintance with the philosophy of language. 4 units, Spr, Sum (Follesdal)

140L. Language and Thought—(Same as Psychology 146.) Survey of psycholinguistics, including speech perception, sentence structure and sentence processing, language acquisition by children, and the biological bases of language. Consideration of the relationship between constraints on the structure of natural languages and the processes by which they are produced, comprehended, and acquired. (DR:4) 4 units Aut (H. Clark)

145L. Language and Thought—The study of language in society. Social dialects, awareness of social and ethnic differences in speech. Prestige and stigma associated with different ways of speaking. The aim of this course is to train students in the systematic observation of speech; there will be some practice in participant-observation, interviewing and recording of conversations. Prerequisite: 10 or its equivalent. alternate years, given 1986-87

145L. Introduction to Sociolinguistics—The study of language in society. Social dialects, awareness of social and ethnic differences in speech. Prestige and stigma associated with different ways of speaking. The aim of this course is to train students in the systematic observation of speech; there will be some practice in participant-observation, interviewing and recording of conversations. Prerequisite: 10 or its equivalent. alternate years, given 1986-87

145L. Language and Thought—The study of language in society. Social dialects, awareness of social and ethnic differences in speech. Prestige and stigma associated with different ways of speaking. The aim of this course is to train students in the systematic observation of speech; there will be some practice in participant-observation, interviewing and recording of conversations. Prerequisite: 10 or its equivalent. alternate years, given 1986-87

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 of this course is to train students in the systematic observation of speech; there will be some practice in participant-observation, interviewing and recording of conversations. Prerequisite: 10 or its equivalent. alternate years, given 1986-87

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 of this course is to train students in the systematic observation of speech; there will be some practice in participant-observation, interviewing and recording of conversations. Prerequisite: 10 or its equivalent. alternate years, given 1986-87

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 of this course is to train students in the systematic observation of speech; there will be some practice in participant-observation, interviewing and recording of conversations. Prerequisite: 10 or its equivalent. alternate years, given 1986-87

151L. Pidgins and Creoles—(Same as Anthropology 177.) 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)

155L. Multilingualism—Linguistic, social, and psychological dimensions of language contact and multilingualism. Topics include interlanguage phenomena, language convergence and divergence, and attitudes toward language. Prerequisite: an introductory course in linguistics. 4 units, Spr (Ferguson)

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. 3-5 units, Aut (Robinson)
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. (DR:4) alternate years, given 1986-87

200L A,B,C. Foundations of Linguistic Theory —Readings in theories that have shaped twentieth century linguistics; comparison of analyses of selected categories across languages. given 1986-87

202L. History of Linguistics—The historical development of linguistic theory and method with major emphasis on the Western tradition up to the present. alternate years, given 1986-87

205L. Phonetics—(Same as 105.) 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)

207L. Morphology—How morphology fits into the lexicon and how the lexicon fits into the grammar. Inflection and word-formation: blocking, productivity, analogy. Morphological categories. Interaction of morphology with phonology within the lexicon: level-ordering, prosodic morphology. The treatment of postlexical morphology. Review of English morphology and analysis of representative material from languages with richer morphologies. 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. alternate years, given 1986-87


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)

215L. Instrumental Phonetics—(Same as Hearing and Speech Sciences 220.) Techniques of instrumental research in speech perception and production. Theory and instrumentation for analysis and manipulation of speech signals. Laboratory course. Given any quarter. Prerequisite: consent of instructor. 2-4 units, (Huntington) by arrangement

216L. Experimental Phonetics—(Same as Hearing and Speech Sciences 310.) 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. 4 units, any quarter (Huntington) by arrangement

220L. Syntactic Theory I—Intensive introduction to syntactic argumentation through detailed 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—Continuation of Syntactic Theory I. Theory to be discussed 1985-86: Generalized Phrase Structure Grammar. 4 units, Win (Sag)

222L. Issues in Syntactic Theory—Exploration of central issues in syntactic theory, including anaphora and island constraints. Reading primary sources from several different perspectives, including transformational grammar, gr
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: Linguistics 222.

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.

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.

4 units, Win (Kiparsky)

227L. Computational Models of Syntax of Natural Language — (Same as Computer Science 375.) 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 (Kiparsky)


4 units, Aut (Van Valin)

230L. Semantics and Pragmatics — Introduction to speech acts and the analysis of illocutionary force; conversational implicature; the model-theoretic analysis of semantic content, including singular and general noun phrases (quantification), relative clauses, verbal tenses and aspects, adjectives, and infinitive and sentence-embedding constructions.

4 units, Spr (Karttunen, Sag)

231L.A.B. Semantics and the Logic of Natural Languages — 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.

4 units, Aut, Win (Barwise, Etchemendy)

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.

Alternate years, given 1986-87


3-4 units, Spr (Staff)

237L. Phenomenological Foundations of Cognition, Language, and Computation — (Same as Computer Science 378.) Critical analysis of the 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)

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)


4 units, Win (Clark)

242L. Acquisition of Phonology — Current state of knowledge on children's phonological development. Relation of perception to production, babbling to early speech, child phonology to adult phonology. Relevance of phonological theory to child development and vice versa. Prerequisite: 240 or consent of instructor.

Alternate years, given 1986-87
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: Linguistics 45 or consent of instructor.

1-3 units (Huntington) by arrangement

246L. Psycholinguistics—(Same as Psychology 214.) Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark)

247L. Psycholinguistic Theories of Parsing—(Same as Psychology 279.) Computational modeling of parsing processes, theories of parsing, and the relation between psycholinguistic theories and linguistic theories.

4 units, Aut (Ford)

248L. Topics in Language Acquisition—(Same as Psychology 251.) Variable topics selected from semantics, syntax, morphology, discourse structure or phonology.

alternate years, given 1986-87

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. Special attention to the question of what general linguistics might gain from the sociolinguistic approach to problems of linguistic theory and description, and linguistic change. Prerequisite: Graduate standing in Linguistics or consent of instructor.

4 units, Win (Rickford)

252L. Sociolinguistic Approaches to Discourse Analysis: Discourse and Ideology—(Same as Spanish and Portuguese 310.) Creation of meaning as a social process, ways in which ideology is produced, reproduced, and transformed in linguistic interaction, whether and how American competence models can interlock with theories that see language as constituting social reality and self. Readings on the concept of socially determined meaning, discursive practices in the French tradition, British empirical analyses, American sociolinguistics.

4-5 units, Aut (Pratt)

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.

5 units, Win (Fox)

258L. Topics in Sociolinguistics—Topics for 1985-86: 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 will be explored cross-linguistically. May be repeated for credit.

4 units, Aut (Ferguson)

259L. Topics in Multilingualism—Focus varies yearly including recent work on one or more of the following: code-switching; competence models; language shift; language death; social, psychological and linguistic constraints on language choice or interference; substratum versus alternative explanations for features of 'new' languages arising from multilingual contact; foreigner talk; acquisition in a multilingual setting.

alternate years, given 1986-87

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)

261L. Topics in Language Change—Topic for Autumn 1985-86: The development of auxiliary verbs in English; focus on syntactic, semantic and discourse factors, with some attention to phonological correlates; discussion of Lightfoot’s Transparency Principle; Kroch’s analysis of variation and spread of do.

4 units, Aut (Traugott)

278L. The Structure of Modern Chinese—(Same as Asian Languages 291.) Prerequisite: Asian Languages 23 or equivalent. Recommended: a general introductory course in linguistics.

4 units, Spr (Kao)

285L. Research Methods in Psycholinguistics—Methods of data collection and analysis; logic of experiment and observation; reading and discussion of problems in research.

alternate years, given 1986-87

286L. Sociolinguistic Field Methods—Principal methods of data collection in sociolinguistics. Readings, discussions, and practice focus on: oral elicitation, survey questionnaires, the Matched Guise Technique, tape recorded sociolinguistic interviews, and other methods of extending the stylistic continuum and tapping linguistic intuitions.

4 units, Spr (Rickford)

287L. Field Methods—Analysis of the structure of an unknown language using data gather
...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.

**alternate years, given 1986-87**

288L. *Research Methods in Phonetics*—Treatment of experimental design, statistics, exploratory data analysis; presentation of results, and pitfalls in obtaining and analyzing instrumental data. Coursework will include critical reading of published research for methodological soundness and exercises in analysis of data and presentation of results. Prerequisite: Linguistics 205.

**alternate years, given 1986-87**

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 (Politzer)

385L. *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 (Traugott)

386. *Directed Teaching.*
1-5 units, any quarter (Staff)
by arrangement

387. *Directed Reading.*
1-5 units, any quarter (Staff)
by arrangement

1-6 units, any quarter (Staff)
by arrangement

1-15 units, any quarter (Staff)
by arrangement

**COURSES REGULARLY OFFERED BUT NOT DURING 1985-86**

35. *Language and Culture.*

72. *Linguistic Approaches to Point of View in Fiction.*

100. *Indigenous Languages of North and South America.*

160. *Historical Linguistics and Cultural History.*

218. *Topics in Phonetics.*

219. *Topics in Phonology, Morphology.*


238. *Topics in Semantics, Pragmatics.*


249. *Topics in Psycholinguistics.*

251. *Sociolinguistics and Pidgin/Creele Studies.*

253. *Language Planning and Public Policy.*

254. *Literacy: Social and Historical Perspectives.*

256. *Topics in Linguistic Anthropology.*

261. *Phonological and Morphological Change.*

262. *Syntactic Change.*

263. *Semantic Change.*

270. *The Structure of Hausa.*


275. *Germanic Syntax.*

276. *History of the German Language.*


**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.

5 units, Aut, Win, Spr (Staff)


5 units, Aut, Win, Spr (Staff)

Other African languages may be offered on request. In the past several years, these courses have included:

608A,B,C. *Beginning Amharic.*

610A,B,C. *Beginning Yoruba.*

611A,B,C. *Intermediate Yoruba.*

614A,B,C. *Beginning Wolof.*

615A,B,C. *Advanced Wolof.*
SCHOOL OF HUMANITIES AND SCIENCES

616A, B, C. Setswana.
618A, B, C. Beginning Bambara.

SPECIAL LANGUAGE PROGRAM (620-679)

The Special Language Program offers a number of foreign languages not otherwise taught at Stanford.

Courses planned for 1985-86, given sufficient enrollment, are:

620A, B, C. Beginning Arabic — Successful completion of 620C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Barhoum)

621A, B, C. Intermediate Arabic.
4 units, Aut, Win, Spr (Barhoum)

628A, B, C. Beginning Accelerated Hebrew — Successful completion of 628C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Naveh)

4 units, Aut, Win, Spr (Naveh)

630A, B, C. Advanced Hebrew.
4 units, Aut, Win, Spr (Naveh)

642A, B, C. Beginning Norwegian.
3 units, Aut, Win, Spr (Staff)

644A, B, C. Beginning Swedish.
3 units, Aut, Win, Spr (Staff)

648A, B, C. Beginning Cantonese.
3 units, Aut, Win, Spr (Staff)

652A, B, C. Beginning Hindi.
3 units, Aut, Win, Spr (Staff)

656A, B. Beginning Indonesian.
3 units, Win, Spr (Staff)

664A, B, C. Beginning Czech.
3 units, Aut, Win, Spr (Henzl)

670A, B, C. Modern Greek — Successful completion of 670C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Prionas)

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.

These and other languages will be offered only on request. Requests must be made by the end of Autumn 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 is on a Pass/No Credit basis. 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.

650A, B, C. Beginning Navaho.

654A, B, C. Beginning Tagalog.

658A, B, C. Beginning Korean.

660A, B, C. Beginning Taiwanese.

662A, B, C. Beginning Thai.

666A, B, C. Beginning Polish.

672A, B, C. Beginning Hungarian.

674A, B, C. Beginning Irish.

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
69A. 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

69B. 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. 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, and 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 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 Advisory Committee on Literature (Humanities and Sciences) has prepared the following list of courses to assist students in selecting courses which feature foreign works in English translation. Please consult departmental listings for further information.

ASIAN LANGUAGES

110. Japanese-Western Literary and Cultural Interaction.

114. Haiku.

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.


FRENCH AND ITALIAN
115. Existentialism (Julliard).
185. Simone de Beauvoir (Giraud).

GERMAN STUDIES
19A. Introduction to the Germanic Languages.
31A, 32A, 33A. German Culture and Civilization.
35A. Images of Women in German Film.
60A. An Introduction to the Medieval Literature of England, France, Germany, and Scandinavia (500-1300).
245A. Marxism and Literary Criticism.
276A. European Novel IV.
given 1985-86
284A. Joyce, Proust, Mann.
given 1985-86
291A. Literature of Decadence.
given 1985-86

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 Twentieth Century.

SLAVIC LANGUAGES AND LITERATURES
145. Survey of Russian Literature in Translation I.
146. Survey of Russian Literature in Translation II: The Novel and Beyond.
147. Survey of Russian Literature in Translation III.
151. Fyodor Dostoevsky.
153. Leo Tolstoy.

SPANISH AND PORTUGUESE
123A. Spanish American Literature in Translation.

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), Michael Genesereth (Computer Science), Gene Golub (Computer Science), John G. Herriot (Computer Science), Joseph B. Keller (Mathematics), Robert Osserman (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), Mary V. Sunseri (Mathematics)

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 PROGRAM

BACHELOR OF SCIENCE

The requirement for the bachelor's degree, beyond the University's basic requirement, is an approved course program of 72 to 76 units, distributed as follows:

1. Mathematics (33 units): Calculus and Analytic Geometry through Mathematics 44, or equivalent; Linear Algebra and Matrix theory (113) or Linear Algebra and its Appl...
cations (113S); Linear Algebra and Matrix Theory (114) or Linear Algebra and its Applications (114S); Fundamental Concepts of Analysis (115); Modern Algebra (120) or Modern Algebra and its Applications (120S); Differential Equations (130).

2. Computer Science (11-13 units) of which two must be chosen of the following: Discrete Mathematics (60); Introduction to Software Engineering (106A), or Introduction to Computer Programming (106H), or Introduction to Software Engineering (106X); Introduction to Software Engineering (106B); Fundamentals of Computer Science (108A, B, C). Also one of the following must be chosen: Fundamentals of Artificial Intelligence (223A); Numerical Analysis (237A); Formal Languages (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; Mathematics 116; 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 IN MATHEMATICAL AND COMPUTATIONAL SCIENCE

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 graduate course, or (c) at least three units of directed reading.

MOTHEMATICS

Emeriti: (Professors) Harold M. Bacon, Ralph Phillips, George Polya, Hans Samelson, Menahem Schiffer, Gabor Szego

Chairman: Solomon Feferman


Associate Professors: Ralph Cohen, Steven Kerckhoff, Peter Sarnak

Assistant Professors: Walter Craig, Russell Lyons, Brad Osgood, Philip Scowcroft, Dennis Stowe, Stephanos Venakides, Brian White

Acting Assistant Professors: Shaughan Lavine, Roberto Scaramuzzi

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.
INTRODUCTORY COURSES

The Department of Mathematics offers two sequences of courses in the calculus.

1. Calculus and Analytic Geometry (41, 42, 43) presents one-variable calculus and plane analytic geometry in the first two quarters (41, 42), and multi-variable differential calculus and space geometry in the third quarter (43).

2. Calculus and Analytic Geometry (19, 20, 21, 22, 23) covers the material of (41, 42, 43) in five quarters instead of three.

Precalculus Mathematics (3) is offered for those who need or desire a better preparation in these subjects before entering one of the calculus sequences.

The introductory course in modern algebra is Linear Algebra (113 or 113S). There are no formal prerequisites for this course, but appropriate mathematical maturity is expected.

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, 22, 23, 44 or 41, 42, 43, 44). These courses should be started during the first year.

Students intending to go on to graduate work in mathematics are strongly urged to study at least one foreign language chosen from French, German, and Russian.

2. Nine courses each carrying at least three units credit, numbered 100 or above or 44H, 45H, 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 (or 113S), 114 (or 114S), 120 (or 120S), 121, 152; analysis—44H, 45H, 101, 102, 106, 107, 115, 116, 117, 130, 131, 132; geometry—143, 159; foundations—160A, 160B, 161. Graduate courses in the same subject may be substituted for the preceding courses—for example, 206A for 106.

3. Five additional courses, each carrying at least three credits, chosen from courses numbered 100 or above.

Mathematics majors must have at least a C average in all courses used to fulfill the major requirement. Letter grades are required in all courses used to fulfill the major requirement, except for those offered Pass/No Credit only and for cognate courses (see 4, below).

Students planning graduate study in mathematics are advised to include one or more 200 level courses in their programs and, to facilitate this, to complete 113 (or 113S), 114 (or 114S), 115 and 116 as early as possible.

4. One of the following options. The choice of (a) or (b) is recommended.

a) Physics 51, 53, 55, 57 (total, 15 units) 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 IN MATHEMATICS

The Department of Mathematics offers a program leading to the degree of Bachelor of Science in Mathematics with Honors. Programs leading to this degree are formulated by individual students in consultation with a department representative. Typically such a program includes, beyond the courses required for the B.S. degree, electives including graduate courses and courses in Independent Work, with one of the latter culminating in a scholarly paper. Further details concerning admission to the program and a statement of the requirements of the program can be obtained from the Academic Secretary of the department.

BACHELOR OF SCIENCE IN MATHEMATICAL 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 the Computer Science Department material in this bulletin.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the "Degrees" section in this bulletin. The following are 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.

Training and experience in teaching is part of the Ph.D. program. Each student is required to teach or assist in teaching one course per quarter for three quarters. The quarters and nature of the teaching assignment will be determined by the department in consultation with the student.

For the degree of Doctor of Philosophy in Computer Science, see the Computer Science Department material in this bulletin.

For further information concerning degree programs, requirements for a Ph.D. minor in Mathematics, fellowships, and assistantships, inquire of the Academic Secretary of the department.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the School of Education section of this bulletin or address inquiry to the Credential Secretary, School of Education.

MASTER OF ARTS IN TEACHING (MATHEMATICS)

In cooperation with the School of Education, the department offers a program leading to a degree, Master of Arts in Teaching (Mathematics). This degree is intended for candidates who have a teaching credential 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."

COURSES

INTRODUCTORY AND UNDERGRADUATE COURSES

Introductory courses will be offered only if twenty or more students enroll.

3. Precalculus Mathematics—Establishes the background needed to begin calculus: Func-
tions 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 — Presents a rather complete introduction to the concept, techniques and applications of differentiation and a brief introduction to the concept, techniques and applications of integration. The sequence (19, 20, 21, 22, 23) covers the same subjects as the sequence (41, 42, 43) described below. Prerequisites are the same as for 41. (DR:6)

3 units, Aut (Sunseri) MWF 8, 9
Win (Sunseri) MWF 8, 9, 10, and 11


3 units, Win (Sunseri) MWF 8, 9
Spr (Sunseri) MWF 8, 9, and 10


3 units, Aut (Staff) MWF 8 and 2:15
Spr (Sunseri) MWF 8 and 9


3 units, Aut (Staff) MWF 2:15
Win (Staff) MWF 8

23. Calculus and Analytic Geometry—Continuation of 22. Prerequisite: 22. (DR:6)

3 units, Win (Staff) MWF 2:15
Spr (Staff) MWF 8

41. Calculus and Analytic Geometry—Note: Mathematics 41-42-43 (Autumn, Winter, Spring respectively) will consist 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. Mathematics 41 presents 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 (Sarnak) 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, 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 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.

5 units, Aut (Stouve) MTWTh 2:15-3:15

44. Calculus—Continuation of 43. Principal topics included are: Taylor's theorem, line and surface integrals, Green's theorem, Stokes' theorem; complex numbers and functions. Prerequisite: 43 or equivalent.

3 units, Aut (Staff) MWF 10, 11, and 1:15
TTh 11-12:15 and 1:15-2:30
Win (Staff) MWF 9 and 10
TTh 11-12:15
Spr (Staff) MWF 11
TTh 11-12:15

44H. Honors Calculus—Continuation of 43H. Topics from multiple integrals, applications, line and surface integrals, first order differential equations, higher order linear differential equations, Laplace Transform, numerical methods. Prerequisite: 43H or consent of instructor.

5 units, Win (Finn) 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 Gauss, Green, and

5 units, Spr (R. Cohen) 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 seek to enhance a student’s ability to think quantitatively and to understand the character and interrelationships of technology, mathematics, and science. The course 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. Fulfills distribution requirements in areas 6, 7, and 8. For 1985-86, registration is provisionally limited.

3 units, each quarter, Aut, Win, Spr
(Adams, Fetter, Osserman)

92. Topics in the History of Mathematics from Antiquity to the 17th Century — (Enroll in Philosophy 140.)
3 units, Spr (Knorr)

COURSES FOR UNDERGRADUATES AND GRADUATE STUDENTS

Unless explicitly stated there are no prerequisites for the courses listed below. Where a prerequisite is stated it may be waived with the consent of the instructor.

101. Advanced Calculus—Topics include: 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 (Osgood) MWF 10
Spr (Berg) MWF 11

102. Advanced Calculus—(Continuation of 101.) Topics from: differentiation and integration of integrals depending on a parameter; uniform convergence; differentiation and integration of sequences and series; improper multiple integrals; Fourier series. Prerequisite 101 or consent of instructor.
alternate years, given 1986-87

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 (Levine) MWF 11
Spr (Staff) MWF 9

107. Theory and Applications of Functions of a Complex Variable—Topics from the theory of analytic function with applications, selected by the instructor. Possible topics include: conformal mapping and fluid dynamics; integration and the inversion, and asymptotic expansion of Laplace and Fourier Transforms; differential equations in the complex domain and the special functions of mathematics physics; integration and the spectral theory of operators on Hilbert space.
3 units, Spr (Berg) MWF 2:15

113. Linear Algebra and Matrix Theory—The study of the algebraic properties of matrices and their interpretation in geometric terms. The relationship between the algebraic and geometric points of view and matters that are fundamental to the study and solution of linear equations are dealt with. Topics include: linear equations, vector spaces, linear dependence, bases and coordinate systems; linear transformations and matrices; similarity and eigenvalues; reduction of quadratic forms. (DR:6)
3 units, Aut (Royden) MWF 9
Win (Ornstein) MWF 11

113S. Linear Algebra and Its Applications—A treatment of linear algebra and matrices with an emphasis on computational and algorithmic aspects together with a consideration of scientific problems in which linear algebra is applied. Solution of linear equations. Linear spaces and matrices. Orthogonal projection and least squares. Eigenvalues and eigenvectors. (DR:6)
3 units, Aut (Staff) MWF 10, 11, and 1:15
TTh 1:15-2:30
Win (Staff) MWF 11 and 1:15, TTh 11-12:15
Spr (Staff) MWF 11 and 1:15, TTh 1:15-2:30
Sum (Staff)

114. Linear Algebra and Matrix Theory—Continuation of 113. A deeper study of certain of the topics indicated as well as additional topics chosen among the following: invariant subspaces, canonical forms of matrices; minimal polynomials and elementary divisors; vector spaces over arbitrary fields; inner products; Hermitian and unitary matrices; multilinear algebra.
3 units, Win (Royden) MWF 9
Spr (Royden) MWF 11

114S. Linear Algebra and Its Applications—Continuation of 113S. Determinants, eigenvalues and eigenvectors. Positive definite
matrices, extremum problems, computations with matrices, elements of linear programming and game theory.

3 units, Win (Berg) MWF 2:15
Spr (Scaramuzzi) TTh 1:15-2:30

115. Fundamental Concepts of Analysis—A rigorous development of real analysis in Euclidean space: sequences and series, limits, continuous functions, derivatives. Basic point set topology. Especially recommended for students who intend to take graduate work in mathematics. Prerequisite: 44.

3 units, Aut (Staff) MWF 11 and 1:15
Win (Chung) MWF 11

116. Fundamental Concepts of Analysis—Lebesgue theory of measure and integration in Euclidean space; completeness of $L^2$. Elements of Hilbert space theory, orthogonal expansions. Prerequisite: 115 or equivalent.

3 units, Win (Scaramuzzi) MWF 11

117. Introduction to Functional Analysis—Linear operators on Hilbert space. Spectral theory of compact operators; applications to integral equations. Elements of Banach space theory. Prerequisite: 116.

3 units, Spr (McGregor) MWF 1:15

120. Modern Algebra—Group theory: normal subgroups, permutation groups, Sylow's theorems, finite abelian groups. Introduction to rings. Prerequisite: 113 or 113S.

3 units, Aut (Lavine) MWF 1:15

120S. Modern Algebra and Its Applications—A course with the same principal content as Mathematics 120, but with emphasis on applications of modern algebra. Applications will include symmetry groups—in particular, crystallographic groups—and error-correcting codes. Prerequisite: 113 or 113S, or equivalent.

3 units, Win (Samelson) MWF 10

121. Modern Algebra—Continuation of 120. Rings, ideals, polynomials, fields, Galois theory.

3 units, Win (Lavine) MWF 1:15

123. Theory of Probability—Introductory course 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. Classical limit theorems for sequences of independent random variables are discussed in some detail. Prerequisite: 44.

3 units, Win (Zhao) MWF 9

124. Introduction to Stochastic Processes—Course presents an elementary systematic account of several principal areas in stochastic processes including branching processes, Markov chains, Poisson processes. A wide range of applications will be discussed relevant to the natural, biological, social and managerial sciences.

alternate years, given 1986-87

126. Mathematical Models in Population Biology—(Same as Mathematics 226.) A course for advanced undergraduates and beginning graduate students in biology and mathematics. Topics will include the elements of population genetics and ecology, and theory of enzyme kinetics.

alternate years, given 1986-87

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 1:15
Win (Staff) MWF 10 and 1:15
TTh 11-12:15
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 (Staff) MWF 10

134A,B. Honors Analysis—A course designed to give a coherent, mathematically sophisticated presentation of some of the basic areas in classical real analysis. Directed chiefly toward mathematics majors who would normally enroll in an honors sequence—but of use and interest to other majors who are at ease with rigorous proofs and qualitative discussion. A major portion of the course will be devoted to ordinary and partial differential equations. Prerequisite: 116, or consent of instructor. Corequisites: 113-114, or 113S-114S.

alternate years, given 1986-87

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.

138. Introduction to Computing—(Enroll in Computer Science 106.)

137A, B, C. Numerical Analysis—(Enroll in Computer Science 237A, B, C.)


150. Introduction to Combinatorial Theory—(Enroll in Computer Science 264.)

152. Elementary Theory of Numbers—Euclid's algorithm, fundamental theorems on divisibility; prime numbers; congruence of numbers; theorems of Fermat, Euler, Wilson; congruence of first and higher degrees; Lagrange's theorem, its applications; residues of power; quadratic residues; introduction to theory of binary quadratic forms.

159. Introduction to Topology—This course will cover some of the basic properties of metric and topological spaces; compactness, connectedness, and continuity. Special attention will be paid to the Euclidean spaces; and the fixed-point and degree of mapping theorems will be developed.

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 will be discussed and applied. Prerequisite: Philosophy 57 and a basic knowledge of set theory for students with no mathematics or computer science background.

160B. Computability and Logic—(Enroll in Philosophy 160B.) A precise definition of "effective procedure" is given through Turing machines, register machines and recursive functions. Church's Thesis is explained. These are used to develop Gödel's work on the undecidability of arithmetic, culminating in his famous Incompleteness Theorem. Other undecidable problems are also discussed. Prerequisite: 160A.

161. Axiomatic Set Theory—(Enroll in Philosophy 161.) Zermelo-Fraenkel axioms are the basis of the course. Operations on sets, relations and functions. Equivalence and ordering relations. Equipollence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. This is a computer-based course; there are no lectures. Each student progresses through the course at his or her own pace. The first meeting is organizational only, held at 2:15 on the first class day of the quarter.

192A, B. Topics in the History of Mathematics.

192A. Topics from the 17th to the 19th century. Principally the rapid development of the powerful new concepts and methods in analysis and their direct connection with the physical sciences, in particular mechanics. Illustrations from the work of famous mathematicians from Descartes to Abel.

192B. Topics from the 19th to the early 20th century. The further extension and expansion of analysis and its applications. Rigorization and generality; the rise of algebra and abstract mathematics. Illustrations from the work of famous mathematicians from Fourier to Lebesgue.
ment for the degree in mathematics. Students wishing to use credit for the course toward the fulfillment of the department's area requirements must receive the approval of the Undergraduate Affairs Committee of the department. Students having a topic they wish to investigate but who need help in finding a faculty member to direct their reading should consult the Academic Secretary of the department.

(Staff) by arrangement

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
<th>Term</th>
<th>Time</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>205A, B, C</td>
<td>Theory of Functions of a Real Variable</td>
<td>3</td>
<td>Aut (Katznelson)</td>
<td>MWF 10</td>
<td></td>
</tr>
<tr>
<td>205A</td>
<td>Theory of Functions of a Real Variable</td>
<td>3</td>
<td>Win (Katznelson)</td>
<td>MWF 10</td>
<td></td>
</tr>
<tr>
<td>205C</td>
<td>Theory of Functions of a Real Variable</td>
<td>3</td>
<td>Spr (P. Cohen)</td>
<td>MWF 10</td>
<td></td>
</tr>
<tr>
<td>206A, B, C</td>
<td>Theory of Functions of a Complex Variable</td>
<td>3</td>
<td>Aut (Osgood)</td>
<td>MWF 11</td>
<td></td>
</tr>
<tr>
<td>206B</td>
<td>Theory of Functions of a Complex Variable</td>
<td>3</td>
<td>Win (Hawley)</td>
<td>MWF 11</td>
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</tr>
<tr>
<td>206C</td>
<td>Theory of Functions of a Complex Variable</td>
<td>3</td>
<td>Spr (Hawley)</td>
<td>MWF 11</td>
<td></td>
</tr>
<tr>
<td>210A, B, C</td>
<td>Modern Algebra</td>
<td>3</td>
<td>Aut (Milgram)</td>
<td>TTh 11-12:15</td>
<td></td>
</tr>
<tr>
<td>210B</td>
<td>Modern Algebra</td>
<td>3</td>
<td>Win (Milgram)</td>
<td>TTh 11-12:15</td>
<td></td>
</tr>
<tr>
<td>210C</td>
<td>Modern Algebra</td>
<td>3</td>
<td>Spr (Milgram)</td>
<td>TTh 11-12:15</td>
<td></td>
</tr>
<tr>
<td>217A, B</td>
<td>Differential Geometry</td>
<td>3</td>
<td>Win (Stowe)</td>
<td>MWF 11</td>
<td></td>
</tr>
<tr>
<td>217B</td>
<td>Differential Geometry</td>
<td>3</td>
<td>Spr (Osserman)</td>
<td>MWF 11</td>
<td></td>
</tr>
<tr>
<td>220A, B, C</td>
<td>Methods of Mathematical Physics</td>
<td>3</td>
<td>Aut (Craig)</td>
<td>TTh 9-10:15</td>
<td></td>
</tr>
<tr>
<td>220B</td>
<td>Methods of Mathematical Physics</td>
<td>3</td>
<td>Win (Craig)</td>
<td>TTh 9-10:15</td>
<td></td>
</tr>
<tr>
<td>220C</td>
<td>Methods of Mathematical Physics</td>
<td>3</td>
<td>Spr (Venakides)</td>
<td>TTh 9-10:15</td>
<td></td>
</tr>
<tr>
<td>221A, B</td>
<td>Calculus of Variations</td>
<td>3</td>
<td>Aut (Finn)</td>
<td>TTh 1:15-2:30</td>
<td></td>
</tr>
<tr>
<td>221B</td>
<td>Calculus of Variations</td>
<td>3</td>
<td>Win (Finn)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>224</td>
<td>Integral Equations</td>
<td>3</td>
<td>Spr (Levine)</td>
<td>MWF 2:15</td>
<td></td>
</tr>
<tr>
<td>226</td>
<td>Mathematical Models in Population Biology</td>
<td>3</td>
<td>Same as Mathematics 126</td>
<td>alternate years, given 1986-87</td>
<td></td>
</tr>
<tr>
<td>230A, B</td>
<td>Advanced Probability</td>
<td>3</td>
<td>Win (Chung)</td>
<td>MWF 9</td>
<td></td>
</tr>
<tr>
<td>230B</td>
<td>Advanced Probability</td>
<td>3</td>
<td>Spr (Chung)</td>
<td>MWF 9</td>
<td></td>
</tr>
<tr>
<td>232</td>
<td>Introduction to Stochastic Integration</td>
<td>3</td>
<td>Spr (Levine)</td>
<td>MWF 2:15</td>
<td></td>
</tr>
<tr>
<td>233</td>
<td>Stochastic Equations and Waves in Random Media</td>
<td>3</td>
<td>Same as Mathematics 126</td>
<td>alternate years, given 1986-87</td>
<td></td>
</tr>
<tr>
<td>235A, B, C</td>
<td>Selected Topics in Ergodic Theory</td>
<td>3</td>
<td>Aut (Keller)</td>
<td>TTh 11-12:15</td>
<td></td>
</tr>
</tbody>
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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.

235A, B, C
Selected Topics in Ergodic Theory—Expositions of Kolmogorov-Sinai theory of entropy; isomorphism theorem for Bernoulli shifts and Bernoulli flow; K-automor-
Theorem for positive matrices. Variational formulas in matrix analysis, ordering and monotone preserving properties, a heirarchy of determinental inequalities, applications to stability analysis of certain nonlinear transformations. Applications in statistics, probability and in the natural, biological and managerial sciences.

alternate years, given 1986-87

Ordinary Differential Equations—Fundamental existence theorems, stability and asymptotic behavior of nonlinear systems, Poincaré-Bendixson theorem, linear systems and Sturm-Liouville eigenvalue problems; selected topics from equations in the complex domain; Fuchsian theory, Hamiltonian systems, existence of periodic solutions and orbital stability.


Lie Groups and Lie Algebras—Topics from the following: the "L^1 theory" of harmonic analysis— the singular integral theory of Calderon and Zygmund and its extensions, interpolation
of operators, multiplier transformations, and smoothness properties of functions; the "L' theory" of harmonic analysis—sets of uniqueness for trigonometric series, spectral syntheses, thin sets, the spectral theory of convolution operators, and applications. Prerequisite: knowledge of the elements of Fourier analysis.  
alternate years, given 1986-87

270. Perturbation and Asymptotic Methods with Applications—An exposition of perturbation and asymptotic methods. Topics include regular perturbation theory, singular perturbation theory, initial and boundary layers, the method of multiple scales, ray theory, two-time methods, etc. Applications will include problems from fluid and solid mechanics, wave propagation, etc. Prerequisites: Some familiarity with ordinary and partial differential equations.  
3 units, Win (Keller) TTh 11-12:15

274. Wave Propagation — (Same as Mechanical Engineering 236B.) The following concepts will be 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 will be made to electromagnetic, acoustic, elastic, and other types of waves. (M.E. 236A is not a prerequisite for this self-contained course.)  
alternate years, given 1986-87

275. Introduction to Nonlinear Continuum Mechanics—(Same as Mechanical Engineering 242A.) Definitions of general states of stress and deformation of continua, including rate-of-deformation and spin (vorticity). General balance principles; thermodynamical foundations and entropy. Discussion of constitutive equations and influence of material symmetries. Applications of the theory with particular reference to finite elasticity. Introduction to the theory of imperfect continua (containing defects) and the role of the material momentum tensor. Discussion of new material conservation laws and their relevance to path-independent integrals of fracture mechanics.  
alternate years, given 1986-87

alternate years, given 1986-87

277A,B. Mathematical Theory of Relativity —Ricci calculus; variational principles and covariance properties; differential geometry of space-time; Cauchy's problem for the differential equations of gravitation and electromagnetism; relativistic hydrodynamics; unified field theories.  
alternate years, given 1986-87

alternate years, given 1986-87

283A. 3 units, Win (Milgram)  
283B. 3 units, Spr (Hsiang)

284A,B. Differentiable Manifolds—Embeddings of manifolds in Euclidean space, tubular neighborhood theorem, Morse theory, transversality, differential forms, integration on manifolds, deRham cohomology.  
284A. 3 units, Aut (Kerckhoff) MWF 9  
284B. 3 units, Win (Kerckhoff) MWF 9

286A,B. Topics in Differential Geometry—The purpose of this course is to present some parts of differential geometry which will lead students to do research in the field. Possible topics include: the relation between the curvature of a manifold and its topology; the use of the methods of partial differential equations in the construction of metrics, and the isometric embedding problem; the problem of isometric deformation of submanifold; the application of geometry to general relativity. The choice of the topics will depend to some extent on the interest of the students. Prerequisite: 217B.  
alternate years, given 1986-87

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.  
alternate years, given 1986-87

290A. 3 units, Win (Lavine)  
290B. 3 units, Spr (Lavine)

alternate years, given 1986-87

292A,B. Set Theory—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.

alternate years, given 1986-87

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.

293A. 3 units, Aut (Beeson) TTh 1:15-2:30
293B. 3 units, Win (Beeson) TTh 1:15-2:30

294. Topics in Logic—These will 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, Spr (Feferman) TTh 1:15-2:30

350. Directed Reading.
any quarter (Staff) by arrangement

351. Seminar Participation—Participation in a student-organized graduate seminar under the general supervision of a faculty member.
any quarter (Staff) by arrangement

360. Advanced Reading and Research.
any quarter (Staff) by arrangement

361. Seminar Participation—Participation in faculty-led seminar which has no specific course number.
any quarter (Staff) by arrangement

by arrangement

381. Seminar in Analysis.
by arrangement

383. Seminar in Function Theory.
by arrangement

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MEDIEVAL STUDIES


Affiliated Faculty: Theodore M. Andersson (German Studies), Lawrence V. Berman (Religious Studies), George H. Brown (English, on leave 1985-86), Brigitte Cazelles (French and Italian), Stephen Ferruolo (History), John Freccero (French and Italian, on leave 1985-86), Hester Gelber (Religious Studies, on leave 1985-86), Donald R. Howard (English), Nancy S. Kollmann (History), Gavin I. Langmuir (History), Suzanne Lewis (Art), Sabine G. MacCormack (Classics and History), William Mahrt (Music), Eleanor Prosser (Drama), Madeleine Sutherland (Spanish and Portuguese), William M. Todd III (Slavic Languages and Literatures), W. Wesley Trimpi (English), Mary Wack (English, on leave Autumn)

The Medieval Studies Program is administered through Humanities Special Programs. There is no formal undergraduate degree program in Medieval Studies, rather the option exists for interested students to propose individually designed majors in "Medieval Studies." Individually designed majors must be proposed to and approved by the Dean of Undergraduate Studies’ Advisory Committee on Individually Designed Majors. Guidelines may be found under the section “Program for Individually Designed Majors.” Students interested in planning a course of studies should consult the Chairman of Medieval Studies. Additional information about this option, as well as referral to faculty advisors, is available through the Humanities Special Programs office. For infor-
information about proposing individually designed majors, students should go to the Academic Information Center. The major would normally be declared by the beginning of the student's third year.

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:

The introductory course, Medieval Studies 65, "Medieval Culture".
Two upper level interdisciplinary courses in Medieval Studies.
Four courses in one of the following categories:
1. Literature
   A. English
   B. German and Scandinavian
   C. French
   D. Spanish
   E. Italian
   F. Slavic
   G. Latin
2. History
3. Art History, Drama, Music
4. Philosophy, Religious Studies, Humanities (Certain Humanities courses may fulfill requirements within other categories.)
Two courses in a second category chosen from the above list.
One course in a third category chosen from the above list.

In addition to these ten courses, a language proficiency equal to two years of college-level study is suggested in Latin or one of the following: French, German, Spanish, or Italian.

COURSES
65. Introduction to Medieval Culture and Society—(Same as Art 65, History 65.) This course will offer an introduction to the culture and society of the Middle Ages in Western Europe from 1100 to 1500. Major events, works of art and literature will be explored within the broad context of medieval life. The approach to medieval history, literature and art will be interdisciplinary and integrated throughout the course, with a consistent structured emphasis on the mutual interdependence of all aspects of culture and society from the 12th through the 14th century. The course will explore such questions as how medieval people defined themselves and their world, their conceptions of reality, their relationships to God and nature, and the individual's role in society. (DR:2)
5 units, Win (Lewis, Ferruolo, Staff)
MTWTh 10 plus 1-hour discussion section

RELATED COURSES
Courses which are suitable for self-designed majors in Medieval Studies are listed below. More detailed descriptions of the courses are to be found under the various departmental headings with (DR) notations. See the Time Schedule each quarter for changes in listings.

ART
5. Introduction to Ancient and Medieval Art.
103. Byzantine Art and Architecture.
105A. Art and Architecture in Medieval Britain.
108. 15th-Century Netherlandish Painting.
204A. Seminar: Medieval Manuscript Illumination.

CLASSICS
11. Age of Heroes.
103. History of the Roman Empire.
107. Art, Religion, and Society in Late Antiquity, 284-717 A.D.—(Same as History 112A.)
118. Post-Classical Latin.

ENGLISH
102. The History of the English Language.
171A. Chaucer's Canterbury Tales.
171B. Chaucer's Troilus and the Dream Poems.
205. Old English.
208. Post-Classical Latin.
211. Readings in Middle English.
270A. Beowulf.
362. Medieval and Renaissance Romance.

FRENCH
130. French Literature I—Middle Ages and Renaissance.
134. Poésie Médiévale.
315. The Grail.
ITALIAN
128. Survey of Italian Literature I: 13th to 16th Century.
146. The Divine Comedy in Translation.
152. Seminar on Medieval Italian Literature.

GERMAN STUDIES
160. Medieval German Literature, 800-1500.
265A/305A. Introduction to Old Norse Icelandic.
208A. Introduction to Middle High German.
251L. Readings in Medieval Literature.

HISTORY
107. The 12th-Century Renaissance: European Society and Culture, 1050-1220.
108. The Christianization of Western Europe, 500-1350.
212. Augustine and the City of God.
214A. The Crusades.

MUSIC
100. Music History: Medieval and Renaissance.

PHILOSOPHY
138B. Introduction to Cosmology: Middle Ages to Newton.

POLITICAL SCIENCE
151. Religion and Political Theory.

RELIGIOUS STUDIES
23. Judaism.
24A. Early Christianity.

SLAVIC LANGUAGES AND LITERATURES
211. Introduction to Old Church Slavic.
212. Readings of Old Church Slavic and Old Russian Texts.

SPANISH
316. Hispanic Romancero

MODERN THOUGHT AND LITERATURE

Committee in Charge: Terry Castle (English); Wanda Corn (Art); René Girard (French); Arturo Islas (English); Diane Middlebrook (English); Kurt Mueller-Vollmer (German Studies); Renato Rosaldo (Anthropology); Peter Stansky (History); Ann Swidler (Sociology); William M. Todd III (Slavic Languages); Hans Weiler (School of Education and Political Science).

Co-Chairmen: John Bender (English); Russell Berman (German Studies).

Faculty: John Bender (English); Russell Berman (German Studies); Terry Castle (English); Wanda Corn (Art); Sandra Drake (English); Charles Drekmeier (Political Science); Jay Fliegelman (English); Estelle Freedman (History); Barbara Gelpi (English); René Girard (French); Albert Guerard (English); David Halliburton (English); Van Harvey (Religious Studies); Arturo Islas (English); Diane Middlebrook (English); Thomas C. Moser (English); Kurt Mueller-Vollmer (German Studies); Mary Pratt (Spanish and Portuguese); Paul A. Robinson (History); Renato Rosaldo (Anthropology); Lucio Ruotolo (English); Peter Stansky (History); Ann Swidler (Sociology); William M. Todd III (Slavic Languages); Ian Watt (English); Hans Weiler (German Studies); Marilyn Yalom (Center for Research on Women)

OFFERINGS
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.

GRADUATE PROGRAMS

MASTER OF ARTS

Only candidates for the Ph.D. will be admitted. But students in the Ph.D. program who satisfy the committee of their progress, and who complete satisfactorily 45 units of work, may apply for an A.M. in Modern Thought and Literature.

DOCTOR OF PHILOSOPHY

A candidate for the Ph.D. degree in Modern Thought and Literature must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the A.B. He or she will be expected to offer at least 90 units of graduate work in addition to the dissertation. At least three consecutive quarters of graduate work must be taken at Stanford. Students may spend one year of graduate study abroad.

Each student will plan his or her program with specific advisors. The exact distribution of time, between the literature of specialization and the interdisciplinary work in modern thought and literature, will depend on the nature of the undergraduate preparation. Candidates with an inadequate preparation in earlier literature may be asked to take appropriate additional courses.

The Committee believes that creative writing or other artistic activity contributes to the development of the teacher of modern literature. A reasonable amount of creative work (the amount to be approved by each student's advisor) may be counted among the 40 units of interdisciplinary work required.

The requirements for the Ph.D. in Modern Thought and Literature are as follows:

1. An introductory seminar, Modern Thought and Literature 361 (5 units).
2. 45 units of advanced work in modern literature of one language, normally English. Of the 45 units, at least 30 must be regularly scheduled, substantive courses in post-1750 English and American literature. Courses in the teaching of composition (English 396, 397), ad hoc graduate seminars (395), research courses (398), and thesis registration (399) may not be counted among these 30 units. 396, 397, and 399 may not be counted among the 90 units of graduate work required for the degree.
3. Approximately 40 units of advanced work in a coherent and individually arranged interdisciplinary program, including at least one further seminar. The program may include courses and readings in various areas of modern thought and culture, and individual creative work.
4. Qualifying Procedures:
   a) Colloquium or Essay
      By the end of the Spring Quarter of the first year each student will either organize a colloquium developed from work done in the Winter Quarter Modern Tradition seminar, or submit a 25-30 page essay based on the student's term paper for that seminar. The colloquium must be scheduled, or the seminar paper completed and given to the secretary, at least three weeks before the end of the Spring Quarter.
   b) Knowledge of Literature Since 1750
      Students may choose between two ways of demonstrating their knowledge of literature since 1750: a special one hour examination at the beginning of the second year, or a collection of brief critical commentaries on authors not covered in courses, to be submitted not later than the eighth week of the sixth quarter in residence. These tests or commentaries will be based on reading lists drawn up by the student in consultation with her or his advisor and approved by the committee in charge. The list should be based primarily on one of the advisory reading lists in literature, but may include 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.

GRADUATE PROGRAM IN HUMANITIES

The Committee participates in the Graduate Program in Humanities leading to a joint Ph. D. degree in Modern Thought and Literature and Humanities. For a description of the Humanities program, see the “Humanities Special Programs” section.

UNDERGRADUATE PROGRAM

The Committee sponsors several courses open to qualified undergraduates, but does not at present offer a major in Modern Thought and Literature. Undergraduates who wish to develop their own majors in Modern Thought and Literature should consult with the Chairperson and may be given permission to undertake an interdisciplinary plan of study under the Humanities Honors Program.

In special cases involving a few very qualified honors undergraduates, the Committee offers a coterminous A.M. Interested students should petition the chairperson not earlier than their ninth quarter (or upon completion of 105 units) and not later than the eleventh quarter.

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 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)

208. Autobiography and Literature: Gender and Genre—(Same as Comparative Literature 208.) A study of Western autobiography from its self-conscious inception at the end of the eighteenth century until our own time. Focus on the similarities and differences between the writing of women and men inscribing their life stories. Special attention to recent critical theory on autobiography as a modern literary form and as an historical document. Readings selected from: Rousseau, Goethe, George Sand, Harriet Martineau, John Stuart Mill, Elizabeth Cady Stanton, Mary McCarthy, Simone de Beauvoir, Jean-Paul Sartre, Anne Moody and Maxine Hong Kingston. 5 units, Win (M. Yalom)

216. The Romantic Age: Revolution and Revival.

216A. The Generation of Wordsworth and Austen. Major Poems and Prose Works of the Period 1789-1815—(Enroll in English 216A.) 5 units, Win (Dekker)

216B. Byron, Shelley, Keats, and Their Contemporaries: Literary Works of the Decade 1814-1824—(Enroll in English 216B.) 5 units, Spr (B. Gelpi)

221. History of Film—(Enroll in Communication 141/241.) 4 units, Win (Breitrose)

231. Italian Romanticism—(Enroll in Italian 231.) A study of the romantic movement in Italy. 4 units, Spr (Springer)

235A. Marxism and Literary Criticism—(Enroll in German Studies 245A.) 3-5 units, Win (Berman)
237. Introduction to 20th Century Italian Poetry—(Enroll in Italian 137/237.)
   4 units, Aut (Allen)

242. Deutsche Geistesgeschichte II—From Hegel to Nietzsche—(Enroll in German 242.)
   Taught in German.
   3-5 units, Win (Wellbery)

243. Deutsche Geistesgeschichte III—From Nietzsche to the Present—(Enroll in German 243.)
   Taught in German.
   3-5 units, Spr (Staff)

245. Deutsche Geistesgeschichte I—From Lessing to Romanticism—(Enroll in German Studies 241.)
   Taught in German.
   3-5 units, Aut (Wellbery)

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 (Freigen)

245C. Survey of Russian Literature in English Translation III: A Fractured Culture—
   (Enroll in Slavic Languages 147/247.)
   4 units, Spr (Brown)

246. The Divine Comedy in Translation—(Enroll in Italian 246.)
   For students unfamiliar with the poem or the Italian language.
   4 units, Aut (Schnapp)

247. Anthropology and History—(Enroll in Anthropology 246.)
   5 units, Aut (Jackson, Rosaldo)

248. Topics in Contemporary Criticism—(Enroll in German Studies 248.)
   3-5 units, Spr (Berman, Wellbery)

250. Poetry and Poetics—(Enroll in English 250.)
   5 units, Spr (Fields)

251. Seminar: Classics of Modern Political Theory—(Enroll in Political Science 250.)
   5 units, Win (Drekmeier)

254. Essentials of Political Theory—(Enroll in Political Science 254.)
   5 units, Aut (Drekmeier)

256. Liberalism—(Enroll in Political Science 256.)
   5 units, Spr (Drekmeier)

257. American Drama Since 1920—(Enroll in Drama 257.)
   5 units, Aut (Richards)

258. Feminist Theory in Anthropology—(Enroll in Anthropology 241.)
   5 units, Aut (J. Collier)

260. The Thought of Martin Buber—(Enroll in Religious Studies 260.)
   4-5 units, Win (Vogel)

261. Victorian England: From Revolution to Reform—(Enroll in English 261.)
   Admission by consent of instructor.
   5 units, Win (Gagnier)

262B. Victorian Cultural Debate: The Relations of Morality and Beauty—(Enroll in English 262B.)
   5 units, Aut (Smith)

263G. Feminist Literary Criticism: Theory and Practice—(Enroll in English 263G; Same as Feminist Studies 170/270.)
   5 units, Spr (B. Gelpi)

264A. Contemporary Narrative Theory: An Introduction—(Enroll in English 264A.)
   5 units, Spr (Stewart)

265. Cultural Transmission—(Enroll in Anthropology 265.)
   3-5 units, Spr (G. and L. Spindler)

266. The American Enlightenment—(Enroll in English 266.)
   5 units, Aut (Hellenbrand)

267. Freud and Literary Criticism—(Enroll in English 267.)
   5 units, Aut (Castle)

274D. Friedrich Nietzsche—(Enroll in Religious Studies 274D.)
   4 units, Spr (Harvey)

275. Fascism and Culture: The Fascist Advantage—(Enroll in Italian 175/275.)
   4 units, Win (Schnapp)

280. Modern Italian Novel—(Enroll in Italian 180/280.)
   4 units, Spr (Schnapp)

281. Keats and His Circle—(Enroll in English 281.)
   5 units, Aut (Grigely)

284. Hawthorne and James—(Enroll in English 284.)
   5 units, Win (Dekker)

285. Simone de Beauvoir—(Enroll in French 285.)
   4 units, Aut (Giraud)

287. Seminar: Convergence and Divergence in Industrial Societies—(Enroll in Sociology 287.)
   5 units, Spr (Inkeles)

290. Anthropological Theory in Historical Context—(Enroll in Anthropology 290.)
   5 units, Win (Rosaldo, Yanagisako)
295. Freud and Literary Theory—(Enroll in French 396.)
4 units, Aut (Girard)

296. The Literature of Decolonization—(Enroll in French 296.)
4 units, Win (Giraud)

300. Graduate Seminar: Theory of Narrative—(Enroll in Slavic Languages 300.)
4-5 units, Spr (Todd)

303A. Colloquium: Poetry and Prose, 1740-1800—(Enroll in English 303A.)
5 units, Aut (Carnochan)

303B. Colloquium: Sexuality and Terror: Gothic and Fantastic Literature of the 18th Century.—(Enroll in English 303B.)
5 units, Win (Castle)

304A. Colloquium: Love and Passion in 19th Century Fiction—(Enroll in English 304A.)
5 units, Win (Polhemus)

304B. Colloquium: Theories of Romanticism—(Enroll in English 304B.)
5 units, Spr (Lindenberger)

307A. Colloquium: Major Modern Critics—(Enroll in English 307A.)
5 units, Win (Lindenberger)

307B. Colloquium: Post-Modern Fiction: American and European—(Enroll in English 307B.)
5 units, Win (Sorrentino)

309. Seminar: Nature and the Natural in Victorian Culture—(Enroll in English 309.)
5 units, Aut (Ritvo)

310. Discourse and Ideology—(Enroll in Spanish 310.)
5 units, Aut (Pratt)

325A. Colloquium: Issues and Interpretations in Russian Social History—(Enroll in History 325A.)
5 units, Win (Confino)

333. Cultural European History—(Enroll in History 333.)
5 units, Aut (Paret)

331. Seminar: Major Twentieth-Century American Novelists—(Enroll in English 331.)
5 units, Aut (Solomon)

337A. Colloquium: Modern European Intellectual History—(Enroll in History 337A.)
5 units, Spr (Robinson)

346. Poetics I: Narrative Theory and Analysis—(Enroll in German Studies 246/346.)
3-5 units, Spr (Schultz, Wellbery)

349G. The Young Goethe—(Enroll in German Studies 349G.)
3-5 units, Aut (Wellbery)

351A. Seminar: Samuel Beckett—(Enroll in Drama 351A.)

354A. Seminar: Twentieth-Century Aesthetics—(Enroll in Drama 354A.)
5 units, Aut (Eddelman)

354B. Seminar: Semiotics of Drama—(Enroll in Drama 354B.)
5 units, Spr (Esslin)

356. West German Literature of the Sixties—(Enroll in German Studies 356.)
3-5 units, Aut (Berman)

361. Seminar: The Modern Tradition—(Enroll in English 361.) 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 11-12:30

363. Seminar: Victorian Masters: from Apprenticeship to Late Experimentation—(Enroll in English 363.)
5 units, Spr (Stewart)

364B. Seminar: The Bloomsbury Group—(Enroll in English 364B.)
5 units, Spr (Ruotolo)

385A. Seminar: Ezra Pound and the Pound Tradition—(Enroll in English 385A.)
5 units, Spr (A. Gelpi)

395. Ad Hoc Graduate Seminars—In a given quarter, a group of graduate students (at least three but preferably more) who wish the following quarter to study a subject or an area not covered by regular courses and seminars may plan an informal seminar and approach a suitable member of the faculty to supervise it, either on a letter grade or Pass/No Credit basis.
any quarter, by arrangement

396. Introduction to Graduate Study—(Enroll in English 396.)
5 units, Aut (Fifer, Fliegelman)

397A. Rhetoric and Teaching Composition—(Enroll in English 397A.)
5 units, Aut (Fifer)

397B. Teachers Workshop I—(Enroll in English 397B.)
5 units, Win (Fifer)

397C. Teachers Workshop II—(Enroll in English 397C.)
5 units, Spr (Fifer)
396. Research Courses—The student pursues a special subject of investigation under supervision of some member of the Committee or another faculty member. Thesis work not to be registered under this course.

any quarter, by arrangement

RELATED COURSES

Students of Modern Thought and Literature are referred to the offerings of the following departments: Anthropology, Art, Asian Languages, Communication, Comparative Literature, Drama, English, French and Italian, German Studies, History, Humanities Special Programs, Linguistics, Philosophy, Political Science, Psychology, Religious Studies, Sociology, Slavic Languages and Literatures, and Spanish and Portuguese. Consent of the instructor is required for most courses offered in this department.

MUSIC

Chairman: Albert Cohen
Professors: Albert Cohen, John Chowning, George Houle, William H. Ramsey, Leland C. Smith
Associate Professors: Karol Berger, William P. Mahrt (on leave 1985-86)
Assistant Professor: Thomas Bauman
Professors (Performance): Arthur P. Barnes (Director of Bands), Andor Toth* (Director of Orchestras and Opera)
Senior Lecturers: Judith Bettina (Voice), Margaret Fabrizio (Early Keyboard), Gennady Kleyman (Violin, Viola), Naomi Sparrow (Piano)
Lecturers: Paul Nahay (Theory), Gregory A. Wait (Voice), Josephine A. Gandolfi, David Ng-Quinn (Piano), Stephen Harrison*, Margaret Rowell, (Violoncello), Stephen Tramontozzi, (Contrabass), Frances Blaisdell, Alexandra W. Hawley (Flute), James Matheson (Oboe), Gregory Dufford (Clarinet), Harold Stein (Saxophone), Rufus Olivier (Bassoon), William Klingelhofer (French Horn), David Burkhart (Trumpet), J. Elwood Williams (Trombone), Floyd O. Cooley (Tuba), Anthony J. Cirone (Percussion), Marjorie Chauvel (Harp), Charles A. Ferguson (Guitar), Herbert Myers (Early Winds), Harlan Hokin (Early Voice), Michael B. West (Glee Club), Mayumi Ohira (Violin), Bernard Zaslav (Viola), Members, Stanford String Quartet, Ensemble in Residence
Visiting Professor Emeritus: John Pierce Visiting Professor: Fenner Douglass
*Member of Stanford String Quartet

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, Campbell Recital Hall, and the Knoll, including two theaters for concert and operatic productions, a choral rehearsal hall, an orchestral rehearsal hall, 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 departmental library contains a comprehensive collection of complete editions, scores, books, and records. Supplementing this is the Stanford Memorial Library of Music, which is an invaluable collection of musical manuscripts and first editions.

The Music Department has 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

Undergraduate Major—May be planned in one of three ways depending on whether the student wishes:

1) A concentration in composition, performance, or music history.
2) Preparation for secondary school teaching.
3) A general program of studies without special emphasis on any particular branch of music.
The plan in each case will be drafted by the student and his or her advisor to include certain required work as outlined below plus electives which take into account the individual's particular talent and interest.

To ensure a strong foundation for the individual concentrations, all students are required:

A. To include the following courses in their programs:
   1. Music 21-22 (Elements of Music)
   2. Music 23 (Functional Harmony)
   3. Music 24 (Elementary Tonal Counterpoint)
   5. Music 100, 101, 102, 103, 104, 121 and 122 (Music History and Theory)
   6. One elective from among the following topics: theory and composition, history and literature, conducting, or performance practices. Music 199 and honors projects will not satisfy this requirement.
   7. Individual studies in performance: six quarters
   8. Ensemble: six quarters of work in one or more departmental organizations or in chamber music, excluding Music 161C (Sports Activity Band) and Music 167 (Glee Club).

B. To demonstrate a minimum proficiency in piano, which will include sight-reading of works at the level of Clementi sonatinas as well as playing two prepared pieces comparable in difficulty to Bartok's Mikrokosmos, Book 4. This requirement should be fulfilled as early as possible and not later than the beginning of the junior year.

C. To demonstrate ability to hear music accurately and to perform it at sight. These skills will be checked by two examinations, the first to be taken upon completing Music 22, the second to be taken in the first quarter of the senior year.

The sample schedule given below shows how the University Distribution Requirements may be fulfilled so as to permit substantial work in music during the freshman and sophomore years. Note the inclusion of foreign language study, which is strongly recommended for all music majors and especially for those expecting to continue into graduate work.

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**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>English* (2 quarters writing)</td>
<td>3</td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>Music 21,22,22S,23,23S</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>
</tr>
<tr>
<td>Choice of Foreign Language, Freshman Seminar, Western Culture or University Distribution requirement</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>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 24,24S</td>
<td>4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Music 100, 101, 102, 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>University Distribution Requirement</td>
<td>3-5</td>
<td>3-5</td>
<td>3-5</td>
</tr>
<tr>
<td>Elective (or Music 23 in autumn if not taken previously)</td>
<td>3-5</td>
<td>(3)†</td>
<td>(3)†</td>
</tr>
</tbody>
</table>

**THIRD YEAR**

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 103, 104, 122, Music Elective</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

* (English or Music 21 may begin Winter Quarter. If Music 21 and 22 are taken in Winter and Spring Quarters of first year, Music 23 must be taken in Autumn Quarter of second year).
† Optional

**HONORS PROGRAM IN MUSIC**

The department offers a special program for undergraduate majors leading to honors in music. Eligibility for this program consists of a marked ability in composition, performance, or music history, as indicated by grade average and recommendations from members of the faculty. The program, in addition to the regular requirements for the major, consists of a special honors project undertaken for the duration of one or two quarters of the senior year. Application for the program must be made well before the end of the Spring of the junior year.

**GRADUATE 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: (a) to demonstrate proficiency in piano equal to that specified in the A.B. program; (b) to demonstrate a reading
knowledge of one foreign language chosen from French, German, or Italian; (c) to take placement tests in theory and music history.

Students whose previous preparation proves insufficient must expect to spend more than the minimum time in residence.

None of Stanford's required undergraduate courses in music may be credited toward an advanced degree.

Only work that receives a grade of A, B, or plus will be recognized as fulfilling the advanced degree requirements in music.

Doctoral candidates working in absentia on Ph.D. dissertations or D.M.A. final projects which require consultation with faculty members must continue enrollment in the University under the heading of Terminal Graduate Registration.

Teaching—All fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at 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: (a) four term projects; (b) a final project; and (c) a public lecture-demonstration.

Candidates in performance practice will make an extensive study of historical styles of performance, technique, and repertory, leading to four demonstrations of their ability to give performances of music from different historical periods. Each demonstration is to be supported by a written document covering questions of analysis and performance practice. Candidates who major in voice or an instrument may present a public recital as one demonstration of the four required.

Candidates in composition will be expected to produce a number of original works demonstrating their ability to compose in a variety of forms and for the common media of vocal and instrumental music. Insofar as possible, the works submitted will be presented in public performance prepared by the composer.

Final Project—(1) composition: an extended work for instruments, voices, or electronic media; (2) performance: possibilities open to the candidate include (a) preparing a modern performing edition of an early score; and (b) writing an extended critical or historical essay on a selected problem or phase of performance practice.

Public Lecture-Demonstration—This is to be given during the last quarter of residence. It should be about one hour in length, dealing with some aspect(s) of the candidate's final work.

Foreign Language Requirements—All students are required to demonstrate a reading knowledge of French, German, or Italian. Concentrators in performance are further required by the end of their first year of doctoral study to demonstrate reading ability in a second language chosen from the three listed above.

Departmental Examinations—(1) a qualifying examination consisting of written and oral tests in the general field of music history, no later than the fifth quarter of full-time 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.
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, Spr (Houle)
2A. The Symphony. (DR:2)
   3 units, Win (Barnes)
2B. The Concerto.
   3 units, (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 (Staff)
4C. The Music of Beethoven.
   3 units Spr (Bauman)
4D. The Operas of Mozart. (DR:2)
   3 units, Aut (Berger)
4E. The Music of Debussy and Ravel.
   3 units, Win (Ratner)
5A. Music in America. (DR:2)
   3 units, Aut (Cohen)
   alternate years, given 1986-87
5B. Music for Organ, An Introduction.
   3 units Aut (Douglas)
6D. Technology and Musical Expression—
   (Enroll in VTSS 165.)
   4 units, Spr (Good)
6E. The Mathematics of Music—The mathematical aspects of music theory and composition from the Middle Ages to the present. Readings and projects in musical analysis and composition.
   3 units, Spr (Nahay)
19. Introduction to Music Theory—A preparatory course in the fundamentals of music notation, basic sight reading, sight singing, ear training, keyboard harmony, and melodic, rhythmic, harmonic dictation. This is a skill oriented course, using piano and voice as basic tools to develop listening and reading skills. Enrollment: for non-music majors and music majors who are unable to pass the proficiency test for entry to Music 21.
   3 units, Spr (Staff)
   Win (Nahay)

FOUNDATION COURSES FOR
A.B. MAJOR

21. Introduction to the Language and Structure of Western Music—The elements of melody, rhythm, harmony and texture are studied through analysis, composition, and exercises in practical musicianship. Students intending to continue with Music 22-24 who do not have piano proficiency should begin Music 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 (Nahay, Staff)
   Win (Nahay)
22. Elements of Music—A continuation of Music 21, with emphasis on contrapuntal writing: modal and species counterpoint. Use of
keyboard, ear training and sight singing will underlie all written work. Lecture and laboratory sections. Prerequisite: 21.

3 units, Win (Barnes)
   Spr (Nahay)

225. 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 (Nahay)

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 (Bauman)

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. (DR:2)
4 units, Win (Houle)

102. Music History: Classic — Prerequisite: 24.
4 units, Spr (Bauman)

103. Music History: Romantic—Prerequisite: 102. (DR:2)
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 (Nahay)

123. Composition—Individual projects in creative work. May be repeated for credit. Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Smith)

125. Modal Counterpoint.
3 units, (Berger)

126. Tonal Counterpoint—Prerequisite: 103.
3 units (Ratner)

127. Orchestration—Prerequisite: 23.
3 units, Aut (Barnes)

220A. Fundamentals of Computer-Generated Sound—Introduction to computer sound generation, basic mathematics of signal processing, and computer programming. Prerequisite: experience in musical composition or consent of instructor.
4 units, Aut (Chowning, Smith)

220B. Compositional Algorithms, Psychoacoustics, and Spatial Processing—Use of high-level programming language as a compositional aid in creating complex musical structures. Studies in the physical correlates to auditory perception, theories of hearing, and review of psychoacoustic literature. Simulation of a reverberant space and the control of the position of sound within the space. Prerequisite: 220A.
4 units, Win (Chowning, Smith)

220C. Research—Research projects in composition, psychoacoustics, or signal processing. Prerequisite: 220B.
4 units, Aut, (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. Solfege and Score Reading.
225.
4 units, Spr (Barnes)

225. 4 units, (Barnes)

HISTORY AND LITERATURE
OF MUSIC

Unless otherwise stated, prerequisite for any course in this section is 103.

140. Studies in Medieval and Renaissance Music—Prerequisite: 100.

140E. The Music of Guillaume Dufay.
4 units (Mahrt)


4 units, Spr (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, Win (Berger)

4 units, (Mahrt)

143B. The Music of Brahms.  
4 units, (Smith)

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)

150D. Organology of Early Keyboard Instruments. 
4 units, Win (Douglass)

153. Organ Literature. 

153A. Organ Music (Cabezón to Bach).  
4 units (Staff)

153B. Organ Music (Bach to Ligeti).  
4 units (Staff)

198. Senior Honors Project.  
4 units (Staff)

199. Independent Study—For advanced undergraduates who wish to do work outside the regular curriculum. Before registering for this, a student must present a specific project and must enlist a faculty sponsor. Credit up to 4 units per quarter.

251. Choral Repertory (1500-1750).  
4 units, Win (Ramsey)

252. Choral Repertory (1750 to Present).  
4 units, Spr (Ramsey)

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 (Ng-Quinn)

65C. Voice Class—For Credential candidates, music majors, and non-majors who are members of departmental performing organizations.  
1 unit, Aut, Win, Spr (Wait, Hokin)

65D. Percussion Class—For Credential candidates.  
1 unit, Spr (Cirone)

72, 73, 74, 75, 76, 77. Small Group Instruction—A special fee of $50 per quarter is charged for enrollment in any of these groups.  
1 unit, Aut, Win, Spr (Staff)

72. Piano Class—For intermediate students.  
(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 $100 per quarter for majors and $200 for non-majors is charged for enrollment in these courses. Students who wish to enroll in individual instruction must demonstrate, by audition with the appropriate teacher, a minimum proficiency on his or her instrument. Minimum repertory lists for each instrument are available at the Music Department office.  
3 units, Aut, Win, Spr


172A, 272A. Piano.  
(Baller, Gandolfi, Ng-Quinn, Sparrow)

172B, 272B. Organ.  
(Douglass)

172C, 272C. Harpsichord.  
(Fabrizio)

172E, 272E. Early Piano.  
(Fabrizio)

(Bettina, Wait)
174.274. Stringed Instruments.

174A,274A. Violin.
(Kleyman, Ohira, Toth)

174B,274B. Viola.
(Kleyman, Zaslav)

174C,274C. Violoncello.
(Harrison, Rowell)

174D,274D. Contrabass.
(Tramontozzi)

174E,274E. Viola da Gamba.
(Staff)

174F,274F. Classical Guitar.
(Ferguson)

(Chauvel)

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)

177,277. Percussion.
(Cirone)

PRACTICES

130. Orchestral Conducting—Prerequisite: 127.

130A. 3 units, Win (Toth)

130B. 3 units, Spr (Toth)

131. Choral Conducting.

131A. 3 units (Ramsey)

131B. 3 units (Ramsey)
alternate years, given 1986-87

4 units, Aut (Houle)

180. Diction for Singers.

180A. Italian.
1 unit, Spr (Staff)

180D. English.
1 unit, Win (Staff)

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 (Mahrt) given 1986-87

269B. Renaissance.
4 units, Win (Houle)

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 (Nahay) T 4:15-6:05

159. Early Music Ensembles.

159A. Early Music Singers.
1 unit, Aut, Win, Spr (Staff)

159B. Renaissance Wind Band.
1 unit, Aut, Win, Spr (Houle, Myers)

160. University Orchestra.
1 unit, Aut, Win, Spr (Toth)
MTh 7:15 p.m.
161. University Bands.

161B. Studio Band.
1 unit, Aut, Win, Spr (Barnes)
by arrangement

161C. Sports Activity Bands.
1 unit, 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 and 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) TTh 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)

171. Performance Special—For students who take part in performances organized in Music 369 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 (Staff)

201. Graduate Review in Musical Analysis.
4 units, Aut (Nahay)

211. History of Music Theory.
4 units, Aut (Cohen)

221B. Baroque Through Modern.
4 units, Win (Cohen)

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, (Mahrt)
300B. 4 units, (Mahrt)
300C. 4 units, (Mahrt)
alternate years, given 1986-87

301. Seminar in Music History and Analysis.
4 units, Aut, Win, Spr (Smith, Bauman, Berger)

302. Research in Musicology.
Aut, Win, Spr (Staff)
by arrangement

310. Seminar in Research.
4 units, Aut, Win, Spr (Bauman, Berger)

321. Readings in Music Theory.
3 units, any quarter (Staff)
by arrangement

323. D.M.A. Term Projects in Composition.
4 units, Aut, Win, Spr (Smith)

330. D.M.A. Term Projects in Conducting.
4 units, Aut, Win, Spr (Ramsey, Toth)

any quarter (Staff) by arrangement

369. D.M.A. Term Projects in Performance.
369A. Early Music to 1800.
4 units, Aut, Win, Spr (Staff)

369B. Music From 1800 to the Present.
4 units, Aut, Win, Spr (Staff)

369C. D.M.A. Recital.
4 units, Aut, Win, Spr (Staff)

399. D.M.A. Final Project.
any quarter (Staff) by arrangement
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 works 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 and/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, however. In general, students can study overseas for one, two, or three quarters. Tuition overseas is the same each quarter as on the home campus and the overseas fee closely approximates the quarterly room and board fees on the home campus.

All courses taken overseas receive regular University credit. Courses taken at an overseas studies center will satisfy Distribution Requirements according to the "DR: designation 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. More up to date information about departmental credit for overseas courses may be obtained at the Overseas Studies Office.

Application deadlines for Berlin, Florence, Tours, and Vienna are:
To begin Spring Quarter, 1985-86
   November 22, 1985
To begin Summer Quarter, 1985-86
   January 31, 1986
To begin Autumn Quarter, 1986-87
   March 7, 1986
To begin Winter Quarter, 1986-87
   May 23, 1986

Application deadline for the advanced language university-based programs (Paris, Berlin-FU, Salamanca, Lima, São Paulo, Cairo, and Lome) is January 31, 1986. Applications for the fall semester Haifa program 1986-87 are due November 22, 1985. Applications for Winter Semester Haifa Program (corresponds to Stanford's Winter and Spring Quarters) are due on May 23, 1986. For more information about offerings, requirements, fees, and application deadlines, see the publication Stanford Overseas Studies, 1985-86 or the appropriate program folder, both available in the Overseas Studies Office, room 112, Old Union.

More detailed information about courses described below can be found in the Overseas Studies Course Abstracts. Courses are not listed for the FU-Berlin, Haifa, Paris, São Paulo or Salamanca programs because students choose from among the courses offered at the university in which they are enrolled.

STANFORD PROGRAM IN BERLIN

Academic and administrative personnel:
Director: Karen Kramer
Assistant Director: Hannelore Noack
Faculty: Maria Biege, Thomas Connolly, Stephen Economides, Lawrence Friedlander, Eike Gebhardt, Manfred Görtemaker, Franz Neckenig, Hermann Rupieper, Frieder Wolf

SOCIAL SCIENCES, NATURAL SCIENCES AND TECHNOLOGY

60B. The Holocaust: The German-Jewish Experience—(Also listed as English 60B.) The Holocaust, the single most traumatic experience in recent western history, is a kind of touchstone for understanding Germany and German attempts to deal with the past. Course material covers history of the Nazi Period, some representative German works about the Second World War and the Holocaust, and some Jewish responses.

4-5 units, Win (Friedlander)
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 Ger-
mans; the economic miracle; detente; the Ger-
man student rebellion; SPD/FDP coalition;
German terrorism; the coming to power of the
CDU; and the emergence of the Green and
Alternative movements. (DR:5)
5 units, Aut (Nockenig)

132. Germany and the European Community
—(Also listed as History 132.) An exploration of
the origins of the European Community which
includes both historical study of the events and
issues leading to its creation, and analysis of its
contemporary functions.
5 units, Win (Wolfe)

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 deals with
both East and West Germany and tries to take
advantage of the unique opportunities of Berlin
for field trips and films. (DR:5)
4-5 units, Spr (Rupieper)

140W. Ecology and Social Policy—Course
investigates the special problems of dissent and
deviance arising in Germany, and the attempts
to integrate or excommunicate dissenting
groups. Students discuss problems compound-
ed by the uncertainties of democratic traditions.
The class studies the social movements that
have emerged in response to problems such as
the nuclear arms race, the paranoia about rad-
icals, the squatter's movement, etc. Special
emphasis on ecological problems and the
Greens.
4-5 units, Aut (Gebhardt)

140X. The German Federal Republic in the
International System—(Also listed as Political
Science 140X.) Deals with emergence of West
Germany's Foreign Policy since the early
1950s. Special attention is given to the changing
international and domestic conditions (political
and economic) which have influenced the Fed-
eral Republic in its international environment,
especially those which have an impact on Ger-
an-American relations and the role of the
Federal Republic in the East-West conflict.
(DR:5)
4-5 units, Win (Gortemaker)

141X. Beyond the Nation State: Europeanism
and the Idea of Eternal Peace—(Also listed as
Political Science 141X.) Based on a clear grasp
of some unsolved conceptual problems of the
modern nation state, there will be an attempt
made to analyse the perspectives of transnation-
al politics, especially of European unification
and other approaches to transcend the problem
of war inherent in the constitution of the
modern nation state. The course will be divided
into 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. Themes
will be carried from the classical to current
times.
5 units, Win (Wolfe)

180. Energy and Society—(Also listed as Engi-
neering 180.) Course will cover the production,
distribution, and consumption of energy in the
world with some emphasis on the statistics for
the Federal Republic of Germany and the Euro-
pean community compared to the U.S. Topics
will include: kinds and magnitudes of energy
resources relative to current consumption; the
projection of future energy demand; the tech-
nological options for conversion of primary
energy resources to electricity and other forms;
social conflicts between growing demands and
environmental degradation. This course is
quantitative without being highly mathemat-
cal. Non-engineering students are encour-
gaged to discuss the course with the instructor.
(DR:8)
3-5 units, Aut (Connolly)

181. Contemporary International Cinema —
(Also listed as Communications 181.) An intro-
duction to the semiotics of film and general
introduction to film and ways of seeing. Course
culminates in intensive participation in the Ber-
lin Film Festival, which students will receive
passes to attend. Students are asked to com-
plete individual projects during the festival.
4 units, Win (Friedlander)

OVERSEAS STUDIES 509
their historical, literary and socio-political context. Attendance at theatrical productions from the classical and modern repertory in both East and West Berlin will be an integral part of the course.

5 units, Aut (Kramer)

101B. German Theater— (Also listed as Drama 101B.) Plays and productions of German theater discussed in their historical, literary and sociopolitical context. Attendance at theatrical productions from the classical and modern repertory in both East and West Berlin will be an integral part of the course. No prerequisites. (DR:2)

4 units, Spr (Kramer)

120X. New Ways of Seeing — (Also listed as Art 120X.) Attempt to interpret 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)

122X. German Art between Romanticism and New Sobriety — (Also listed as Art 122X.) German art (architecture, sculpture and painting) between 1780 and 1920 is situated in the epochs of the bourgeois emancipation (1780-1830), of the Industrial Revolution (1830-1870), and of Imperial Germany (1871-1918/19). The class is intended to demonstrate through examination of function, use and relevance of the art works and their public reception, the relation between art and social reality. The course also will present the development of art styles, their characteristics each era and the ideological and spiritual preconditions. (DR:2)

4 units, Win (Neckenig)

123X. German Art in the Weimar Republic and the Nazi Reich— (Also listed as Art 123X.) An analysis of the active role that German art in the period 1919-1933 played in the general development of European art. This course will clarify the artistic preconditions, study the different schools of art between 1919 and 1933, and discuss 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)

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. Such developments as documentary literature, the death-of-literature discussions, and New Subjectivity. Feminist writings will be discussed in the context of changing political discourse.

5 units, Win (Kramer)

GERMAN LANGUAGE PROGRAM

60. Special Intensive German—Grammar, composition, reading, and conversation are covered in 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 will be covered in a course designed to increase students' fluency in German language as rapidly as possible and to help them take advantage of the many opportunities in Berlin.

6 units, Aut, Win, Spr (Staff)

80. Intermediate German—A course designed for students who wish to improve their knowledge of the German language and begin reading texts from such areas as history, literature, politics, and economics.

3-4 units, Aut, Win, Spr (Staff)

90. Advanced German—Course is for advanced students who wish to expand their knowledge of the German language and to become more familiar with the finer points of German grammar and style.

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

Academic and administrative personnel:
Director: Giuseppe Mammarella
Assistant Director: Carla Lekai
Language Program Coordinator: Joan M. Mammarella
Faculty: Franca Celli, Napoleone Colajanni, Roberto D'Allmonte, W. S. DiPiero, Mark Draghi, Guello Frulla, Umberto Giovine, Paola Gori, Robert McGinn, Richard Randell, Giovanni Scichilone, Maria Todorow, Virginia Walbot
61. Plants, Food, and People—(Also listed as Biology 61.) Course will examine the impact of a changing agricultural technology on Italian life and teach the basic principles of plant biology as they relate to crop productivity. Starting with a description of the Italian diet in Roman times, trees and shrubs used for wood and fiber, and common medicinal plants, it will trace the impact of introduced plant species on life and agriculture in Roman, Renaissance, and modern times. Topics will include modern molecular biological methods, the regulation of agriculture in Italy, and the government role in supporting agricultural research for national needs. Includes a visit to a typical Italian farm.

3-4 units, Spr (Walbot)

62. Italian Formal Gardens—(Also listed as Biology 62.) Seminar-lecture-field trip course will explore the basic principles of Italian formal garden design and how they reflect the Italian appreciation and use of nature. There will be visits to four famous local gardens and to some of the city parks in Florence to make sketches of basic design and special features which will be part of a book kept at the Vila on life in Florence. The class will also observe the Villa garden and possibly use the greenhouses to propagate plants.

3-4 units, Spr (Walbot)

110X. Contemporary Italian History and Politics—(Also listed as Political Science 110X.) A close look at the Italian political system and how it functions as seen by following the day to day political events of government through the news media. Guests for lectures and discussions will be current political figures. (DR:5)

5 units, Aut, Spr (Mammarella)

115. Firenze nel Rinascimento—(Also listed as History 115.) A study of Florentine civilization from Dante to Machiavelli, including intellectual and political history. Students visit important Florentine sites of the Renaissance. (DR:3)

5 units, Win (Frulla)

118. Resorgimento to Fascism: 1860-1922—(Also listed as History 118.) Course is 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 will be particularly emphasized.

5 units, Aut (Mammarella)

123W. Technology and Society in Italy—(Also listed as Sociology 123W, VTSS 101A.) Course will explore the impact of modern technology and industrialization on Italian society since the turn of the 20th century. Materials will be drawn from: anthropology, history, literature, and public policy. Key issues will include: the nature of technology in traditional and modern forms; the course of Italian industrialization in the 20th century, particularly as conditioned by cultural and social as well as techno-economic factors; the impact of modernization on traditional Italian culture; the early reception of industrialization in the sphere of Italian culture; transformation of daily life; residues of traditional Italian culture in the industrial era; the interplay of matters technological and cultural in selected Italian public policies (as compared with the United States).

4 units, Aut (McGinn)

124W. Work and Society in Italy—(Also listed as Sociology 124W.) The purpose of this class is to understand the changing nature, structure, and problems of the institution of work in Italy, particularly as conditioned by rapid social and technological change. Part I is an historical perspective exploring how industrialization affected the structure, contours, and content of work in Italy and the effects of the labor union tradition. Part II investigates various aspects of the contemporary work scene in Italy, using economic, sociological, and anthropological analytic perspectives to focus on the contrasts in the evolution of work between Italy and the U.S. as a function of cultural and political differences. (DR:5)

4 units, Aut (McGinn)

125X. Comparative European Institutions—(Course is intended as an introduction to Western European Politics combining a thematic approach with a country-based analysis. Most of the material is grouped by topic to allow for comparison. The country-based type of analysis will be 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. Topics such as constitutional models, parties and party systems, electoral trends and electoral systems, and the development of the “welfare” state will be treated in detail. The last section will be devoted to analysis of the European Economic Community and its future.)

4 units, Spr (D’Allimonte)

127X. Il Sistema Politico Italiano—Course is designed to give 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 will deal with the general trends of political and economic development.
SCHOOL OF HUMANITIES AND SCIENCES

and will emphasize the contrast between a rapidly expanding economy and a political system retaining many of the traditional features of rural society. Part II will focus on the institutional mechanisms of the state and on parties and interest groups. Prospects for regime change will be examined with emphasis on 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.) Deals with the economic, political, military, and cultural relations between the United States and Western Europe. Analyses the different American policies toward Europe from 1945 to 1982 within the framework of East-West relations. Particular stress is on the European answer at political and economic levels. Course is designed to give an understanding of European points of view toward American policy. (DR:5)

5 units, Spr (Mammarella)

180. Mediterranean Problems — After briefly reviewing the historical background, students will concentrate on developments in the Mediterranean area between the World Wars (particularly the partitioning of the Ottoman Empire), the Cold War, and the more recent problems associated with the Arab- Israeli conflict. (DR:5)

5 units, Aut (Giovine)

LITERATURE AND ARTS

5. Italian Opera—A historical and aesthetic introduction to some of the most outstanding Italian Operas for those students who are just beginning to take an interest in this beautiful and exciting subject. The course offers a brief outline of the history of Opera in Italy with particular emphasis on its Florentine origin and development.

4-5 units, Spr (Frulla)

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.) A study of the stylistic trends, iconography, and social history of Italian art, concentrating on Michelangelo and Raphael but including such artists as Bronzino, Vasari, Titian, Tintoretto, and Caravaggio. Particular emphasis will be given to the classical influence on the artists studied. (DR:2)

4 units, Win (Todorow)

112. A Drawing Study of Florentine Sculpture—(Also listed as Art 112.) Drawings will be used to intensify observation of sculpture and to develop awareness of the technical and conceptual problems involved in selected sculptures. Each week there will be classroom drawings as well as drawing at sculpture sites. Additional drawing assignments will be proposed as the course develops.

2 units, Aut (Randell)

Survey of Italian Literature—The following three courses constitute an Italian literature series offered partially in English and partially in Italian. Each course can be taken independently and there are no prequisites.

125A. Masterpieces of Italian Literature: Origins to Dante—(Also listed as Italian 125A.) (DR:2)

4-5 units, Spr (J. Mammarella)

125B. Masterpieces of Italian Literature I: 1900-1945—(Also listed as Italian 125B.) (DR:2)

4-5 units (Staff)

125C. Masterpieces of Italian Literature II: 1945 to Present—(Also listed as Italian 125C.) (DR:2)

4-5 units, Aut, Win (J. Mammarella)

154. The Art of Sculpture Since 1900—(Also listed as Art 154.) The progression of sculpture styles will be examined in terms of the artists' changing intent and purpose which accounts for the extraordinary appearance of sculpture to 1950. (DR:2)

3 units, Aut (Randell)

182. Images of Italy—(Also listed as English 182.) A consideration of Italian cultural and political life as it has been viewed, and in some instances imagined or recreated, by European and American writers. The readings will touch on many aspects of Italian history and customs, and will include such authors as Goethe, D.H. Lawrence, Henry James, Stendhal, Thomas Mann, and Bernard Malamud. (DR:2)

5 units, Win (DiPiero)

183. Seminar: Modern Italian Poetry—(Also listed as English 183.) A survey of the history of Italian poetry in the twentieth century. We will study the different literary movements that have shaped modern Italian poetry such as "Crepuscular" poetry, Hermeticism, and the New Classicism by concentrating on representative individual poets. These poets will include Gozzano, Ungaretti, Quasimodo, Montale, Scotellaro, and others. All texts will be bilingual editions. (DR:2)

5 units, Win (DiPiero)
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 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.

50. 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, Celli, Benini, Gori)

STANFORD PROGRAM IN OXFORD

Academic and administrative personnel:
Director: Geoffrey Tyack
Associate Director: Pamela Murray
Faculty: George Dekker, Gerald Meier, Morris Zelditch, David Brown, Sally Brown, Anna Clare Bryson, Nicholas Crafts, Martin Holmes, Ruth Mateer, Susan McRae, David Miles, Syed Rizvi, Trevor Rowley

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

114. Modern British Economy Since World War II — (Also listed as Economics 114.) A survey of 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, Win (Crafts)

114X. Modern British Government and Politics — (Also listed as Political Science 114X.) An introduction to the British party system, Cabinet government, Civil Service, Parliamentary powers, and extra-Parliamentary pressure groups in the context of post-war British history and issues of current importance (E.E.C. defenses, etc.) Recent elections will be analyzed.
4-5 units, Aut (Holmes)

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)

131W. Seminar: English Society in Film and Literature — (Also listed as Sociology 131.) Post-war fiction, drama, and film are used to study the underlying structure of English society and its variations by community, region, class, and gender. Topics include the English sense of loss of empire, the decline of its gentry and industrial spirit; changes in and reconstitution of the community; education and social mobility; changes in the condition of women, and the effects of these changes on marriage and the family; and the aging of the population and its care in a welfare state. Enrollment limited to 20. (DR:5)
5 units, Spr (Zelditch)

132X. The British Empire and the Commonwealth — (Also listed as History 144V.) An examination of British imperialism in the twentieth century and its legacy today. Topics covered will be the Commonwealth as an element in international affairs, immigration from the Commonwealth, trade with and aid to the Third World. (DR:5)
4-5 units, Spr (Rizvi)

134X. Seminar: From Colonial Economics to Developmental Economics — (Also listed as Economics 134X.) Topics include: Colonial Economics as demonstrated in studies of Africa, pre WW II, early development economics at Oxford in late 1940’s and early 1950’s, structuralist views, the resurgence of neo-classical economics, development record, and evolution of development thought. Prerequisite: Economics 1.
5 units, Aut (Meier)

138X. British Politics and the International System — (Also listed as Political Science 138X.) Course will cover British politics and international relations from 1935-1985. Topics include: Britain’s role in the Second World War, and afterwards in the EEC, defense policy, the relinquishment of the empire, formation of the nation, the Suez Crisis, Middle East, and Falkland Islands War.
4-5 units, Win (Holmes)
141. English History 1485-1688—(Also listed as History 141.) An 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, Spr (Bryson)

143A. British History 1780-1870—(Also listed as History 143A.) Examination of the development of Britain during a period of profound and far-reaching change in which she emerged as the world's first industrial nation. Underlying theme is of modernization: of the economy, of the political system, and of social structure and habits of thought. Course begins with an analytical survey of Britain at the time of the American Revolution and proceeds in a broadly chronological manner. The word "Britain" is taken to include Scotland and Ireland, as well as England. Foreign affairs and imperial development reviewed in so far as they impinged on national life and politics. (DR:5)
4-5 units, Aut (Tyack)

143B. British History 1870-1970—(Also listed as History 143B.) Tracing of 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 will be explained in their international context. Simultaneous examination of those internal developments which have contributed more 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)

151W. Seminar: Class in British Social Thought—(Also listed as Sociology 151W.) Seminar is concerned with the concept of "class" in British social thought, with particular emphasis on contemporary debates. Topics include "class" before Marx and Engels in England, and debate both inside and outside of English Marxism over the concept of "class" since the end of the Second World War. We will read Adam Ferguson, Engels, Marx, contemporary English Marxists, Thompson, Miliband, and Anderson, as well as contemporary British critiques and defenses of Marx. Enrollment limited to 20 (DR:3).
5 units, Spr (Zelditch)

168X. America and Britain in the World Economy—(Also listed as Economics 168X.) Course examines the position of America and Britain in relation to some major international economic problems. Considered in the first 3-4 weeks will be the features of the Bretton Woods agreement and the fundamental principles of the international monetary system and balance of payments policy, followed by an application of these principles to the post war evolution of the Bretton Woods system, the European Economic Community, the public policy implications of the internationalization process, and the current interest in international economic reform. Prerequisite: Economics 1.
5 units, Aut (Meier)

Tutorials in Science and Engineering may be arranged.

LITERATURE AND ARTS

5. British Art—(Also listed as Art 5.) A chronological survey of English paintings 1650-1900 focusing on the most important artists from Dely to Sickert and their major works. Field trips to museums are planned.
5 units, Win (Brown)

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 on archeological techniques. (DR:5)
4-5 units, Aut (Rowley, Miles)

173. Shakespeare—An in-depth study of major Shakespearean plays. Plays will be chosen according to theater performances available.
5 units, Spr (Brown)

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 twentieth century, using examples taken from Oxford and places within reasonably easy reach of the city. The analysis will be both stylistic and functional, and buildings will be related to their historical background. Subjects covered include: the rich variety of materials used; the influence of foreign ideas on English architecture; the rise of the professional architect during the seventeenth century; and the emergence of new types of building with changing historical circumstances, especially during the eighteenth and nineteenth centuries. Although most of the course will be devoted to the study of grand buildings like the Oxford Colleges, some time will also be spent on looking at the ordinary homes of the people. Students will be expected to spend a good deal of time looking at buildings for themselves. (DR:2)
4-5 units, Spr (Tyack)
180. English Literature, English Places—
(Also listed as English 180.) Chronologically,
the course deals with texts written as far apart as
1650 and 1950. Generically, it includes both
poetry and prose fiction. One purpose is to trace
some of the shifting literary perspectives on
English landscape and townscape which
develop as the nation gradually changes from an
agrarian to an industrial economy and as its
population becomes increasingly urbanized.
One of the main questions we will seek to
answer is: how does "description" function in
literature? What constitutes the "placeness" of
English places? (DR:2)
5 units, Aut (Dekker)

181. Modern British Literature as Social
Thought—(Also listed as English 181, Sociology
144W.) Course will include novels, films, and
theatre visits, concentrates on examining class
relationships in 20th century English society.
Topics include: the role of the aristocracy;
images of the country house; the impact of the
two world wars; ideas of Oxford; the position of
women; and the development of the novel from
Hardy to Fowles. We will compare films with
novels and films with plays, drawing on the
particularly innovative British film industry of
the 1960's.
5 units, Win (Bartholomew)

554. Contemporary British Theater—A sur-
vey of contemporary British drama in the con-
text of the development of the twentieth cen-
tury theater. Students will view many theatrical
performances. (DR:2)
5 units, Win (Mateer)

STANFORD PROGRAM
IN TOURS

Academic and administrative personnel:
Director: Paul LeMoal
Assistant Director: Claude Doubinsky
Assistant Director: Anne Durand
Faculty: Patrick Baleyraud, Jean Noel Billard,
Gerald Chaix, Daniel Dayan, André Gorgues,
Nancy Green, Michelle Jomaron, Guy
Leboucher, Ségolène LeMen, Pauline
Newman-Gordon, Francoise Perdoux, Robert
Sauzet, Eric Smee, Steven Uran

SURVEY COURSES

It is suggested that each quarter students take
one survey course from among the following:

120. 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, as well
as on the chief artistic techniques used over the
centuries. Field trips are organized to cities and
museums. (DR:2)
4 units, Win (DuFresne)

120B. History of Art: Baroque in France and
Europe—Students are acquainted with the
masterpieces of French art. Lectures will focus
on the architecture and interior decoration of
castles and palaces, on painting and sculptures,
as well as on the chief artistic techniques. Slides
will illustrate the study of each significant work,
each lecture being intended to encourage stu-
dents to visit, in their own free time, the re-
gions, cities and museums where these works
can be found. Field trips will be organized to
museums and cities. (DR:2)
4 units, Spr (DuFresne)

129. Mythologies Historiques de la France: de
Jeanne d'Arc a Mitterand—(Also listed as His-
tory 129.) The great French historical figures
from Joan of Arc to President Mitterrand are
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, Aut (Chaix)

130A. Survey of French History to 1789 —
(Also listed as History 130A.) General introduc-
tion to the political, social, and cultural history
of France from the Medieval period thru the
Ancient Regime, the Enlightenment, the In-
dustrial Revolution, and the French Revolu-
tion. (DR:5)
5 units, Win (Green)

130B. Survey of French History: 1789 to Pres-
ent—(Also listed as History 130B.) A chrono-
logical and thematic approach to modern
French history from the French Revolution to
the present, covering political, social, and eco-
nomic developments of the period. Throughout
the quarter, the class discusses basic questions
such as how were the French Republics con-
stituted, what was the nature of republicanism,
what forces threatened it, and how they were
overcome. (DR:5)
5 units, Spr (Green)

131T. French Literature Survey: Seventeenth
Century—(Also listed as French 131T.) Empha-
sis is on the works and authors that made the
most significant contributions to western liter-
ary culture. The seventeenth century is viewed
as the Age of Classicism. Starting with a brief
introduction to the main features of Renaissance
Humanism as they relate to intellectual devel-
opments in the seventeenth century, lectures
focus on the pessimistic vision of the French
morality (Pascal, La Rochefoucauld, La
Bruyere, Madame de Lafayette) and on some of the most important plays of Corneille, Racine, and Moliere. (DR:2)

4 units, Aut (Doubinsky)

132T. French Literature Survey: Nineteenth Century—(Also listed as French 132T.) A survey of the evolution of the 19th century French novel which will focus on works by Stendhal, Balzac, Flaubert and Zola. Works by these novelists will be studied in detail not only for their intrinsic literary qualities but also because, taken together, they trace the progression of realism in French fiction. (DR:2)

4 units, Win (Doubinsky)

133T. Survey of French Literature: Twentieth Century—(Also listed as French 133T.) Course studies some of the masterworks of the twentieth 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)

4 units, Spr (Doubinsky)

SOCIAL SCIENCES, AND NATURAL SCIENCES

111X. La politique française contemporaine —(Also listed as Political Science 111X.) Two major aspects of the French political system, political institutions under the Fifth Republic and agents of political action (such as political parties and pressure groups), will be studied. Comparisons with the American political system will be an integral part of the course. (DR:5)

5 units, Win (Billard)

114T. Modern French Novel—(Also listed as French 114T.) Course traces the evolution of the French novel in the first half of the twentieth century. Dwelling upon the transition between the heroic main character and the character as anti-hero, the role of the writer from dispenser of answers to seeker of answers, and the description of an orderly universe to that of an existential and absurd universe. Also discussed will be the plot, characters, chronology, changes in language, and the effect of the subconscious on behavior. (DR:2)

4-5 units, Aut (Newman-Gordon)

120X. La politique extérieure de la France—(Also listed as Political Science 120X.) France's role in, and reaction to the international problems produced by the Cold War and the ensuing policies of detente will be the focus of this course (DR:5)

5 units, Aut, Spr (Billard)

122X. L'économie de la France moderne—(Also listed as Economics 122X.) Contemporary French economy will be studied in terms of the diverse traditions and economic activities of the various regions of the country. The economy of the Tours region will provide a special focus of attention. French international economics will also be discussed.

5 units, Win (Leboucher)

128X. Les Problemes contemporains de la croissance economique—(Also listed as Economics 128X.) An investigation of the concept of economic growth which will include its definition and measurement, short term and long range consequences, relationship to inflation, and its specific expression on the French economy.

5 units, Aut (Leboucher)

140. 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. Course begins with a brief historical introduction to France's legacy of colonization and the economic, military, and technical issues that it raised. The first half of the course deals with France's relations with both Maghreb (Tunisia, Algeria, Morocco) and Black Africa. Beginning with DeGaulle's policies, course will trace 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 of discussion: 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)

5 units, Win (Billard)

FRENCH LANGUAGE, LITERATURE AND ARTS

115T. L'Existentialisme Litte'raire — (Also listed as French 115T.) An approach to the literary expression of existentialism through the studies of representative works. Emphasis is 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 are centered around Camus and Sartre. (DR:2)

4 units, Spr (Jomaron)

119. Introduction to French Art: Romanesque to Renaissance—(Also so listed as Art 119-)

Introduces students to 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)

131W. The New French Cinema: A Sociological Approach—(Also listed as Sociology 131W.)

It is impossible to use film as a social revealer and reflection of beliefs, values, behavior and outlook of the society that gave birth to it without the help of an adequate critical apparatus. Based on some of the most novel French films, lectures and discussions will focus on technical and social conditions of film production, reception, criticism, ideological and documentary functions. The course familiarizes American students with methods of film analysis and the problems of modern French society.

4 units, Spr (Galinoé)

172T. Seminar: Proust—(Also listed as French 172T.)

Readings include Swann’s Way, Guermantes’ Way, and a portion of Time Regained. Discussion will center on the relationship between the novelist and his characters, the narrator’s philosophical and esthetic itinerary, the classification of the novel as philosophical, psychological, historical, or analytical, and the insights it affords in terms of man’s search for identity. Fieldtrips will allow for the integration of sightseeing with discovery of text.

4-5 units, Win (Newman-Gordon)

173T. Symbolism—(Also listed as French 173T.)

Course will investigate Baudelaire’s use of the word “symbol” and his theory of correspondences as part of the poet’s quest for wholeness and mastery over his destiny. Similar concerns will be identified in the poetry of Verlaine, Rimbaud, Mallarme, and others with an attempt to explain their use of the term “Symbolism”, its formation, history, and values. Some attention will be paid to offshoots of the Symbolist movement and there will be an optional field trip to the Jeu de Paume Museum in Paris. (DR:2)

4-5 units, Win (Newman-Gordon)

180T. Modern French Poetry—(Also listed as French 180T.)

Course is conceived as an introduction to the works of modern French poets; masters, descendants and contemporaries. The following questions will be asked: How has modern poetry been affected by such trends as Symbolism, Cubism, Surrealism, Existentialism? How has the Marxist oriented review “Tel Quel” formulated esthetic concerns relevant to poetic expression? Special emphasis will be placed on three poets of the Loire region: DuBellay, a sixteenth century poet who wrote in an elegiac vein, will be used as a point of comparison when we discuss the breakdown of traditional distinctions and the rejection of re-

9-4 units, Aut (Newman-Gordon)

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 — This will be an 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, through examples taken mostly from contemporary sources.

4 units, Spr (LeMoal)

STANFORD PROGRAM

IN VIENNA

Academic and administrative personnel:

Director: Siegfried Korninger

Associate Director: Hedwig Thimig

Language Program Coordinator: Margaret Mehrl

Faculty: Roswitha Benesch, Hans Heinrich, Maximilian Peyfuss, William Ramsey, Wendelin Schmidt-Dengler, Gottfried Scholz, Robert Textor, Karl Vocelka, Karl Wagner

SOCIAL SCIENCES AND NATURAL SCIENCES

69. Ethnographic Futures Research—(Also listed as Anthropology 69.) Seminar and practicum offering instruction in the rationale and conduct of Ethnographic Futures research (EFR), in local settings. EFR is an auxiliary technique for research on sociocultural change, a means of augmenting conventional planning and policy-making approaches, and an educational technique for both interviewer and interviewee. Students are expected to collect, analyze, interpret, and write-up their own field data.

4-5 units, Aut (Textor)
113X. Poland and Eastern Europe—(Also listed as Political Science 113X.) Main purpose is to generate awareness of Poland's key role in European politics. Poland's peculiar features are explained by its unique historical development and in a comparative analysis. The present Polish social, economic and political systems are contrasted with those of other East European societies. (DR:5)
4-5 units, Spr (Heinrich)

123. Austria and Southeast Europe—(Also listed as History 123.) The role of Austria in the history of Southeastern Europe will be examined from the time of the Ottoman onslaught through the Christian liberation, the two World Wars and the Soviet aftermath. (DR:5)
4 units, Win (Peyfuss)

123X. Austrian Politics in Comparative Perspectives—(Also listed as Political Science 123X.) Students will be introduced to the characteristics of Western European government by discussing the development of Austria's political traditions and institutions. Austria's economic and social stability appears rather remarkable to outside observers. The course will emphasize various aspects of Austrian politics and especially stress those which have contributed to Austria's positive performance in the past. Issues will be studied in a comparative perspective (starting with a framework of comparative political analysis)
4 units, Win (Gerlich)

130X. Eastern Europe Since 1945—(Also listed as Political Science 130X.) Course explores 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. Special attention will be given to the analysis of decision making processes under the specific economic social and political constraints characteristic of the East European area. (DR:5)
4 units, Win (Gerlich)

133B. A Survey of Habsburg History—(Also listed as History 133B.) An introduction to historical problems of Central Europe under Habsburg rule from the late Middle Ages to the beginning of the First World War. Emphasis is on the extension of Habsburg dominion, the internal structures of these territories, and the economic, social and cultural development of the Habsburg lands. Topics include the problems of industrialization, the secularization and centralization of the state, and the difficulties of a multinational empire. (DR:5)
4 units, Aut (Vocelka)

134B. Austrian History 1918-1980—(Also listed as History 134B.) Course covers the thorny path which led from the collapse of the Habsburg Empire to the present prosperity and stability of the tiny Austrian Republic. Material covers economic, social, and political inheritance of the Austro-Hungarian Monarchy, problems of Austrian national identity, international economic crisis, Anschluss and World War II, and finally, statehood and neutrality in 1955. Role of Austria as mediator between East and West is explored.
4 units, Win (Vocelka)

5. Opera and Operetta in Vienna—Course will deal primarily with 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. The development of the Viennese waltz and operetta and the changing self-image of Viennese society as viewed through opera will be explored. The choice of specific operas for discussion will be co-ordinated with the current repertoire of the Vienna Opera.
4 units, Aut, Spr (Larson)

11A. Art and Museums 1500-1800—(Also listed as Art 11A.) A study of the development of European art and architecture from the sixteenth to the eighteenth centuries. Special emphasis will be placed on works of art in the Kunsthistorisches Museum in Vienna and on Viennese architecture of this period. (Enrollment limited to 20 students.)
4 units, Aut, Spr (Benesch)

11B. Art and Museums in Vienna: 1800-Present—(Also listed as Art 11B.) The major focus of this course will be on Viennese and Austrian art of the last two centuries, including comparisons with the mainstreams of European art during this period. (Enrollment limited to 20 students.)
4 units, Win (Benesch)

18. Journal Keeping—Course will meet once a week to discuss selected excerpts from the journals that members of the class will keep during their stay overseas. Each student will start with a loosely defined problem orientation, but is encouraged to record some of the vast array of unanticipated events and episodes that happen in the course of travel and study in a foreign culture. Students will be firmly encouraged
keep two separate journals, one “sharable”, to be read by the professor and in class, and one private to record personal impressions, feelings, and anxieties.

3 units, Aut (Textor)

50. Choral Music of Central Europe—A survey of the choral genre, tracing its development from the 18th century to the present. Lectures include structure and symbolism in choral music as well as directed listening. Exact composition for study include works by: Bach, Handel, Purcell, Hayden, Mozart, Beethoven, and others. Students are taught historical, structural, and harmonic analysis, are expected to apply these techniques to individual works in four different papers, and will learn to look at structure and form, melodic and contrapuntal analysis, as well as textual, textural, and orchestral analysis. (DR:2)
4 units, Win (Ramsey)

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)

163A. European and Austrian Theater History— (Also listed as Drama 163A.) This course explores the development of European and Austrian theater as far as stage design, costume and lighting are concerned. Also covers theater “revolutions” like Goethe’s theater at Weimar, Tieck in Berlin, and Brecht, Piscator and Reinhardt in the twentieth century.
4 units, Aut (Thimig)

165. Chorale— (Also listed as Music 165.) The Stanford Chorale is a Chamber Choir which is dedicated to the performance of a variety of choral literature suited to the small choral ensemble.
2 units, Win (Ramsey)

167. Austrian Literature — 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 (ENG, GER)—An introduction to the literary, cultural, and political contributions of Austrian intellectuals, such as Freud, Wittgenstein, Schnitzler, Hofmannsthal, and Kafka. (DR:2)
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 1985-86: Mark Mancall

STANFORD PROGRAM IN PARIS
Director 1985-86: Marc Bertrand (Autumn); Larry Berman (Winter)

STANFORD PROGRAM AT THE FREE UNIVERSITY IN BERLIN
Director: Karen Kramer

STANFORD PROGRAM IN SALAMANCA
Director: Isabel Criado

OXFORD SUMMER FOCUS PROGRAM 1986
WOMEN AND MEN IN MODERN BRITAIN

During the Summer Quarter 1986, Overseas Studies will offer an eight-week Focus Program: Women and Men In Modern Britain. Designed to make maximum use of the Stanford campus at Oxford as a site for study and field trips, the curriculum will be based on discussions of gender difference in British history, literature, arts, and institutions.

All students enroll in three interrelated courses: “History and Literature”, “Imagination and Gender”, and “Gender Politics: Selected Topics.” Much of the course work will be based on excursions to exhibits, performances, museums, and talks by British professionals.

Faculty members will include Diane Middlebrook, Professor of English, and Susan Groag Bell, Historian and Affiliated Scholar at the
Stanford Center for Research on Women. Students should prepare themselves for the program by taking courses at the home campus in modern British history and literature, and courses in which the social construction of gender is a central topic.

PHILOSOPHY


Chairman: Julius Moravcsik

Director of Graduate Study: Nancy Cartwright

Director of Undergraduate Study: Jean Roberts

Professors: Jon Barwise (on leave Winter), Nancy Cartwright, Solomon Feferman, Dagfinn Føllesdal (on leave Spring, Summer), Julius Moravcsik, David Nivison, John Perry, Patrick Suppes

Associate Professors: Michael Bratman, Peter Galison (on leave Spring), Wilbur Knorr, Thomas Wasow (on leave)

Assistant Professors: Arnold Davidson (on leave Autumn), John Dupré, John Etchemendy, Eckart Förster (on leave Autumn, Winter), Richard Pruitt, Jean Roberts

Courtesy Professor: Denis Phillips

Visiting Professors: Robert Goldblatt (Spring only), Brian McGuinness (Winter only)

Visiting Associate Professor: Harvey Siegel (Winter only)

Visiting Assistant Professors: David Brink (Winter, Spring only), Linda Foy, Mary Louise Gill (Autumn only)

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 Philosophy and Logic of Formal Systems allows students to learn the technical side of computer science along with the logical principles and philosophical tradition that underlie it. Students interested in this program should see the special advisor.

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 three ways of majoring in philosophy, the "General Program," the "Special Program in the Philosophy and Logic of Formal Systems," and the "Special Program in the
History and Philosophy of Science." A student completing any one 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 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, at least 13 of which must be numbered above 99 for a total of 55 units.

2. 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 (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 special major in philosophy allows students to learn the technical side of computer science along with the logical principles and philosophical tradition that underlie it. Within the major there is room for specialization in one of several disciplines: philosophy, logic, computer science, or formal linguistics.

1. **Course requirements:**
   a) Preparatory courses. Three courses as follows, each of which must be passed with a "B-" or better by the end of Winter Quarter of the junior year (hopefully sooner).

PHILOSOPHY 521
1) Philosophy 80 (normally students will take an introductory philosophy course first)
2) Computer Science 104, 105A and B, or 106.
3) Philosophy 160A. (Presumes some background in logic or math, e.g. Philosophy 159, or Math 120.)

b) Core requirements.
   1) Philosophy:
      (a) Two of the following: 102, 184, 186, 187
      (b) One of the following: 162, 163, 164, 165
      (c) One of the following: 181, 183
   2) Logic:
      (a) Philosophy 160B
      (b) One of Philosophy 161, 162, 390A, 390B, 391A, 391B, 392A, 392B, 393A, 393B
   3) Computer Science and Linguistics:
      (a) Computer Science 108A
      (b) Computer Science 111
      (c) Linguistics 130
      (d) One of Computer Science 154, 275, Linguistics 202
   4) Additional course. One of: Statistics 60; Mathematics: 41, 113, 113S; Computer Science 155.

c) Specialization Electives. Students must have developed prior to the senior year a specialized program of at least five additional advanced courses approved by the program advisor in writing. Any changes in this program must be approved.

2. 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 (Philosophy 196, 197) may not be counted in the requirement. No more than 10 units completed with grades of "Pass" may be counted in the requirement.

3. Transfer units must be approved 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.

**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
   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, 168, 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 IN PHILOSOPHY

Students who wish to undertake a more intensive and extensive program of study, including seminars and independent work, are invited to apply for the Honors Program during the Winter Quarter of their junior year. Admission will be selective on the basis of 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, 160A, 162-169.
2) Ethics and Value Theory: Philosophy 170 or 171.
3) Epistemology, Metaphysics, and Philosophy of Language: Philosophy 181, 184, 186, 187.
4) 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.

6. 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 Master's Advisor and have their proposed program approved in writing.

Unit Requirements—Each program requires a minimum of 36 units in philosophy though students in a special program may be allowed or required to replace up to nine units of philosophy by nine units in the field of specialization. Though the requirements for the Master of Arts are designed so that a student with the equivalent of a strong undergraduate philosophy major at Stanford might complete them in one year, most students will need longer. Students should also keep in mind that 36 units is the minimum required by the University; quite often more units are necessary for a given student to complete the departmental requirement. Up to six units of directed reading in philosophy may be allowed. There is no dissertation requirement. A special program may require knowledge of a foreign language. At least 36 units must be completed with 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 160A.
   b) Philosophy of Science: 60 or one of 162-169.
   c) Ethics: 170 or 171.
   d) Metaphysics and Epistemology: one of 181-187.
   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 PHILOSOPHY OF SCIENCE

Only students with substantial preparation in philosophy or at least one of the sciences will be admitted. Entering students whose primary preparation in one of the sciences 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 the sciences.

Course requirements:

1. Philosophy of science: at least four of 60, 162-169.
2. At least one approved graduate seminar in the philosophy of science.
3. At least one approved course in the history of science, or in the natural or social sciences.
4. Two courses in logic, numbered 160A or higher.

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 OR 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—The University oral examination is taken after completion of an acceptable first draft of the dissertation, and is primarily a dissertation defense.

Dissertations must be completed and approved within five years from the date of 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:

List A: One core seminar
   Both history exams

List B: 160A (but take 57)
   One history exam

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
   4) Metaphysics, Epistemology, and Philosophy of Language
   5) History

   c) Two additional courses numbered over 199 must be taken in one of these 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 GAPS FAS 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 Schedules for revised listings.

INTRODUCTORY COURSES

These courses will acquaint the student with some of the most important problems, positions and methods in Philosophy. Some are designed to give the student general preparation for further work in Philosophy. Some apply the philosopher's approach to particular problems and subjects the student may encounter in other areas of study. Courses 5A, B, C form a Western Culture Sequence, sponsored by the Department of Philosophy as part of the Western Culture Program.

5A, 5B, 5C. 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—This course traces the origin of philosophizing in antiquity and relates classical problems to current issues of human concern. Readings will include: selections from Greek literature and prose, Greek philosophic writings, and selections from the Hebrew and Christian traditions. Recommended for entering students. (DR:1; three-quarter sequence)

5B. Ideas in Western Culture: Faith, Reason, and Evil—Great works of literature, philosophy, and art from the Age of St. Augustine to the Age of Descartes 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 seamier sides of western culture are also examined, such as slavery and anti-semitism. (DR:1; three-quarter sequence)

5C. Ideas in Western Culture: Ideas of Human Liberation—Conceptions of the problems and possibilities of human life in the light of the breakdown of traditions in religion, science, literature, and society in the 19th and 20th centuries. Readings from Voltaire, J.S. Mill, Oscar Wilde, William James, T.S. Eliot, J.P. Sartre and others. (DR:1; three-quarter sequence)

10. The Self—The concept of the self in three areas of philosophical inquiry; the nature of personal identity; the problem of freedom of the
will and its relation to determinism; the concept of the individual in ethics and political theory. Our concern will be to lay out and critically investigate the various conceptions of the self and the role they play in philosophical theories. (DR:3)

5 units, Aut (Foy) MWF 11 plus section

30. Personal Morality: Introduction to Moral Philosophy—Topics will include: What makes acts and policies right? To what extent can disagreements on moral matters be settled by reasoning and by argument? These questions will be approached through a review of some of the still influential classics of moral philosophy. The social and political implications of different moral theories will be 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? Particular 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. (DR:3)

5 units, Spr (Brink) 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, Spr (Christian) MWF 10

46. Introduction to Chinese Philosophy—(Same as 120, Asian Languages 46 and 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 Philosophy 120.) (DR:3*)

4 units, Spr (Nivison) MWF 10, 1:15

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) MTWTThF 9

60. The Growth of Scientific Knowledge—Introduction to the philosophy of science by way of the historical analysis of philosophical-scientific debates. Discussion 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 texts. (DR:3)

5 units, Aut (Galison) MWF 11 plus section

78. Medical Ethics—(Same as Human Biology 173.) The application of systematic ethical theory to problems in medicine and biobehavioral research. Abortion, euthanasia, justice in the allocation of scarce medical resources. Justifications for experimentation on human subjects. Definitions of death, health, and disease.

5 units, Aut (Davidson) MWF 9 plus section

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 both 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 (Rhinelander) 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 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. Prerequisite: one philosophy course or consent of instructor. This will be a writing-intensive course.

5 units, Win (Etchemendy) MWF 9 plus section

HISTORY OF PHILOSOPHY

Courses 100-105 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. Some attention will be given to the pre-Socratic background. (DR:3) given 1986-87

101. Medieval and Renaissance Religious Philosophy—(Same as Religious Studies 167.) Developments in philosophy of language, philosophy of religion, philosophy of science, theory of knowledge, and ethics. Readings arranged by topic; focusing on the work of Augustine, Anselm, Abelard, Aquinas, Scotus, and Occam. Prerequisite: one course in philosophy or consent of instructor.
4 units, given 1986-87

102. Modern Philosophy, Descartes to Kant—Examines the origins and early development of modern philosophical thought. Thinkers to be discussed among others: Descartes, Leibniz, Locke, Berkeley, Hume and Kant. Emphasis on epistemological issues. (DR:3)
4 units, Win (Foy) TTh 8:35-9:50

103. Nineteenth Century Philosophy—An examination of some of those ideas and conceptions that shaped nineteenth century philosophy. Thinkers to be discussed, among others: Fichte, Hegel, Marx, Kierkegaard, Nietzsche.
4 units, Spr (Forster) MWF 9

4 units, Win (Pruitt) MW 1:15

106. Philosophy, Theology, and Religious Belief—Course explores some of the basic issues in philosophical theology and in philosophy of religion concerning the nature of God and the problem of religious belief. Is the existence of God provable by reason alone? Disprovable? Supposing God's existence cannot be proved or disproved, is it nonetheless rational to believe in God, or is agnosticism the only reasonable alternative?
4 units, Aut (Menzel) MWF 1:15

110/210. Pre-Socratic Philosophy—(Graduate students register for 210.) Intensive study of the thought of Heraclitus and Parmenides, with stress under metaphysical doctrines. Prerequisite: one course in philosophy.
4 units, Win (Moravcsik) MWF 1:15

111/211. Plato—(Graduate students register for 211.) A survey of Plato's metaphysics and epistemology.
4 units, Aut (Roberts) MWF 11

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, given 1986-87

112B/212B. Aristotle's Doctrine of Substance—Course will focus on Aristotle's doctrine of substance, beginning with the early theory of the *Categories*, then tracing Aristotle's dialectical treatment of the topic through the central books of the *Metaphysics* (VII, VIII, and IX), and finally relating the discussion of body and soul in *De Anima* II 1-5 to the *Metaphysics* account. Aristotle's theory of predication, his essentialism, and his concepts of potentiality and actuality will be discussed in connection with the central theme. Offered in translation with a separate Greek reading section if desired.
3 units, Aut (Gill) MW 2:15

113. Hellenistic Philosophy—(Same as Classics 165.) Epicurean and Stoic philosophers and their influence at Rome; the philosophical writings of Ciro and Seneca.
3-4 units, Spr (Wigodsky)

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 on the correction of the understanding and the Clarke-Leibniz correspondence (edited by Alexander.)
4 units, Aut (Hampshire) MWF 10

120. Introduction to Chinese Philosophy—(Same as Philosophy 46. For philosophy majors.)

130/230. Kant's Critique of Judgment—(Graduate students register for 230.) (Same as German Studies 230.) A study of both parts of Kant's *Critique of Judgment*, with concentration on its philosophical content and its subsequent influence, both on philosophy and literature.
4 units, Spr (Hampshire, Förster) MWF II

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)
HISTORY OF SCIENCE

138A, B. Introduction to Cosmology — (Same as History of Science 138A, B, History 138A, B, Classics 138A, B.) A two-quarter sequence on the history of the exact sciences, with special emphasis on the field of cosmology. Technical aspects of the classical theories (Ptolemaic and Copernican), including mathematics, astronomy, physics and chemical theory. Also, more speculative aspects in natural philosophy and theology.

138A. Ancient Period—(DR:3. Completion of 138A and 138B also fulfills DR:6.)
4 units, Win (Knorr) MWF 1:15

138B. Middle Ages to Newton—(DR:3. Completion of 138A and 138B also fulfills DR:6.)
4 units, Spr (Knorr) MWF 1:15

140. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Same as History of Science 140, Math 92.) 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, Spr (Knorr) MWF 2:15

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.
(DR:3)
4 units, given 1986-87

151. Science Under Banners: Introduction to the Political History of Science—(Same as History of Science 151.) Science under competing political ideologies. 19th century origins of concepts of objectivity, neutrality, and the freedom of science; history of various attempts to “politicize” science. Historical examples of attempts to plan science, and debates surrounding the nature of scientific freedom. How do values structure the priorities of scientific research? Case studies in the history of Soviet proletarian science; Nazi racial science; and science under liberalism. Recent problems in the history of science politics, including the politics of cancer, “green revolutionary” agriculture, the military use of science; science and social movements.
4 units, given 1986-87

4 units, Win (Proctor) TTh 8:35-9:50

PHILOSOPHY

4 units, Win (Proctor) TTh 8:35-9:50

LOGIC AND PHILOSOPHY OF SCIENCE

158. Axiomatic Set Theory—Zermelo-Fraenkel axioms are the basis of the course. Operations on sets, relations and functions. Equivalence and ordering relations. Equivalence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. This is a computer-based course; there are no lectures. Each student progresses through the course at his own pace. The first meeting is organizational only, held at 2:15 on the first class day of the quarter.
4 units, Aut, Win, Spr (Suppes)

159. Basic Concepts in Mathematical Logic—(Same as Linguistics 135.) An informal introduction to the basic concepts and techniques used in mathematical logic: sets, functions, structures, formalization, proof, mathematical induction, enumerability and effectiveness.
4 units, Aut (Barwise, Etchemendy) TTh 8:35-9:50

160A. First-order Logic—(Same as Linguistics 136.) 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) will be discussed and applied. Prerequisite: 57 and basic knowledge of set theory for students with no mathematics or computer science background.
4 units, Win (Etchemendy) TTh 8:35-9:50

160B. Computability and Logic—A precise definition of “effective procedure” is given through Turing machines, register machines and recursive functions. Church’s Thesis is explained. These are used to develop Gödel’s work on the undecidability of arithmetic, culminating in his famous Incompleteness Theorem. Other undecidable problems are also discussed. Prerequisite: 160A.
4 units, Spr (Barwise) TTh 8:35-9:50
161. 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, (Phillips) given 1986-87

162. Foundations of Measurement—(Same as Psychology 158A,B,C.) Detailed treatment of fundamental theories of measurement from a formal standpoint. Some attention as well to their empirical adequacy. Basic representation theorems for extensive, conjoint and difference measurements are a main topic. Organizational meeting at 3:15 on the first class day of each quarter.

3 units, Aut, Win, Spr (Suppes)

164. Topics in Philosophy of Science — Detailed analysis of structure and methods of empirical science. Examples range from physics to psychology and sociology. Intended for undergraduate and graduate students and for philosophy majors interested in conceptual problems in the natural and behavioral sciences.

4 units, Win (Siegel) MWF 9

165. Philosophy of Physics—Course this year will focus on the question, "Does quantum mechanics need photons?" We will read a number of historical papers by Compton, Einstein, and others, and also consider conceptual problems generated by more recent photon-correlation experiments. Familiarity with introductory quantum mechanics will be presupposed.

4 units, Win (Cartwright) MWF 9

166. Introduction to Philosophy of Social Science—(Same as Education 211.) The course will begin by focusing upon the differences various writers have noted between the natural and social sciences, and will move to several topics of importance in the social sciences: explaining human action, the functional explanation of social phenomena, holistic versus reductionist orientations. Examples will be used from contemporary social science research literature to illustrate the relevant issues. For majors in the social sciences and beginning graduate students in related areas such as education.

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

167. Philosophy of Biology—(Same as Human Biology 105.) Addresses philosophical issues in biology focusing on sociobiology. The first half addresses epistemological issues underlying sociobiology: the nature of human nature; biological determinism; analogies between humans and other animals; and the application of games theory to evolutionary speculations. The second part looks more closely at specific areas of sociobiological theory, and possible ethical and political significance, including the biology of altruism, and the biological basis of gender differences.

given 1986-87

168. History of Modern Physics — (Same as History 139A, History of Science 168, VTSS 133.) History of the physical view of the fundamental nature of matter from Maxwell's time to the present. Will discuss the mechanical and electromagnetic world views, special relativity, quantum mechanics and the standard model of elementary particle physics. Will focus on several case studies to illustrate the historical problem orientation of each period, as well as the connection between theory and experiment. Readings: original scientific texts, archival material and secondary sources.

4 units, Win (Galison) TTh 2:15-3:30

ETHICS, AESTHETICS AND SOCIAL AND POLITICAL PHILOSOPHY

170. Ethical Theories—Focuses on fundamental issues about rationality, morality, and personal identity, and their relations to each other. The main text will be Derek Parfit's Reasons and Persons. Prerequisite: Philosophy 20 or two courses in Philosophy.

4 units, Spr (Bratman) MWF 1:15

171. Political Argument—Focuses on the relationship between morality and the law; more 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, given 1986-87

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, Aut (Pruitt) TTh 11-12:15

177/227. Feminism and Political Theory—(Graduate students register for 277.) Part I of the course will consider what various types of political theory (liberal, Marxist, socialist) have had to say about the position and role of women, as well as feminist criticisms of those theories. Part II will look at more concrete political/ethical problems which have been of particular
concern to feminists, e.g., affirmative action, pornography, abortion.

4 units, Aut (Roberts) TTh 2:15-3:30

178. Medical Project Development: Ethical and Normative Issues of Intervention—Medical issues such as alternative modalities of intervention, appropriateness and timing of intervention, costs and dependencies, intervention measures, criteria of evaluation.

3 units, Spr (Mazur)

179. Advanced Philosophy of Law.
4 units, Spr (Brink) MWF 11

EPistemology, Metaphysics AND PHILOSOpy OF LANGUAGE

Philosophy 80 or permission of the instructor is a prerequisite for the 180 series.

183/283. Meaning and Experience—(Graduate students register for 283.) (Same as Linguistics 138.) A study of the interrelationships between meaning and experience, with particular emphasis on how our judgments concerning meaning may be based on empirical evidence. Philosophers to be discussed will include W. V. Quine and Donald Davidson. The lectures will presuppose some acquaintance with the philosophy of language.

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, Win (Foy) TTh 11-12:15

187. Metaphysics—The topic for 1985-86 will be causation, and various philosophical analyses of it. In particular the course will be concerned with the relationship between regularity accounts, offered by empiricists like David Hume, John Stuart Mill, and, more recently, Patrick Suppes, and accounts, like the counterfactual account of David Lewis or the sufficiency account of G. E. M. Anscombe, which take singular causal connections as basic.

4 units, Spr (Cartwright) MWF 2:15

194 Series. Undergraduate Seminars in Philosophy — This is a series of advanced undergraduate seminars. Enrollment is 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 will serve as a preparation for writing an honors thesis.

194A. Rationality—Investigation into the role of reasons and the appeal to rationality in the description, explanation, and justification of behavior. What is distinctive of systems or individuals to which rationality is ascribed? Can there be rational assessment of fundamental desires and values? Is explanation by reasons a species of causal explanation? These will be discussed alongside a study of the breakdowns in reason, the alleged conflict between individual and collective rationalities, weakness of the will, self-deception. Readings from classical and modern sources.

3 units, Aut (Foy) M 3:15-5:05

194B. Topic to be announced.
3 units, Win (Staff) W 3:15-5:05

194C. Topic to be announced.
3 units, Win (Staff)

194D. Topic to be announced.
3 units, Spr (Staff)

194E. Comparative Ethics—Study of the Confucian ethics in light of recent work done in Anglo-American moral philosophy. First half devoted to Mencius, and second half to other Confucian thinkers. Readings include translated Confucian texts and writings on various topics in Anglo-American moral philosophy.

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

194F. Seminar in Phenomenology.
3 units, Spr (Follesdal) 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

Courses Intended Primarily for Graduate Students

210. Pre-Socratic Philosophy—(Same as 110. For graduate students.)

211. Plato’s Philosophy—(Same as 111. For graduate students.)

212. Aristotle’s Philosophy—(Same as 112. For graduate students.)

230. Kant’s Critique of Judgement—(Same as 130. For graduate students.)

234. Graduate Seminar in Phenomenology—(Same as 194C. For graduate students.)

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

237A,B. Methods in the History of Science—(Same as History of Science 237A,B.) Contemporary issues in the history of science. Guest lecturers from History, History of Science, Philosophy, Physics, Biology and Medicine will 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.

2 units, Aut, Win (Galison) 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. given 1986-87
3 units, Win (Suppes) given 1986-87
3 units, Spr (Cartwright, Suppes)  
T 2:15-4:05

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.  
4 units, Aut, 2 units, Win, given 1986-87

268. Seminar on Evolution and Human Nature—Considers what illumination, if any, the theory of evolution can offer to the understanding of human nature. Course begins by addressing some theoretical problems in evolutionary biology which seriously affect the understanding of human evolution, then examines critically some of the recently popular attempts to give evolutionary accounts of human behavior (especially sociobiology). Finally, in the light of the defects of these approaches, we attempt to evaluate some more sophisticated attempts to provide a conceptual scheme in which to describe the evolution of culture.  
3 units, Win (Dupre) W 10-12

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 (Bratman, Roberts) MW 3:15-5:05

271. Graduate Seminar in Political Philosophy.  
3 units, Spr (Hampshire) F 1:15-3:05

277. Feminism and Political Theory—(Same as 177. For graduate students.)

279. Graduate Seminar in Axiomatic Metaphysics—Study of an axiomatized theory of abstract objects in philosophical English and in a formal language. Utilization of the theory to identify and theorize about a variety of abstract entities postulated by various philosophers: Platonic forms, Leibnizian Monads, Possible Worlds, Fregean Senses, Husserlian nominal, Meinongian objects, fictional characters and stories, and mathematical objects and relations.  
3 units, Spr (Zalta) Th 10-12

280A,B. Metaphysics and Epistemology—Intensive one and a half-quarter seminar in metaphysics and epistemology, for first and second year students in doctoral program and possibly others with consent of instructor.  
4 units, Aut, 2 units, Win (Moravcsik, Zalta) MW 3:15-5:05

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 consent of instructor.  
2 units, Win, 4 units, Spr, given 1986-87

283. Meaning and Experience—(Same as 183. For graduate students.)

287A,B,C. Topics in Language and Information.  
287A. The topic will be cognition and propositional attitudes. We will focus on Stitch’s From Folk Psychology to Cognitive Science.  
3 units, Aut (Perry) M 1:15-3:05
287B. Topic to be announced.  
3 units, Win (Perry) M 1:15-3:05
287C. The topic will be frameworks in semantic interpretation and will focus on Stalnaker’s Inquiry.  
3 units, Spr (Perry) M 1:15-3:05

290. Reference, Interpretation and Realism—Contemporary issues in the philosophy of language and their possible significance for classical problems of scepticism and ontology. Readings will include work by Quine, Davidson, Putnam, Dummett.  
3 units, Spr (Foy) T 10-12

293. Wittgenstein’s Tractatus.  
3 units, Win (McGuinness) Th 2:15-4:05

323. Chinese Philosophy of Language—(Same as Philosophy 323.) The seminar will focus on Hansen’s Language and Logic in Ancient China and Graham’s Later Mohist Logic.  
5 units, Aut (Nivison) given 1986-87

326. Epistemological Problems of Artificial Intelligence—(Same as Computer Science 326.) Formalisms for representing what a general intelligence program must know about the common sense world including facts about causality, ability, knowledge and action. Modes of rigorous and conjectural reasoning, especially nonmonotonic reasoning. Approximate theories and counterfactuals. Connections with philosophy, especially philosophical logic and epistemology. Some familiarity with first order logic will be assumed. Offered alternate years.  
3 units, Win (McCarthy)  
alternate years, given 1986-87
331. Seminar in Confucian Ethics—(Same as Asian Languages 331 and Religious Studies 238.) Prerequisite: Consent of instructor. 3-5 units, Aut (Nicison) MW 4:15-5:30

346. Seminar on Mind and Action — Discussion of selected problems in the philosophy of mind and action. given 1986-87

390A,B. Model Theory—(Enroll in Mathematics 290A,B.) Language and models of the first order predicate calculus. Validity and definability. Complete and decidable theories; applications to algebra. Saturated models, ultraproducts, categoricity in power. Infinitary languages. Prerequisites: 160A,B and 161 or equivalent. 3 units, Win (Staff)


392A,B. Set Theory—(Enroll in Mathematics 292A,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. alternate years, given 1986-87

393A,B. Proof Theory—(Enroll in Mathematics 293A,B.) Gentzen's natural deduction and/or sequential calculi for first order predicate logic. Normalization, cut-elimination procedures. Extensions to infinitary calculi; ordinal complexity of proof trees. Subsystems of analysis and their reduction to constructive theories. Prerequisites: 160A,B or equivalent. 3 units, Aut (Feferman) TTh 1:15-2:30 393B. 3 units, Win (Feferman TTh 1:15-2:30

394. Topics in Logic—(Enroll in Mathematics 294.) These will 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 290A,B through 293A,B or equivalent. 3 units, Spr (Feferman) TTh 1:15-2:30

396. Seminar on Issues in Logical Theory. 3 units, (Israel)

450. Thesis. any quarter (Staff) by arrangement

PHYSICS

Emeriti: (Professors) Paul H. Kirkpatrick, Robert Hofstadter
Chairman: Stanley G. Wojcicki
Associate Professors: Blas Cabrera, Savas Dimopoulos
Assistant Professors: Richard Bond, C. Jeff Martoff, Peter Michelson
 Acting Assistant Professor: Christian Stoller
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 operating at energies over 100 MeV. 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. Mathematics and physics courses offered to satisfy the Physics Department's major requirements cannot be taken on a Pass/No Credit basis.

Students can follow either of the two course sequences. Sequence II (based on Physics 61, 62 and 63) is deemed preferable for students who have had physics and a year of calculus in high school. In this sequence, Mathematics 41 and 42 are not required. Sequence I (based on Physics 51, 53, 55, and 57) is mainly for students who have 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>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 51, 53.</td>
<td>Mechanics, Electricity, Magnetism</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics 54.</td>
<td>Electricity, Magnetism Laboratory</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Math. 41,42,43.</td>
<td>Analytic Geometry and Calculus</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

#### SECOND YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 55, 57.</td>
<td>Light and Heat, Modern Physics</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics 56.</td>
<td>Light and Heat Laboratory</td>
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<td></td>
<td>1</td>
</tr>
<tr>
<td>Physics 110, 111.</td>
<td>Int. Mechanics</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 44.</td>
<td>any additional Math course numbered 100 or higher. Advanced Calculus</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 130, 131, 132.</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
<td>(3)†</td>
<td></td>
</tr>
<tr>
<td>Math. 106.</td>
<td>Complex Variables</td>
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</table>

#### THIRD YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 105, 106, 107.</td>
<td>Int. Physics Laboratory Seminars</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physics 120,121,122.</td>
<td>Int. Electricity and Magnetism</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Physics 130,131,132.</td>
<td>Quantum Mechanics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 106.</td>
<td>Complex Variables</td>
<td></td>
<td></td>
<td>(3)†</td>
</tr>
</tbody>
</table>

#### FOURTH YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 170,171,172.</td>
<td>Thermodynamics, Kinetic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
<td>3</td>
<td>3</td>
<td>(3)**</td>
</tr>
<tr>
<td>Physics 167.</td>
<td>Essential General Relativity</td>
<td>(3)**</td>
<td></td>
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</tr>
<tr>
<td>Physics 161.</td>
<td>Optics</td>
<td>(3)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 200,201.</td>
<td>Advanced Physics Laboratory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 210, 211.</td>
<td>Introductory Theoretical Physics</td>
<td>(3) 3†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 113, 114, or 120.</td>
<td>Linear Algebra and Matrix Theory or Modern Algebra</td>
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</tbody>
</table>

### SEQUENCE II

#### FIRST YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 61,62,63.</td>
<td>Advanced Fresh. Physics</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Physics 64A,64B.</td>
<td>Advanced Freshman Laboratory</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Math. 43H,44H,45H.</td>
<td>Analytic Geometry, Calculus, Advanced Calculus</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

#### SECOND YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 110,111.</td>
<td>Int. Mechanics</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics 105, 106, 107.</td>
<td>Int. Physics Laboratory Seminars</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physics 120,121,122.</td>
<td>Int. Electricity and Magnetism</td>
<td>3</td>
<td>3</td>
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</tbody>
</table>

#### PHYSICS 535

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 106.</td>
<td>Complex Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 131,132.</td>
<td>Partial Differential Equations I and II</td>
<td></td>
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</tbody>
</table>

#### HONORS PROGRAM IN PHYSICS

The Department of Physics offers a program leading to the degree of Bachelor of Science in Physics with Honors:

a) Students should find a physics project, either theoretical or experimental.

b) The student shall submit his or her proposal to the Honors Subcommittee, which will decide on its suitability as an Honors project.

c) Course credit for the project will be assigned by the advisor within the framework of Physics 205.

d) A written report of the work at its completion will be required for Honors.

e) Before the end of the year each Honors candidate shall give a seminar on his or her work. This seminar will be announced publicly and will be open to the general audience. The expectation is that the student’s advisor along with all the other Honors candidates shall attend the seminar.
The decision as to whether a given independent study project does or does not merit award of Honors shall be made jointly by the Honors Subcommittee and the student's advisor. This decision shall be based on the quality of both the Honors work and the other work in physics.

g) The work done in the Honors Program should not be used as a substitute for regularly required courses.

**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. 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 IN PHYSICS**

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 125 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 comprise demonstration lectures on fundamental principles of physics, problem work on application of these principles to actual cases, and laboratory experiments closely correlated with the lectures. Their objectives are not only to give information on particular subjects, but also to provide training in the use of the scientific method. The primary difference between the two series of courses lies in the fact that topics are discussed more thoroughly and are treated with greater mathematical rigor in the Fifty Series.

Courses beyond 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—Intended to familiarize humanities and social science students with concepts of atomic and subatomic physics. Explain 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. No prerequisite. (DR:7)

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

13. Modern Physics Through Science Fiction—A seminar course for students in Physics interested in exploring topics in modern physics and related fields through readings in science fiction. Topics to be discussed may include time travel, quantum mechanics, parallel universes, extraterrestrial life, teleportation, neutron stars, black holes, and general relativity. Prerequisite: current or prior enrollment in Physics 25.

2 units, Spr (Staff)
one hour by arrangement


3 units, Aut

15. Cosmic Horizons—This course proposes to familiarize the non-science student with modern cosmology. After discussing the physical laws that govern the universe, its evolution will be traced from the initial primeval fireball, through the formation of galaxies, stars, and planets to the development of life. Exotic astronomical objects, such as quasars, pulsars, and black holes, will be discussed. No prerequisites, but some algebra will be used. (DR:7)

3 units, Spr (Bond) TTh 2:15; 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. No prerequisites. (DR:7)

3 units, Aut (Staff) TTh 9
plus one hour discussion by arrangement


3 units, Aut (Staff) MWF 10 or 11
plus one hour discussion by arrangement

21H. Honors Mechanics and Heat—Subject matter identical with that of Physics 21 but has advanced discussion. Prerequisite: Mathematics 19 or consent of instructor. (DR:7)

3 units, Aut (Staff) MWF 10 or 11
plus one hour discussion by arrangement

22. Mechanics and Heat Laboratory—Concurrent or prior registration in 21 or 21H is required. Mandatory P/NC grading.

1 unit, Aut (Staff) 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 9 or 10
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 (Schwettman) 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 (Schwettman) 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 (Staff)
lec MWF 9 or 11; and discussions by arrangement
Sum (Staff) MTWThF 10-12
plus one hour discussion 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 (Hofstadter) lec MWF 9 or 10
and discussions by arrangement
Sum (Staff) MTWThF 10-12
plus one hour discussion by arrangement
higher and 131 (Spr) or equivalent. Physics 61, 62, and 63 are all (DR:7)
61. 4 units, Aut (Cabrera) TTh 9-10:50
62. 4 units, Win (Cabrera) TTh 9-10:50
63. 4 units, Spr (Staff) 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. Prerequisites: 55 or 61.
64A,64B. 1 unit, Win (Staff)
by arrangement
1 unit, Spr (Staff)
by arrangement

105, 106, 107. Intermediate Physics Laboratory Seminars — A year-long series of mini-courses in important experimental techniques. The mini-courses vary in duration between two weeks and eight weeks, depending on the subject matter; courses must be taken in sequence. Typical subjects included are 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 66B, or 54 and 56; concurrent registration in the 120 series.

105. Laboratory Seminar I — Electronics. 3 units, Aut (Staff) by arrangement
106. Laboratory Seminar II. 2 units, Win (Schwettman)
by arrangement
107. Laboratory Seminar III. 2 units, Spr (Staff)
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 (Staff) MWF 9
111. 3 units, Spr (Staff) MWF 9

120,121,122. Intermediate Electricity and Magnetism—Vector analysis, electrostatic fields, including multipole expansion; dielectrics. Special relativity and transformation between electric and magnetic fields. Maxwell's equations. Static magnetic fields, magnetic materials. Electromagnetic radiation, plane wave problems (free space, conductors and dielectric materials, boundaries). Dipole and quadrupole radiation. Wave guides and cavities. Prerequisites: 53 and prior or concurrent registration in 110. Concurrent or prior registration in Mathematics 130 and 131 with Physics 120 and 121, respectively, is required. Concurrent or prior registration in Mathematics 101 is recommended.
120. 3 units, Aut (Staff) MWF 11
121. 3 units, Win (Staff) MWF 11
122. 3 units, Spr (Staff) MWF 11

130, 131, 132. Quantum Mechanics — The origins of quantum mechanics, wave mechanics and the Schrödinger equation, Heisenberg's matrix formulation of quantum mechanics, solutions to one dimensional systems, separation of variables and the solution to three dimensional systems, the central field problem and angular momentum eigenstates, spin and the coupling of angular momentum, Fermi and Bose statistics perturbation theory and other approximation techniques. Scattering theory; partial wave expansion, Born approximation, Green's functions.

Although 130, 131, 132 are primarily courses in quantum mechanics, frequent reference will be made to problems in atomic and nuclear physics with a view to explaining the basic phenomenology of these disciplines. Invariance principles and conservation laws will be 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 (Michelson)
TTh 1:15-2:30
131. 3 units, Win (Staff)
TTh 1:15-2:30
132. 3 units, Spr (Staff)
TTh 1:15-2:30

145. Physics of Nuclear Weapons—Physics and technical issues of radioactivity, nuclear chain reactions, weapons effects; also nuclear proliferation, arms control, advanced weapons development, and weapon deployment and use in warfare. The goal is to enable students to understand and critically evaluate technical issues in national security policy and the political process of arms control. Prerequisites: Physics 21 or 51, concurrent enrollment in 25 or 53, or consent of instructor. (DR:7)
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 (Staff) MWF 12
167. Essential General Relativity—(Formerly Physics 192. One quarter for senior-level students and advanced juniors.) Mathematical development will emphasize the component tensor calculus rather than the abstract differentiable manifold approach. Though cosmological solutions will be obtained and discussed, the advanced undergraduate course in cosmology is AP-111. Prerequisites: Physics 110, 120 plus Math 131.

3 units, Win (Staff) MWF 11

168. History of Modern Physics—(Enroll in Philosophy 169.)

4 units, Win (Calison)

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 their thermal, electrical and magnetic properties. Elementary treatment of phonons in solids, electrons in metals, energy bands. Applications to semiconductors, rectification, superconductors, para- and ferromagnetism, magnetic resonance. Prerequisite: 171.

3 units, Spr (Staff) MWF 9

190. Independent Study—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, Spr (Meyerhof) Sum (Staff) by arrangement
201. 3 units, Aut, Win, Spr (Meyerhof) 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 (Hanna) Sum (Staff)


3 units, Aut (Staff) MWF 10

211. Continuum Mechanics and Mathematical Physics—The physics of classical continuous media. The course will develop many useful methods of mathematical physics. Physical applications include waves in strings, membranes, and gases, dynamics of nonviscous fluids, radiation and scattering of sound, surface waves on incompressible fluids. The mathematical methods include complex variables, partial differential equations and special functions of mathematical physics, eigenfunctions and Sturm-Liouville theory, variational methods, perturbation theory, Green's functions, Fourier and Laplace transforms, and asymptotic approximations. Prerequisite: 210 and preferably Mathematics 106 and 132.

3 units, Win (Staff) MWF 10

212. Group Theory and Mathematical Physics.

not given 1985-86

220-221. Classical Electrodynamics—Electrostatics and magnetostatics: conductors and dielectrics, magnetic media, electric and magnetic forces and energy. Maxwell's equations: electromagnetic waves, Poynting's theorem, electromagnetic properties of matter, dispersion relations, wave guides and cavities, magnetohydrodynamics. Special Relativity: Lorentz transformations, covariant, equations of electrodynamics and mechanics, Lagrangian formulation, Noether's theorem and conservation laws. Radiation: dipole and quadrupole radiation, electromagnetic scattering and diffraction, the optical theorem, Liénard-Wiech-
230, 231, 232. Quantum Mechanics — First quarter reviews limits to classical physics and develops wave mechanics and the Schrödinger equation. Eigenvalues and eigenfunctions are found for simple systems such as the harmonic oscillator, the hydrogen atom, and periodic potentials. Formal developments include matrix mechanics, abstract Hilbert space, and operator methods. The quarter concludes with a discussion of measurement theory and summarizes the postulates of quantum mechanics. Second quarter includes approximation methods for bound states, two-body problem, scattering theory, time-dependent perturbation theory, and electromagnetic radiation. The third quarter continues with electromagnetic radiation including the Wigner-Weisskopf theory of the line width. The quantum theory of angular momentum includes spin, irreducible tensor operators, the Wigner-Eckart theorem, finite rotations, and multipole analysis of the radiation field. Continuous groups in quantum mechanics. Many-body systems are discussed including the Thomas-Fermi theory of atoms and Hartree-Fock theory. Periodic system of elements. Selected topics in atomic and molecular physics. Prerequisites: 132 and 211, Mathematics 106 and 132, and preferably Physics 221.

230. 3 units, Aut (Staff) MWF 9
231. 3 units, Win (Staff) MWF 9
232. 3 units, Spr (Staff) MWF 9

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

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 (Staff) alternate years, given 1986-87
241. 3 units, Win (Staff) alternate years, given 1986-87

250, 251. High Energy Physics — Transition probabilities; relativistic treatment of kinematics, spin, phase space; particles and conservation laws (parity, isospin, hypercharge, etc.); quantum numbers of the baryons and mesons; scattering of strongly interacting particles. Unitary symmetry, weak interactions (muon decay and properties), Regge poles, dispersion relations, nuclear-nucleon interactions. Prerequisites: 240 and 330; concurrent registration in 331, 332 recommended.

250. 3 units, Win (Staff)
251. 3 units, Spr (Staff)

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 (Staff) TTh 12:15-1:05


3 units, Spr (Peskin)

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 Phenomenon — (Enroll in Applied Physics 241.)

3 units, Spr (Beasley, White)

290. Literature of Physics — Intensive study of literature of any special topic. Chiefly preparation, presentation of reports upon topics studied. Prerequisites: 25 units of college physics and consent of instructor. If taken under the supervision of a faculty member outside the department, approval of the Physics Department Chairman is required.

any quarter, (Staff) by arrangement
299. Teaching of Physics—Techniques of teaching Physics by means of lectures and laboratories. All teaching assistants in Physics are required to register for this course.

0 to 3 units, Aut (Staff)

330, 331, 332. Advanced Quantum Mechanics—Review of quantum mechanics and relativity. Second quantization, relativistic one-particle equations (Klein-Gordon and Dirac), canonical field theory, relativistic scattering theory. Second quarter includes quantum electrodynamics: applications, radiative corrections, renormalization theory, the Lamb shift. Unified gauge theories of weak and electromagnetic interactions. Third quarter includes special topics such as symmetry principles, the Heisenberg representation, dispersion relations, current algebras and sum rules, phenomenological field theories, quantum chromodynamics, and grand unified gauge theories. Prerequisites: 211, 221, 232.

330. 3 units, Aut (Staff) TTh 9-10:50
331. 3 units, Win (Staff) TTh 9-10:50
332. 3 units, Spr (Staff) TTh 9-10:50

336. Advanced Topics in Theoretical Physics—Discussion of selected topics of current interest in theoretical physics.

3 units, by arrangement


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

341, 342. Nuclear Theory—First quarter concerns properties of the nucleus and many-body theory of nuclear structure: nuclear forces, nuclear matter, neutron matter, equation-of-state, nuclear moments, shell-model, Hartree-Fock theory, pairing, collective particle-hole states, deformed nuclei, and nuclear rotations. Also theory of angular momentum, group theory of nuclear structure, quark theory. The second quarter concentrates on various interactions with nuclei: electromagnetic interactions, electron scattering, semileptonic weak interactions with nuclei (β-decay, μ-capture, and neutrino reactions), weak-neutral current effects, muonic x-rays, hadronic scattering, including pion-nucleus interactions, theory of the optical potential, isobars, in nuclei, heavy-ion interactions, and nuclear reactions and symmetries. Special topics in intermediate-energy nuclear physics. Prerequisites: 232, 241, 340. Concurrent or prior registration in 331, 332 is recommended.

341. 3 units, Win, (Staff) TTh 1:15-3:05
342. 3 units, Spr, (Staff) TTh 1:15-3:05


3 units, Aut (Staff) by arrangement alternate years, given 1986-87


3 units, Win (Staff) by arrangement, alternate years, given 1986-87

352. Symmetries and Lagrangians—Theories of strong interactions with emphasis on hadron spectroscopy and symmetries. The quark model and transitions between hadronic states. The new particles, their spectroscopy and transitions.

3 units, Spr (Staff) by arrangement, alternate years, given 1986-87

368, 369. Gravitation—Fundamental principles and experiments. Differential geometry. General structure of Einstein’s equations. Other theories and observational tests. Astrophysical applications, such as relativistic stellar structure and black holes. Generation and detection of gravitational radiation. Prerequisites: 220, 221.

368. 3 units, Aut (Staff)
369. 3 units, Win (Staff)

370. Phase Transitions and Critical Phenomena—Landau and mean-field theory, critical exponents, scaling Gaussian model, Ginzburg criterion, renormalization group, real-space techniques, relevant and irrelevant param-
etters, 1/n expansion, spherical model, e expansion, two-dimensional systems, Kosterlitz-Thouless model, dynamics. Prerequisites: 270, 340. Prior enrollment in Applied Physics 241 is recommended.

3 units, Win (Staff)


385A. 3 units, Aut (Staff)
385B. 3 units, Win (Staff)
385C. 3 units, Spr (Staff)

389. Research Orientation—The purpose of this course is to allow students to become familiar with the activities of one or more research groups, within the department or outside. Registration is limited to one quarter per research group with an overall limitation of two quarters. Consent of the student's advisor is required for registration.

any quarter, (Staff) by arrangement

390. Research—All work in experimental or theoretical problems in research, as distinguished from independent study of non-research character listed as Physics 190 and 290. Open only to graduate physics major students, with consent of instructor. If taken under supervision of a faculty member outside the department, Physics Graduate Study Committee approval is required.

any quarter, (Staff) by arrangement

POLITICAL SCIENCE

Emeriti: (Professors) Gabriel A. Almond, Thomas S. Barclay, Philip W. Buck, Robert A. Horn, Nobutaka Ike, Robert C. North, Kurt Steiner, Robert A. Walker
Chairman: Stephen D. Krasner
Associate Professors: Terry M. Moe (on leave), Daniel I. Okimoto
Assistant Professors: Judith L. Goldstein, Con- doleezza Rice (on leave)
Lecturer: Jennifer B. Ring
Acting Associate Professor: Coit D. Blacker

Acting Assistant Professor: George Tsebelis
Visiting Professors: Gerhard Botz, Volker Rittberger
Visiting Associate Professors: Renato R. Boschi, Jack S. Levy, Alex Pravda
Courtesy Professors: Steven H. Chaffee, Roger Noll
Affiliated Professors: Lawrence Friedman, John Kaplan, Michael W. Kist, Robert L. Rabin
Affiliated Associate Professor: Joel Samoff
Affiliated Assistant Professors: Jonathan Ben- dor, J. Serge Taylor

UNDERGRADUATE PROGRAMS

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 IN POLITICAL SCIENCE

The honors thesis program offers qualified students an opportunity to conduct independent research, and to write a thesis of superior quality summarizing the results of their research. The program provides for close contact between students and their advisors, so that students can receive intensive guidance and assistance throughout their research and writing. The aim is to help students go through the process of research, analysis, drafting, rethinking, and redrafting which is essential to excellence in writing.

Because the honors thesis program involves close student-faculty contact, the basic requirement for admission to the program is that students secure the agreement of a regular faculty member to be their thesis advisor. Students should be aware that no faculty member can effectively supervise more than a few honors theses each year. Application to the program should therefore be made as early as possible, and certainly well before the beginning of the quarter in which the student wishes to enter the program. Application forms can be obtained from the department office, should be countersigned by both the student and his or her thesis advisor, and then approved by the Director of Undergraduate Studies, who supervises the program. Normally, the thesis advisor will be a faculty member with whom the student has already worked. Normally, too, students enroll in the program in their senior year, and have at least a letter grade equivalent of a 3.3 average in political science courses when they apply.

The honors thesis program is based on the assumption that good writing takes time. Students are therefore strongly discouraged from attempting to complete an honors thesis in less than two quarters. While details will always be worked out on an individual basis between students and their thesis advisors, the following patterns are typical: (a) If a student already has substantial background on the thesis topic, then the honors thesis program can be completed in two or three quarters (for a total of 10-15 units). (b) If a student has worked done for credit (Political Science 199) may not be counted toward the required 45 units in political science, but may be counted as all or part of the additional 15 units which relate to the student’s interest in political science.

GRADUATE PROGRAMS

ADMISSION TO GRADUATE STANDING

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 15. Admission is offered for the Autumn Quarter only. The department expects all students to pursue a full-time program except for time devoted to teaching or research assistantships.

MASTER OF ARTS

The department offers a terminal Master of Arts program for a limited number of students. Applicants for the A.M. program are selected on the basis of the same criteria as Ph. D. candidates. There is no financial aid available to applicants for the A.M. program. The A.M. degree may be pursued as part of a joint degree program with one of the professional schools within the University. The student should apply for admission to the A.M. program in Political Science during the autumn of the first year in the professional school within the University.

Terminal A.M. students and doctoral candidates 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 coterminous 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**

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. Any two courses in the "General" category (courses numbered 200 to 205 or 301 to 305) may be used to fulfill the third field requirement. Students may also use two courses 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. 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 not later than May 15. At a regular meeting of the department faculty, it will be reviewed, and, if approved, filed with the Graduate Assistant. 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.

5. Following the plan outlined in (4), 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.

6. During a student’s sixth quarter, he or she will file an Application to Candidacy for the Ph.D., which encompasses concrete course plans and records. This document, along with a student’s examination performance, will be reviewed by the faculty at a regular meeting. If it is approved, a student will then be advanced to candidacy.

7. During the third year, a formal dissertation proposal will be submitted by the student to his or her thesis committee of three faculty members including the principal advisor. The faculty will review these proposals. A list of students, their proposals, and their thesis committees will be circulated to the faculty, who will be asked to comment.

8. A candidate for the Ph.D. in Political Science 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.

9. Doctoral candidates who apply for the A.M. degree will be awarded that degree upon completion of the requirements outlined in the description of the Master of Arts program.

10. The candidate shall pass the University Oral Examination on the area of the dissertation, at a time after the passing of the written comprehensive examinations suggested by the candidate’s dissertation committee.

11. The candidate shall complete a dissertation satisfactory to the Dissertation Reading Committee and the University Committee on Graduate Studies.

The University’s basic requirements for the Ph.D. degree are discussed in the “Degrees” section in this bulletin.

Ph.D. MINOR IN POLITICAL SCIENCE

Candidates in other departments offering a minor in political science select two fields in political science in consultation with the Director of Graduate Studies and submit to her or him a program of study for approval. Written approval for the program must be obtained from the Director of Graduate Studies before application for doctoral candidacy. Students are required to complete at least 20 units in political science courses, all of which must be at least 100-level and above. Two of these courses, in separate fields of political science, must be 200-level and above. All grades must be of “B-” or better. Candidates will be examined in their fields in the general oral examination, by a member of the Political Science Department, chosen in consultation with the Director of Graduate Studies.

WEST REFERENCE ROOM

The department maintains, for its faculty, guests, graduate students and advanced undergraduates, a small reference room that holds political science journals, handbooks, books useful in preparing for Ph.D. examinations, and other materials. Access to West Reference Room is restricted to eligible key holders.

PRIZES

The attention of undergraduate students is called to three annual prizes—the Edwin A. Cottrell Memorial Prize for the best student in Political Science 1, the Arnaud B. Leavelle Memorial Prize for the best student in an introductory Political Theory course, and the Lindsay Peters, Jr., Memorial Prize for the outstanding student each year in Political Science 10.

SUMMER SESSION

During the Summer Quarter the Political Science department offers a variety of courses and seminars. The specific offerings depend on the faculty available during the Summer Quarter.

COURSE OFFERINGS

The department uses the following course numbering system:

1-99 Introductory Courses
100-199 Advanced Courses and Undergraduate Seminars (may be open to graduates)
200-299 Undergraduate-Graduate Seminars
300-400 Graduate Seminars
INTRODUCTORY COURSES

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)

   5 units, Aut (Sniderman)

10. American National Government—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 (Manley)

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 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. Recommended background course: Anthropology 21 and History 21. (DR:5*)
    5 units, Win (Abernethy, G. Collier, Duus)

25. Colonialism and Nationalism in the Third World — A comparative historical analysis of European exploration, conquest, and colonial rule in Latin America, the Caribbean, Africa, and Asia. Factors affecting the timing, character, and effectiveness of nationalist movements in the Third World. Impact of colonialism on post-colonial political and economic systems. (DR:5*)
   5 units, Spr (Abernethy)

35. How Nations Deal With Each Other — 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 II, superpower intervention since 1945 and international economic relations, and the normative and policy implications of different theories. (DR:5)
   5 units, Aut (Krasner)

ADVANCED COURSES AND UNDERGRADUATE SEMINARS

Advanced undergraduate courses are open to undergraduates who have the necessary prerequisites and to graduates where advisable. Undergraduate seminars have limited enrollments, and admission generally requires the consent of the instructor. They are intended for juniors and seniors, but may admit graduates where advisable. Sign-up sheets for undergraduate seminars are posted in the department office at registration time. Undergraduates interested in taking seminars should also consider the undergraduate-graduate seminars, numbered 200-299, listed in the next section.

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 (Taylor)

108. Organizational Leadership—(Same as Education 333, 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)

108J. The Politics of Spending and Taxing: Fiscal and Budgetary Policy—(Same as Business 334.)
   5 units, Win (Bendor)

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)

112P. Social Groups in Communist Systems—Focuses on society and politics in communist regimes.

5 units, Win (Pravda)

113A. The Politics of Development in Latin America—Survey course on the principal political systems of Latin America. Deals with the three largest countries (Brazil, Mexico, Argentina) and the major socialist country (Cuba). (DR:5)

5 units, Aut (Packenham)

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, Aut (Okimoto)

115T. Western European Politics—Focuses on post-World War II Western European politics, social forces and political institutions. Particular emphasis on four West European countries: The United Kingdom, France, the Federal Republic of Germany, and Italy. Current developments will be considered in the context of the course.

5 units, Aut (Tsebelis)

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 (Lipset)

116P. Crises and Crisis Management in Eastern Europe—Focuses on the four major systemic crises there, from Hungary in 1956 to Poland in the 1980's, the dynamics of their development, their sources and their repercussions.

5 units, Spr (Pravda)

118B. Southern Africa: Race, Class, and Political Change—Examines the political history of the region's ten countries, with special attention to relations among racial and ethnic groups. Analyzes diplomatic, economic, and military interactions among these states, and the impact of movements, corporations, and international organizations based outside the region. Particular attention to domestic politics and foreign policy of South Africa. (DR:5*)

5 units, Spr (Abernethy)

118J. Africa: Development and Dependence—A survey of African politics whose principal concerns are to examine alternative explanations for the contemporary African situation and alternative strategies for development. Major topics: colonial rule, decolonization, persistence of white rule in southern Africa, colonial and post-colonial social structure, patterns of political and economic organization, internal and external constraints on development, pan-African unity, strategies of development. No prerequisite. (DR:5*)

5 units, Aut (Samoff)

119. Socialism in Latin America—An examination of socialist experiences in Latin America. The interrelationships between political, economic, and cultural change will be stressed. Special attention given to the historical and international contexts relevant in each case. (DR:5*)

5 units, Win (Fagen)

119A. The Soviet Union: Politics and Society Since 1917—(Same as History 123A.) Survey of major trends and developments since the Revolution, and discussion of selected topics, including alternative interpretations, elite conflicts, role of ideology, social stratification, and changing values. (DR:5)

5 units, Spr (Dallin)

121R. Seminar: Contemporary Brazilian Society and Politics—Focuses on very recent political and social transformations in Brazil. An attempt to evaluate some of these transformations and the dilemmas they entail. Emphasis on the modern, dynamic pole of Brazilian society. Focus on categories such as the military, the state sector, the political parties and elections, the industrial bourgeoisie, the Church, the working class, the labor movement, and other urban social movements.

5 units, Win (Boschi)

and the interaction between national and international factors. Prerequisite: 35. In general, previous work in International Relations, Economics, and/or Political Science is highly recommended.

5 units, Win (Fagen)

126. Seminar: Politics in Eastern Europe—Systematic examination of the eight East European political systems in terms of their historical development, their policy-making processes, and their system maintenance and adaptation. Attention will also be paid to Eastern Europe as a region in world politics.

5 units, Win (Fagen)

126G. Evolution of European Fascist Movements—(Same as History 124C.) Beginning with social preconditions and precursor phenomena in Austria and Germany, course emphasizes the Italian and German Model of fascism, which spread in two waves over many European countries, ending up with Hitler’s seizure of power.

5 units, Win (Triska)

128. Seminar: Political Elites—A comparative examination of the behavior of political elites. Emphasis on problems of elite maintenance, recruitment and socialization. Examines the differences in the behavior of elites in western industrial, communist and developing societies. The rise of counter-elites is also explored. Attention to the behavior of different types of elites; legislative, administrative, executive and military.

5 units, Spr (Eulau)

132D. Political and Ethical Aspects of Foreign Aid—Uses general and case study materials to examine characteristics of bilateral and multilateral “official development assistance”; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems posed in the allocation, monitoring, and evaluation of development assistance. Special attention paid to international disaster relief operations.

5 units, Win (Abernethy)

133. Peace Studies—Course purpose is to make faculty, staff, and students who participate in it 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 who finish this course, as well as their teachers, will not come out with answers but with a better understanding of the fundamental questions that need answering. The atmosphere will be one of intellectual exchange. Outstanding scholars will 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—Examination of the formulation and execution of national security policy in the United States and the U.S.S.R. Special attention is devoted to 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 security policy formation and conduct are used to provide an analytical basis for comparison including: weapons procurement, nuclear arms control, and crisis management. Prerequisite: 138A, 117R or 136C are recommended.

5 units, Aut (Blacker)

134R. Problems and Prospects of European Security—(Same as German Studies 134R.) Course seeks to give an overview of major issues of European security, i.e., problems related to crisis and war prevention, as well as to political autonomy and socio-economic welfare in Europe. Cold-war and detente aspects of East-West conflict in Europe; interaction among European actors and the superpowers regarding deterrence and arms control (nuclear and conventional); trade, economic cooperation,
and technology transfer; transnational communication and contacts; and other issues.

5 units, Win (Rittberger)

136. Soviet Foreign Policy—(Same as History 122B.) Foreign and domestic determinants of policy; intentions and capabilities; continuity and change since 1917; institutions and personnel; war and peace; perceptions, priorities, and attitudes; alternative futures. (DR:5)

5 units, Win (Dallin)

138A,B,C,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. Time is devoted to the analyses of strategic military doctrines and to negotiations on strategic and regional military forces including SALT, START, INF, and space-based weapons. The course is taught by an interdisciplinary faculty. 138A is a prerequisite to 138B. 138B is a seminar with limited enrollment, focusing on both 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 138C and 138D. 138C (offered in 1986-87) is an arms control simulation; 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)

138C. Arms Control Simulation.

5 units, Aut (Lewis, Blacker)
given 1986-87

138D. Topics in Arms Control.

5 units, Aut (Lewis, Blacker)

138E. Seminar: Accidental or Unintentional Nuclear War—Course examines the likelihood of nuclear war occurring through accident, miscalculation, misunderstanding, or inadvertence. Embodies 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. Explores mechanisms of risk reduction, anticipatory planning, crisis prevention and management, and the means of translating such measures from theory to practice. Limited enrollment. 138A is a prerequisite.

5 units, Spr (George, Abrams)

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.)

140A,B,C. 1-4 units, Aut, Win, Spr (Fagen, Fuenzalida, Lusignan, McWhorter, Siegel) lectures W 7:30-9:30 p.m.

workshops by arrangement

142L. Seminar: The Causes of War—In spite of the increasing destructiveness of weapons systems, increasing economic interdependence, growing ecological threats, growing belief that war is no longer a legitimate instrument of foreign policy, and other fundamental changes in the international system, military conflict has persisted in relations among states. The objective of the seminar is to gain a better understanding of the conditions, processes, and events leading to the outbreak and escalation of war. Open to undergraduates who have taken P.S. 35 or its equivalent and to graduate students.

5 units, Aut (Levy)

143L. Seminar: Foreign Policy Decision-making—Seminar will examine the processes
through which foreign policy is formulated and implemented. A critical analysis will be made of several alternative models of policymaking — including the “rational-unitary actor,” organizational process, and bureaucratic politics, psychological and socio-psychological models. Attention will also be given to the impact on policy of different officials, agencies, and social groups. While the seminar focuses on American foreign policy, a broad theoretical framework is employed to facilitate study of comparative foreign policy. Open to undergraduates who have taken P. S. 35 or its equivalent and to graduate students.

5 units, Spr (Levy)

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. Begins with the examination of models of foreign policy analysis and the particular internal and external constraints facing American central decision-makers. Topics covered 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 (Goldstein)

146. Seminar: Soviet Foreign Policy in The Third World — 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. Explores the ways in which the competition between East and West affects states and regions in the Third World as well as the constraints upon the Soviet behavior posed by, and Soviet opportunities in, states and regions in the Third World. The emphasis is on contemporary Soviet foreign policy. Prerequisite: 35 or equivalent.

5 units, Spr (Triska)

149. Directed Reading/Research in International Relations — Advanced individual study in international relations.

any quarter (Staff) by arrangement

POLITICAL THEORY

151. Religion and Political Theory — The social and political ideas of the Jews, the early Christians, the medieval period, and the Reformation examined in their institutional setting and in the broader philosophical context. (DR: 3)

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, traced from its inspiration in the work of G. W. F. Hegel; particular focus is placed upon the relationship of Marx’s methodology and the political content of his theory. Some attention will 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. Course concludes with the perspective brought to Marx’s work by 20th century Marxists and Hannah Arendt.

5 units, Win (Ring)

161S. Seminar: Democratic Theory — An examination of 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 — 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 will include both traditional political theory and contemporary American feminist theory.

5 units, Win (Ring)

167A. American Political Thought: From the Puritan Beginnings to the Civil War — Seminar will deal with the main currents of American political thought from its roots in the English Protestant tradition and theocratic theory to the slavery issue and abolition; from the American Revolution and its theories through federalism and anti-federalism to the emergence of mass democracy. Weekly discussions and research paper.

5 units, Win (Eulau)

167B. American Political Thought: From Reconstruction to the Reagan Revolution — Seminar is a continuation of 167A but may be taken by students with sufficient background in prior American history. Topics will include liberalism and conservatism from the reconstruction period to the present day; varieties of socialism; the pragmatic revolt in politics; new left ideology and theoretical aspects of feminism. Weekly discussions and research paper.

5 units, Spr (Eulau)

169. Directed Reading/Research in Political Theory — Advanced individual study in political theory.

any quarter (Staff) by arrangement

PUBLIC POLICY

175. Politics and Public Policy — This course presents a broad historical look at national pub-
AMERICAN POLITICS

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)

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) in order 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 anti-social or "criminal" behavior, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. This course covers Winter and Spring quarters starting January 28. Students must register for both quarters.
2 units, Win plus 3 units, Spr
(Barton, Gibbs, Merryman)

183F. The Development of American Law—(Same as American Studies 171, Law 105.) The growth and development of the American legal institutions with particular attention to crime and punishment; slavery and race relations; the role of law in developing the economy; and the place of lawyers in American society, from Colonial times to the present.
5 units, Aut (Friedman) given 1986-87

183K. The Criminal Law and the Criminal System—(Same as Law 109 and Sociology 109.) Exploration of the purposes and processes of the criminal law with emphasis on the actual operation of the system, and application of theory to contemporary problems. Topics will include the police, the trial, sentencing, corrections and "non-victim" crimes.
4 units, Win (Kaplan)

186K. American Education and Public Policy—(Same as History 158B and 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? Issues analyzed in lectures and in small group discussions.
3 units, Aut (Kirst)

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)

192R. Seminar: The Politics of Policy Toward Unemployment—The policy problem of unemployment is as old as the recognition that forces, apart from the individual's initiative and willingness to work, will from time to time make it impossible for the individual to make a living. With this recognition has 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 will proceed both historically and analytically in order to approach understanding of the problem of unemployment as a public policy problem.
5 units, Win (Brody)

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

202. Seminar: Comparative Studies of Politics and Society—(Same as Sociology 245.) This seminar will focus on analysis of social and political developments in advanced or post-industrial society, with particular emphasis on western Europe and the United States. It will examine the ways in which changes in the technological and class structures have produced new bases for political cleavage and have affected the role of the state.
5 units, Aut (Lipset) given 1986-87

203A,B. Political Data Analysis I and II—Political Data Analysis I: Introduction to fundamentals of research design, measurement, computing and parametric and non-parametric statistics. Instruction will include lectures, discussions of examples in political science literature, and computer assisted analyses of political data sets. Political Data Analysis II: Examination of special problems encountered in quantitative analyses of political data and methods for alleviating those problems. Instruction will include lectures, computational assignments, and critiques of major political research.
203A. 5 units, Win (Tsebelis)
203B. 5 units, Spr (Tsebelis)

204. Seminar: Introduction to Positive Political Theory—Introduces students to concepts and analytical techniques from the theory of games, decision theory, and social choice theory, and will examine their use in modelling political institutions. Open to graduate students in the social sciences and to others with consent of instructor.
5 units, Spr (Ferejohn)

PUBLIC ADMINISTRATION

206. Seminar: Regulatory Strategies—(Same as Business 240.)
5 units, Spr (Taylor)

208. Directed Reading in Public Administration.
Any quarter, (Staff) by arrangement

COMPARATIVE POLITICS

215A,B. Japan's Political Economy—Study of the role of state and private enterprise in Japan's capitalist economy. Coverage of the international economy, political and economic institutions, policies and practices, and performance. First term, readings; second term, research paper.
215A. 5 units, Aut (Okimoto)
215B. 5 units, Win (Okimoto)

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

221S. Education and Radical Change: African Experiences—(Same as Education 395.) Focuses on schools as sites of protest and on education as a core element in development strategy. For the former, considers education and student protest in South Africa. For the latter, considers 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.
5 units, Spr (Samoff)
TTh 12-2:05 and by arrangement

5 units, Spr (Ward)

223P. Seminar: Transition from the Authoritarian Rule—Research-oriented seminar on the nature, conditions, and consequences of transitions from authoritarian rule. Initial readings deal with recent examples in Latin America, but European, Asian, and other cases will also be studied.
5 units, Win (Packenham, Boschi)

225T. Seminar on Political Activists: Comparisons and Theories—What is the importance of political activists for electoral outcomes? What
is their impact on party strategies? What is their societal profile? What are their motivations and their beliefs? Empirical studies concerning the U.S. and Western Europe will be analyzed. The findings will be compared with two opposed theoretical conceptions concerning political parties (Duverger and Epstein). A synthesis of the empirical findings will be attempted in a rational reconstruction of political activism.

5 units, Aut (Tsebelis)

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 instability 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, Win (Lipset)

226G. Seminar: Austria's Heritage from the Third Reich—(Same as History 239B/339B.) Focuses on national socialism, anti-Semitism, and the model of right wing mass parties; personnel, Hitler, Nazi leaders excluded by the "Anschluss", police and concentration camp staff material advantages and resources resulting from the policy of "Anschluss" and integration of Austria, economic, financial.

5 units, Spr (Botz)

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 will be on the dilemma of the two regional powers of how to deal with social change without harming their regional interests.

228A. 5 units, Win (Triska, Packenham)
228B. 5 units, Spr (Triska)

229. Directed Reading in Comparative Politics.

any quarter, (Staff) by arrangement

INTERNATIONAL RELATIONS

234R. The Two Germanies in International Affairs—(Same as German Studies 234R.) Comparison of the foreign policies of the Federal Republic of Germany (FRG) and German Democratic Republic (GDR). Topics include the division of Germany after 1945; internal and external factors shaping foreign policy; role of FRG and GDR in intra-bloc and inter-bloc relations; relations with the Third World; participation in international organizations.

5 units, Spr (Rittberger)

241A,B. International Political Economy—Examines 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 readings. 241B provides the opportunity to complete a research paper. Class sessions will be based on work being conducted by students and the lecturer.

241A. 5 units, Win (Krasner)
241B. 5 units, Spr (Krasner)

242L. Research Seminar: International Conflict—Seminar will undertake a comprehensive review of theory and empirical research on international conflict: conceptual analysis of different types of war; historical trends; causes of war; analysis of strategic deterrence, limited and sub-limited war; coercive diplomacy and bargaining. Open to graduate students and undergraduates of advanced standing. Admission by consent of instructor. Seminar will meet twice a week, days and hours by arrangement.

5 units, Win (Levy)

243. Seminar: International Relations Theory—Course identifies major trends in the North-South and East-West conflicts since World War II and examines data and current literature pertaining to projections and possible alternatives between now and the year 2000.

5 units, Aut (Goldstein)

247R. Seminar: Science, Technology and Change in the International System—(Same as German Studies 180R, VTSS 159.) Examines the role of science and technology in the development of early industrializing countries, and in relations among them; aspects of the scientific-technological dependence and transformation of developing countries; science and technology in North-South negotiations about a new international economic order; and international political-economic consequences of civilian and military applications of advanced technologies.

5 units, Spr (Rittberger)

248. Seminar on International Cooperation in Educational Development: The Role of International Organizations—(Same as Education 207X.) The seminar reviews 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 deals with the World Bank, UNESCO, OECD, regional development organizations such as the African Development Bank or the European Development Fund, and bilateral programs.

4 units, Spr (Weiler) given 1986-87

249. Directed Reading in International Relations.

any quarter (Staff) by arrangement
Graduate students interested in Political Theory offerings should also see courses numbered 150-169.

250. Classics of Modern Political Theory—(Same as Modern Thought and Literature 251.) Intended primarily (not exclusively) for graduate students wishing a basic knowledge of the works of Machiavelli, Hobbes, Locke, Rousseau, and Marx. The lectures and discussions will center on conceptions of power and legitimation and models of society.
5 units, Win (Drekmeier)

254. Essentials of Political Theory—(Same as Modern Thought and Literature 254.) Methods, concepts, and concerns of political theory: problems of valuation and interpretation; recent contributions to the philosophy of political analysis.
5 units, Aut (Drekmeier)

256. Liberalism—(Same as Modern Thought and Literature 256.) The history, theory, and ramifications of that political position we call "liberal." What are the origins of modern thinking about the self and its relation to authority, particularly mechanistic and natural rights theories? Contrasts the several schools of English liberalism, discusses the relation of state and society in these arguments, and contrasts Anglo-American philosophies with continental liberalism. Looks at some modern interpretations of the classical sources as well as considerations of the implications of liberalism for our own day.
5 units, Spr (Drekmeier)

269. Directed Reading in Political Theory.
any quarter, (Staff) by arrangement

AMERICAN POLITICS

284A. 5 units, Aut (Sniderman)
284B. 5 units, Win (Sniderman)

286R. Survey Design and Analysis—(Same as Communications 219.) Introduces the student to survey research via the design and execution of a survey instrument. If feasible, the instrument will employ computer assisted telephone interviewing (CATI) technology as a means of illuminating the intersection of politics and media. Limit 25 students; graduate students get first preference. Prerequisite: 203A, Statistics 60, Psychology 60, or equivalent.
5 units, Spr (Brody)

288K. Educational Evaluation and Federal Education Policy—(Same as Education 323A.) The formulation and administration of federal education policy. Includes federal/state delivery systems and policy evaluation as well as the key actors of coalitions.
3 units, Spr (Kirst) given 1986-87

5 units, Aut (Ferejohn)

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—Examines the use of single and comparative case studies as a research strategy for the development of theory. In addition to reading and discussing general descriptions of this research strategy that appear in the literature, will examine a number of studies that have employed some variant of this approach in an effort to identify the requirements for making successful use of this research strategy. Students have 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)

5 units, Win (March)

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 (Almond, Packenham)

313. Seminar: Development and the International System—Participants will address a number of key issues raised by external constraints and influences on development in the Third World. Emphasis is on the interaction between national and international factors.
5 units, Aut (Fagen)
325. Research Seminar: The Chinese Political System—Participants will examine the roles of leadership, law, and the existing political and economic systems in China's effort to modernize. Special emphasis will be placed on methods used to reform administrative and economic organs, to enhance systematic performance, and on the social limits to politically-induced change. Prerequisite: consent of instructor. 5 units, Spr (Lewis)

327A,B. Seminar: Introduction to Graduate Research on Soviet Politics and Society.
327A. 3 units, Win (Dallin, Staff)
327B. 3 units, Spr (Dallin, Staff)

328. Knowledge and Legitimation: The Politics of Educational Research—(Same as Education 307X.) Within the theoretical framework of legitimation theory, the 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)

332. Research on Decision Making and Strategic Interaction in International Relations. 5 units, Spr (George) by arrangement

370. Seminar: American Political Economy—Explores a wide range of literature that purports to explain the political economy of the United States. Two major competing theories of political economy, pluralism and Marxism, are compared within the U.S. historical context from the New Deal to the present. 5 units, Win (Manley)

380A,B,C. Research Seminar: Workshop on the Theory of Collective Choice—Research on mechanisms of social choice, political processes and strategy. Open to graduate students in the social sciences with consent of instructor. 380A. 5 units, Aut (Ferejohn)
380B. 5 units, Win (Ferejohn)
380C. 5 units, Spr (Ferejohn)

381A,B. Public Opinion and Foreign Policy—Examines the sources of public response to several cases in post-war foreign policy, e.g., the Truman Doctrine, the U-2 Incident, the Bay of Pigs, Cuban Missile Crisis, the Vietnamese War, and the Iranian Hostage Crisis. The roles of prior public attitudes, elite leadership, the media and the events themselves as sources of the public response will be considered. Also considers the roles of public opinion in the formation of U.S. policy with respect to these events. In the second quarter research papers will be developed and presented to the seminar.
381A. 5 units, Aut (Brody)
381B. 5 units, Win (Brody)

COMMITTEE ON POPULATION STUDIES

Committee-in-Charge: W. Brian Arthur, Chairman (Food Research), Luigi L. Cavalli-Sforza (Genetics and Medicine), Paul A. David (Economics and History), Marcus W. Feldman (Biology), Meredith John (Food Research), Samuel Karlin (Mathematics), Jonathan Roughgarden (Biology), Nancy Tuma (Sociology)

Although Stanford University at present does not have a formal degree program in Population Studies, it does have scholars of international reputation in such specialties as population biology, population genetics, epidemiology, demographic methods, demographic history, economic demography, and in the sociology and anthropology of population.

The Committee on 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 Committee also organizes an Interdisciplinary Colloquium in Population Studies to introduce upper division and graduate students to a wide variety of issues in population-related specialties.

For the convenience of students interested in population studies, courses presently offered at Stanford are listed below.

ANTHROPOLOGY

147. Peasant Migration and Social Change. 3 units, Aut (Siegel)

168. Medical Anthropology. 5 units, Aut (Barnett)

250. Nutritional Problems of Developing Nations. 3 units, Win (Martorell)

260. Topics in Urban Anthropology. 5 units, Win (Yanagisako)

263. Regional Systems in Agrarian Societies. 5 units, Win (Skinner)
BIOLOGICAL SCIENCES

   3 units, Aut (Feldman)

   1 units, Win (Arthur, Feldman)

   3-5 units, Spr (Ehrlich)

   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, Spr (Roughgarden)

   1-3 units, Spr (Roughgarden)

ECONOMICS

   5 units, Win (Yotopoulos)

   5 units, Spr (Arthur)

249. Economic Demography.
   5 units, Spr (Arthur)

FOOD RESEARCH INSTITUTE

   5 units, Win (Yotopoulos)

   5 units, Spr (Arthur)

137. Determinants of Human Population Processes.
   5 units, Aut (John)

   1 unit, Win (Arthur, Feldman)

   3 units, Win (Martorell)

286. Demographic Methods.
   5 units, Win (John)

287. Economic Demography.
   5 units, Spr (Arthur)

386. Seminar: Demography.
   3 units, Aut (Arthur, John)

HUMAN BIOLOGY

60. Population Studies Colloquium.
   1 unit, Win (Arthur, Feldman)

120. Human Nutrition.
   4 units, Aut (Martorell, Bray)

   5 units, Spr (Arthur)

137. Determinants of Human Population Processes.
   5 units, Aut (John)

150C. Seminar: Feminist Perspectives of Birth Control.
   5 units, Win (Djerassi)

SOCIOLOGY

   5 units, Spr (Arthur)

PSYCHOLOGY

Emeriti: (Professors) Edith M. Dowley, Ernest R. Hilgard, Douglas H. Lawrence, Quinn McNemar, Robert R. Sears

Chairman: Ewart A.C. Thomas


Associate Professors: Ellen Markman, Brian A. Wandell (on leave Autumn 1985), Jeffrey J. Wine

Assistant Professors: Michael Pavel, George A. Quattrone, Paul Rosenbloom, Daniel A. Weinberger

Senior Lecturer: Barbara Tversky

Lecturer: Lyn Carlsmith

Visiting Professors: Sherri Matteo, James Townsend, Richard Young


OFFERINGS AND FACILITIES

The Department of Psychology comprises facilities and personnel housed in Jordan Hall, where it maintains extensive laboratory and shop facilities. Several of the laboratories are equipped with computers and others are linked directly to the University’s Computer Center. The department maintains a nursery school close to the Escondido married students’ housing area. This provides a laboratory for child observation, for training in nursery school practice, and for research.

The department provides: (1) courses designed for the general student; (2) a major program leading to the degree of Bachelor of Arts; and (3) programs of graduate study and research leading to the degree of Doctor of Philosophy. Applications are not accepted for the master’s degree.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

For the bachelor’s degree, a total of 65 units in psychology and supporting fields are required; of these, a minimum of 45 units must be completed in psychology itself. A maximum of 20 units in non-introductory courses in supporting fields (i.e., mathematics, computer sciences, physical sciences, biological sciences, and social sciences) may also be counted toward the 65 unit requirement.

Beyond these overall requirements, the 45 units in psychology must include Psychology 1, Psychology 60, and at least two courses from each of two groups listed below: Group A consists of broad content courses in the areas of cognition, perception, physiological psychology, and psycholinguistics. Group B consists of courses in the areas of social, developmental, abnormal and personality.

Group A: 102, 106, 107, 108, 109, 110, 120, 146, 147, 183, 164
Group B: 111, 113, 115, 121, 133, 135, 136

These two lists of courses, it should be noted, may change from year to year, and students are encouraged to check with the Department Secretary for additional information.

No more than 10 units of independent study (104, 182, 184, 188, 257, and 257A) may be counted toward the 45 units. All independent study courses are graded on a no-option pass/no credit basis.

A transfer student must take at least 15 units of course work in the department in order to receive the department’s recommendation for graduation. Such students may receive transfer units for courses completed in psychology at any accredited university or college provided that the courses were taught by a regular faculty member. There is no limit to the number of units that may be transferred, but all students must satisfy Group A and Group B requirements through courses completed at Stanford.

Beyond the Minimal Requirement—Many students will wish to complete a “strong” program rather than merely fulfill the minimal requirements listed above. This may be especially true for students who anticipate graduate study in psychology or in closely related fields. Listed below are some recommendations that should help students to strengthen their programs.

1. Research experience, particularly in the junior or senior year, is highly desirable for anyone considering graduate work in psychology. For those interested in clinical psychology, counselling psychology, etc., “para-professional” experience (e.g., Psychology 184 or some similar program) is highly recommended.

2. Courses in statistics (beyond Psychology 60), mathematics, and computer sciences are becoming increasingly important and helpful for graduate work.

3. Courses beyond the introductory level in fields related to psychology (e.g., sociology, anthropology, biology, physiology, etc.) will further strengthen students’ programs.

4. Students should seriously consider the advanced seminars offered by the Psychology Department, particularly in areas closely related to the student’s career plans (e.g., prospective clinicians might enroll in advanced seminars in psychopathology, personality, or behavior modification). Academic advisors can be particularly helpful in guiding such choices.

5. Finally, for those students interested in graduate work in psychology, the senior honors program is strongly recommended. A description of this program follows below.

SENIOR HONORS PROGRAM IN PSYCHOLOGY

A Senior Honors Program is designed for those exceptionally able students who wish in their major, to pursue an intensive and somewhat independent study of psychology, and to engage in psychological research. Admission to the program will be made at the end of the
student's junior year on the basis of academic performance and demonstrated desire to do research. The program is directed toward the integrating of a substantial body of theoretical and factual information, and the development of creative scholarly skills, by independent study, small seminars, and extended research experience. Particular emphasis is laid on the planning of an individual program for the student that will combine his or her specialized interests with the body of basic general psychology essential for all students who are undertaking concentrated study in the field. 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.

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, as well as sufficient additional units to make up a program totaling 45 or more units. In partial fulfillment of this unit requirement, Psychology 152 must be selected as well as two other courses from the content areas, one to be selected from 209, 210, 214, and 215, and one to be selected from 211, 212, 213, and 254. The balance of the 45 units may be satisfied by a master's thesis if both the student and advisor feel that is appropriate. For basic university requirements for the A.M. and Ph.D. see the "Degrees" section of this bulletin.

DOCTOR OF PHILOSOPHY

In addition to fulfilling the residence requirement for the degree, the following requirements are stipulated.

1. 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.

2. 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.

3. Third-Year Major Area Paper—During the first week of the Autumn Quarter of the fourth year, the student will turn in a Conceptual Analysis of the Dissertation Area (CADA). This paper will provide a general
framework for the research topic of the dissertation, address the central issues within the specialty area, and review the pertinent literature(s). Typically, the analysis would have the kind of scope found in the opening chapters of the more traditional dissertations, although the exact format and scope of the paper would be a joint decision made by the student and the advisor.

At this same time, the student would select two faculty members to read the paper and give feedback and commentary on it. These should be two faculty members most likely to serve on the later orals committee of the dissertation.

A portion of the paper, revised as appropriate, could then become the first section of the actual dissertation proposal. Thus the student will receive additional feedback on CADA at the oral examination itself.

If the student should radically change the area of the dissertation research after CADA has been written, the procedure will not have to be repeated for the second dissertation topic. It is still expected, of course, that the student will be knowledgeable about the literature and problems of any research topics being pursued for the dissertation; it is only the formal CADA procedure which need not be repeated.

4. 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.

5. 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.

6. Orals—The candidate shall pass the University oral examination which will be based on the dissertation proposal, not on the defense of the dissertation itself. The reason for the policy is to permit the orals to serve the function of guiding and improving the proposed research. This function can be best served if the orals are scheduled early in the year in which the dissertation research will be conducted. It is therefore expected that the orals will be taken by the end of the Autumn Quarter of the fourth year.

7. 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.

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 interdisci-
Preliminary 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 Cognitive Science Program 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. Personality development, motivation and emotional adjustment, social behavior, learning, perception, and the physiological basis of behavior are among the topics presented. (DR:4)

   4 units, Aut (Markman) MWF 11
   4 units, Win (Quattrone) MW 1:15-2:45
   4 units, Spr (Zimbardo, Staff) MWF 10

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—To acquaint the student with the elements of statistical description (measures of average variation, correlation, etc.) and, more importantly, to develop an understanding of statistical inference. Emphasis is placed on those statistical methods of principal relevance to psychology and related social sciences. NOTE: Students who receive credit for Psychology 60, will not be given credit for Statistics 60. (DR:6)

   5 units, Aut (Pavel) MTWThF 9
   Win (Thomas) MTWThF 9
   Spr (Townsend) MTWThF 9

80. Applications of Social Psychology—This course surveys the application of social psychological theory and research to a variety of issues and problems, including the following: evaluating the impact of social interventions, strategies and shortcomings in personal and social decision making, effects of mass media and other sources of social persuasion, applications of social psychology in legal, medical, educational, and business settings. Prerequisites: 1 and 60, or permission of instructor

   4 units, Spr (Ross) TTh 11-12:30
   given 1986-87

102. Perception—A discussion of how our senses both limit and augment our experience of the world around us. Topics will include the perception of color, sound, pain, and smell. Includes a laboratory section to be arranged. (DR:4)

   4 units, Win (Townsend) MWF 9

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, with an 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, Aut (Wine) TTh 1:15-2:30
   alternate years, given 1986-87

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 our memory of those events. Prerequisite: 1 or equivalent.

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<tr>
<th>Course Code</th>
<th>Title</th>
<th>Instructor</th>
<th>Time</th>
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<tbody>
<tr>
<td>4 units, Spr (Ganz)</td>
<td>TTh 10-11:30</td>
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<tr>
<td>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.</td>
<td>(DR:4)</td>
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<td>3-5 units, Aut (Flavell)</td>
<td>MWF 11</td>
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<td>113. Adolescence — Addresses adolescence from two points of view: as a period of intrapsychic growth and consolidation during which an eponym of the adult self emerges and as a culturally induced delay before the “status” of adulthood is achieved.</td>
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<td>3 units, Win (Walters)</td>
<td>TTh 2-3:15</td>
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<tr>
<td>115. Social Development—The study of 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)</td>
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<td>3-4 units, Win (Lepper)</td>
<td>MWF 10</td>
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<tr>
<td>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.</td>
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<td>3 units, Aut (Matteo)</td>
<td>TTh 10-11:30</td>
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<tr>
<td>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.</td>
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<td>3-5 units, Win, Spr (Bing School Staff)</td>
<td>T 3:30-5 and by arrangement</td>
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<tr>
<td>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.</td>
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<tr>
<td>4-5 units, Aut, Win, Spr (Bing School Staff)</td>
<td>TTh 3:30-5 and by arrangement</td>
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**120. Cognitive Development**—A survey of major topics and issues concerned with cognitive development, developmental changes in memory, conceptual organization, logical reasoning, and communication skills will be discussed. Prerequisite: 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, Zimbardo) MWF 1:15-2:45

**122. Children’s Literature: A Psychological Perspective**—Course will consider, through readings, writing assignments, and class discussions, the many ways of looking at children’s literature (here arbitrarily 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 among others, to this burgeoning field will also be examined. Fairy tales will be discussed from several viewpoints including the psychoanalytic as represented by Bruno Bettelheim. Prerequisite: Psychology 1 or Psych 117.

3 units, Win (B. Shepard) TTh 1:15-2:30

**124. The Social Psychology of Politics**—The course takes a social-psychological approach to the topics of political attitudes and decision-making. Topics will include the nature of political ideology, the rise of the Nazi party in Germany, political socialization, propaganda, the determinants of voting, and strategic power games among nations.

3-4 units, Win (Quattrone) TTh 1:15-3:05 given 1986-87

**125. Psychology and Law**—Legal, psychological, and popular views of morality, responsibility, equity, intention, insanity, evidence, crime and punishment; the police; psychological processes in jury deliberation; homicide and aggression; treatment of accused persons.

3-4 units, Win (Ellsworth) MWF 11

**126. Artificial Intelligence for Psychologists**—(See 245.)

**127. Afro-American Psychology**—Course designed to provide students with an introduction to ethnic psychology, specifically, the psychological dimensions of the Black experience in America. Through lectures and readings, Black psychology explored from its evolution as a concentration area in the social sciences to pre-
sent concerns that impact mental health of Black Americans. Students encouraged to expand upon the methodological constructs employed in the study of Black Americans.

3 units, Spr (Hudson) MWF 10

128. Research Methods and Experimental Design — An examination of research methods and principles in social and developmental psychology. Structured research exercises and the design of an individual research project are required. Prerequisite: consent of the instructor.

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

129. Person Perception, Self-Perception and Stereotyping—The course examines 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 prophecy.

3-4 units, Aut (Quattrone) TTh 1:15-2:30 given 1986-87

131. Seminar in Cross-Cultural Psychology — (Same as Education 132S.) 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 appropriateness, bicultural competence, and clinical efficacy with ethnic minority groups.

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

133. Psychological Disorders of Childhood—Focuses on developing 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

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, Spr (Rosenhan) TTh 1:15-2:45

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, Spr (Rosenhan) by arrangement

137. The Interpersonal Basis of Abnormal Behavior—Course examines the role of interpersonal problems and interpersonal processes in producing different forms of psychopathology, ranging from neurotic reactions to schizophrenia. It combines the clinical (case study) approach with the usual empirical approaches to clarify the origin, nature, and treatment of emotional disorders. Prerequisite: 136.

3 units, Win (Horowitz) TTh 11-12:30

138. Carl Jung and Analytical Psychology—As an introduction to C.G. Jung, this course focuses 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.) Course will explore the development of psychological theory from an historical perspective. Major systematic positions such as structuralism, Gestalt theory, behaviorism, and psychoanalysis will be discussed in some detail. The historical roots of major contemporary positions will be explored. Prerequisites: students should usually have taken 3 courses in Psychology.

4 units, Spr (Hastorf) TTh 11-12:15

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

3 units, Win (Staff) MW 1:15-3:30 and by arrangement

144. Counseling and Therapy: An Introduction—(Same as Education 130.) Some major approaches to counseling and psychotherapy. Primary emphasis on social learning strategies. Case studies on a variety of personal, social, and academic problems. 1 recommended as prerequisite.

3 units, Spr (Krumboltz) alternate years, given 1986-87

145. Psychological Foundations of Education—(Same as Education 215.) Introductory course in 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 psycholinguistics, including speech perception, sentence structure and sentence processing, language acquisition by children, and the biological bases of language. Consideration of the relationship between constraints on the structure of natural languages and the processes by which they are produced, comprehended, and acquired.

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. Offered alternate years. Prerequisites: 107, or Biological Science 43, or Human Biology 4A.

4 units, Aut (Wine) TTh 1:15-2:30

149. Laboratory Course in Behavioral Neurophysiology—(Same as Human Biology 170.) Selected aspects of behavioral neurophysiology will be 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 will then be trained as a group in standard laboratory technique: manufacture of microelectrodes, surgical implantation, recording, behavioral training and histological reconstructions. They will then be divided into smaller working groups (perhaps 3 per group) and each will conduct a mini experiment, in part of their own planning.

3 units, Win (Thompson) TTh 3-5 and by arrangement

152. Analysis of Data—Exploratory data analysis. Robust and resistant measures. The analysis of variance and covariance. This course will offer a nonmathematical approach to the practical issues faced by the data analyst.

3-4 units, Win (Novick, Vallone) MTWF 9

153. Statistical Theory, Models and Methodology—To review elementary probability theory and the theory underlying the more popular statistical techniques, paying attention to applications of these ideas and methods in psychology and the social sciences. Topics include: random variables, expected value, correlation, Chebyshev and other inequalities; the binomial, Poisson, and normal distributions; limit theorems; small sample distributions; estimation and hypothesis testing; simple analysis of variance; elementary principles of sample design.

3 units, Spr (Staff) MWF 9

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

3 units, Win (Snow) MWF 9

156. Decision Making—(Graduate students register for 256.) This course will review major theoretical developments and empirical findings regarding individual decision making. The course will focus on decision making under risk or uncertainty and the attempt to understand and explain attitudes towards risk. The manner in which observed decisions depart from the rational theory of choice will be examined and their implications will be explored.

2-3 units, Aut (A. Tversky) TTh 11-12:15

157. The Psychology of Judgment and Decision Making—Course will explore the strategies and shortcomings of human judgment and decision making. Contributions from cognitive psychology and social psychology will be integrated, with a heavy emphasis on the central question: when and why are people rational or irrational, both in the inferences they make about themselves, their peers and the world around them, and in the courses of behavior they follow. Enrollment limited. Prerequisite: 1.

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

given 1986-87

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 (A. Tversky, 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.)

167A. Peer Counseling: Bridge Community—Course provides 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 given opportunity to develop and apply the above skills in a variety of contexts. Enroll for credit in only one quarter of the course.

2 units, Aut, Win, Spr (D'Andrea, Staff) by arrangement

167B. Peer Counseling: Chicano Community—Course provides instruction in basic 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. 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. Methods of 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—Course provides 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, method of instruction includes reading assignments, lectures, guest speakers, group discussion, role play, and videotaped practice. Students given opportunity to 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—Course 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 will also be 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
169. Women, Madness and Sanity—(Same as Feminist Studies 133.) Concepts of mental health and mental illness as applied to women. Theory of psychotherapy, both traditional and feminist. Alternative approaches to mental health.

3 units, Win (Matteo) TTh 10-11:30
170. Identity and Role: A Practicum—(Same as Drama 124.) After initial conferences, instructions and introductions, the class time will be spent primarily in exercises in role-playing with critique and evaluation of their impact. Each student will undertake 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 instructor.

3-4 units, Win (Zimbardo, Ryan) M 2:15-5:05, W 4:15-5:05
171. Neurology for the Non-Neurologist—(Graduate students register for 284.) An introduction to the major disorders of the human nervous system including congenital malformations, cerebral palsy, epilepsy, muscular dystrophies, multiple sclerosis, and degenerative diseases. Through videotape presentations of selected neurological disorders, the course will integrate the principles of neuroanatomy and neurophysiology. Intended for professionals in health and human services (psychologists, special educators, physical therapists) who will work with individuals with neurological handicaps. Prerequisites: Introductory Biology, Psychology 1, or permission of the instructor.

1-3 units, Spr (Young) 7-9 PM
177. Social Psychology of Physical Deviance and Disability—(Same as Human Biology 177.) Course will consider 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. In addition, discussion of the legal and political issues concerning the handicapped.

4 units, Win (Hastorf) TTh 11-12:15, plus one mandatory section by arrangement
180. Undergraduate Seminar: Selected Topics in Psychology—(Refer to quarterly Time Schedule for seminar listings.)
180B. Undergraduate Seminar: Getting into Graduate School in Psychology—How to decide on a graduate program, application strategies, financial aid, and what to expect when you get there. Alternatives to graduate school (e.g. community jobs in psychology). Guest speakers will include faculty and graduate students. Most helpful for those who do not need to submit applications until after course is completed.

1 unit, Aut (Parpal) M 3:30-5
182. Senior Honors Seminar—Limited to students in the Senior Honors Program. During the Autumn Quarter, students will participate in a weekly seminar concerned with 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.

4 units, Aut, Win, Spr (B. Tversky)
T 3:15-5:05

184A. Paraprofessional Internship Program—Designed primarily for students interested in exploring the areas of counseling, clinical, educational and community psychology through field experience. A variety of programs within the broadly defined areas of Community Mental Health utilize Stanford undergraduates as volunteers "paraprofessionals." On-site training and supervision, and teaching. Use of behavior modification and other techniques in working with emotionally and behaviorally disturbed youngsters at three children's centers. Opportunities for working with adolescents are provided through the peer counseling program in Palo Alto high schools and the Juvenile Probation Department in San Jose. Volunteers at the Menlo Park V.A. Hospital work with Vietnam veterans, drug abusers, and brain-injured patients in innovative clinical programs. Adult programs provide experience in working with former mental patients and with the particular problems of the elderly. Internships demand a heavy commitment in terms of time and energy (8 to 12 hours per week) for two consecutive quarters, but each offers an unusual opportunity for mature, responsible and dedicated students. To supplement the field experience, a bi-weekly 2-hour seminar will explore specific therapeutic techniques and discuss the progress and problems of students' individual placements. Prerequisite: students take this course for two consecutive quarters; consent of the instructor.

3-5 units, Aut (L. Carlsmith)
T 2:15-4:05

184B. Paraprofessional Internship Program—(Same as 184A.)
3-5 units, Win (L. Carlsmith) T 2:15-4:05
and by arrangement

184C. Paraprofessional Internship Program—(Same as 184A and 184B.)
3-5 units, Spr (L. Carlsmith) T 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; concerned with the life experience of the individual affected as well as that of his or her family. Also consider the roles of the Doctor, the therapist, the Special Ed. Teacher, the Counselor, and other professionals involved in the life of the handicapped person. In addition to the weekly seminars, students will teach swimming to children and adults with many different handicaps (mental, physical, emotional, learning, etc.) for at least 3 hours each week, keep an ongoing journal, and participate in a final group or individual action project.

3 units, Aut, Win, Spr (L. Carlsmith)
Th 7:30-9:30 p.m. and by arrangement

187. Computational Models of Cognition—(Same as Computer Science 328A.) 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 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 instructors and limited to 15. Prerequisites: advanced undergraduate standing and either Psychology 106, Computer Science 223 or equivalent experience.

2-3 units, Aut (Pavel, Gluck)
by arrangement, given 1986-87

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. Endocrines and Behavior—(Same as Human Biology 189.) Focuses on the influence of hormones on behavior. The primary emphasis is on the role of stress and the endocrine correlates of stress as they influence behavioral processes. The neuroendocrine control of the pituitary-adrenal system will be covered, in addition to a detailed examination of the concept of stress. The effects of hormones from the pituitary-adrenal system on sensory processes, learning, and memory will also be discussed.

3 units, Win (Levine) TTh 4:15
alternate years, given 1986-87

190A. Early Experience—(Same as Human Biology 143.) This course focuses on the experimental literature related to the effects of prenatal 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.

3-5 units, Win (Levine) TTh 4:15-5:05
191. Undergraduate Seminar: Behavior Change — This seminar will examine social learning approaches to personal and social change. Prerequisite: consent of instructor.
3 units, Win (Bandura) M 2:15-4:05

195. Undergraduate Seminar: Aggression—This seminar will examine the determinants of individual and collective aggression. Primarily intended for majors in psychology. Prerequisites: 1 and consent of instructor.
3 units, Spr (Bandura) M 2:15-4:05

193. Psychobiology of Learning and Memory —Focus is on 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, will be considered and topics will range from habituation and classical conditioning to cognition and language. Prerequisites: Human Biology 4A or Biology 43 or Psychology 107.
3 units, Spr (Thompson) TTh 3:15-4:30

194. Undergraduate Seminars—The 194 seminars are not a series, and may be taken in any order.

194A. Undergraduate Seminar: Parent-child Interaction—Topics of discussion will 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

194B. Undergraduate Seminar: The Childhood Development of Memory, Comprehension and Communication—Seminar purpose is to provide interested students with the opportunity to learn and think about theory and research on the development of memory, comprehension, and communication in children. Prerequisite: consent of the instructor.
3 units, Spr (Flavett) M 1:15-3:05

194D. Undergraduate Seminar: The Psychology of Gender Differentiation—An examination of conceptions of masculinity, femininity and androgyny, as they relate to successive phases of development through childhood and adolescence. The possible roles of biological predispositions, of parents, and of peers in gender development will be discussed. Prerequisite: 111 or equivalent, and consent of instructor. Limited enrollment.
3 units, Aut (Maccoby) T 10-12

196. Human Polysomnography—(Same as Psychiatry 235.) Techniques for human sleep recording including EEG, EMG, respiration, heart rate. Electrode application and polygraph operation are emphasized. Intended for students interested in sleep research projects. Prerequisites: 1 and 107 or equivalent; consent of instructor.
4 units, Win (Carskadon) TTh 11-12 Th 7-10 p.m.

197. The Physiological Psychology of Sleep and Dreaming—Presentation of current knowledge in the areas of sleep, dreams, and sleep disorders. Goal is to provide essential basic information about sleep that everyone should know. Includes physiology of REM sleep versus NREM sleep, circadian rhythms, daytime sleepiness, developmental and phylogenetic aspects, the insomnias, the hypersomnias, sleepwalking, sleep terrors, sleeping pills, dream content, and psycho-physiological correlation. Current research is integral to course material. No prerequisite.
3 units, Aut (Carskadon) MWF 1:15-2:05

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 will be on: techniques (e.g., hypnosis, "love-bombing", sensory deprivation), agents of persuasion (e.g., charismatic leaders, supersalesmen, 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

COURSES PRIMARILY FOR GRADUATE STUDENTS

Undergraduate students may be admitted only by consent of instructor.

206. Behavioral Neuroscience—The focus of this course is on neurobiological substrates of behavior. Topic areas are for the most part organized in terms of categories of behavior. The neuroanatomical, neurophysiological, neurochemical, hormonal and pharmacological aspects of these behavioral phenomena will be 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 back-
grounds. Required of and limited to first-year graduate students in psychology.
3 units, Aut (Hastorf, Zimbardo) 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, Win (Ganz) TTh 1:15-3:05

210. Cognitive Psychology — Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Spr (Bower) MW 11-12:15

211. Developmental Psychology—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Win (Flavell, Maccoby, Markman) MW 10-12

212. Social Psychology—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Aut (Lepper, Ross) TTh 1:15-3:05

213. Personality — Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Win (Weinberger) TTh 3:15-4:45

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 or consent of instructor.
3 units, Win (Pavel, Thomas, Tversky, Wandell) TTh 11-12:15

216. Abnormal Psychology—Course will examine selected literature in abnormal psychology approached from a cognitive and interpersonal perspective. It attempts to integrate psychoanalytic and behavioral views of the nature, origin, and treatment of abnormal behavior. Prerequisite: graduate standing in psychology or 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, Aut (Shepard) Th 3:15-5:05

219. Graduate Seminar on Selected Topics in Cognition—(Undergraduates register for 165.) Prerequisite: consent of instructor.
3 units, Spr (B. Teversky) 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 Psychology 106, Computer Science 223A, or equivalent experience.
3 units, Spr (Rosenbloom) MW 9:30-10:45

224. Survey of Research Topics in Artificial Intelligence — Introductory survey of concepts and problems in artificial intelligence research; heuristic processes in problem solving, and heuristic programming; information processing models as explanations of human cognitive and affective behavior. Prerequisite: Computer Science 107 or equivalent.
2 units, Spr (Lenat) TTh 11-12:15

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 (Ellsworth, Rosenhan) Th 3:15-5:05

226. Emotions—A survey of historical and current psychological theories of emotion, and the related empirical evidence. The interrelationship between cognition and emotion will be emphasized; neurophysiological research will be (relatively) de-emphasized. Draws on material from social, cognitive, developmental and clinical psychology. Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Win (Ellsworth) TTh 11-12:15 given 1986-87

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; how ionic transport molecules of fluid transporting epithelia are controlled by intracellular messengers (which are in turn controlled by neurotransmitters and hormones); and finally, secretion of macromolecules.

2 units, Win (Wine) Th 3:15-5:05

230. The Psychology of Sex Roles—Seminar examines current research on theoretical constructions of sex role norms and expectations. Special topics include but are not limited to reproductive constructions of the social world; sex differences in social/cognitive skills; the effect of sex-role stereotypes on occupational choice and achievement.

3 units, Spr (Matteo) W 1:15-3:15

231. The Auditory Process—(Same as Hearing and Speech Sciences 292.) A systematic survey of our current knowledge of the operation of the auditory system. Emphasis is placed on acquiring a knowledge of the acoustic signal, and on an understanding of the methods of measuring a sensory process. Prerequisite: consent of instructor.

3 units, Aut (Schubert) by arrangement

232. Selected Topics in Psychoacoustics—(Same as Hearing and Speech Sciences 392.) A detailed study of the normal auditory mechanisms with particular emphasis on the use of psychoacoustic methods of analysis. Evaluation of current theories regarding auditory processing of information. Prerequisite: consent of instructor.

3-4 units, 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

239. Advanced Cognitive Development—A critical examination of current theory and research in cognitive development. Topics will include: Piagetian and other theoretical approaches; developmental aspects of perception, attention, memory, comprehension, communication, and social cognition. Prerequisite: 211 or consent of instructor.

3 units, Win (Flavell) Th 3:15-5:05

240. Language Acquisition I—(Same as Linguistics 240.) Review of present knowledge of processes of language acquisition from a linguistic point of view. Survey of recent ad past literature. Prerequisites: Linguistics 10 or 230, or consent of instructor.

4 units, Aut (E. Clark) MW 2:15-3:30


4 units, Win (E. Clark) by arrangement

242. Conceptual Organization and Development—Theories of conceptual organization and development will be critically evaluated. Emphasis will be on comparing the underlying assumptions of traditional theories to those of current theories, including some semantic memory models. Alternative possibilities will be explored.

3 units, Aut (Markman) M 3:15-5:05 given 1986-87

243. General Developmental Seminar—Prerequisite: consent of the instructors.

1-2 units, Win (Maccoby, Flavell, Markman) by arrangement

245. Artificial Intelligence for Psychologists—(Undergraduates register for 126.) Introduction to the concepts of artificial intelligence, and the relationship of these concepts to psychological theory and data. Topics include problem solving, representation of knowledge, control structures, learning, expertise, natural language, and programming languages. Prerequisites: Advanced undergraduate standing, graduate standing, some programming experience, and 106 or equivalent.

3 units, Aut (Rosenbloom) TTh 9:30-10:45

247. Advanced Social Development—Current theory and research on social development will be reviewed and discussed. Topics will include: attachment, aggression, pro-social 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 given 1986-87

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.) Models, methods, and applications of factor analysis. Models for factor analysis; estimation procedures; factor rotation; factor scores; using factor analysis in research.
confirmatory factor analysis; methods for dichotomous variables. Prerequisites: 152 and 248 or Education 250B and 252 or equivalent.

3 units, Sum (Haertel) MW 10-12

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. Krumbloltz) M 3:15-5:05 and by arrangement

251. Topics in Language Acquisition: Acquisition of Morphology and Syntax—(Same as Linguistics 248.) Variable topics. 4 units, Spr (E. Clark) given 1986-87

253. Science and Research in Counseling Psychology—(Same as Education 232.) Examine assumptions of empirical-experimental research in applied human sciences. Critical analysis of relationship between theoretical rationales, research questions, designs, data analyses and conclusions. Enrollment limited. 4 units, Aut (Thoresen) MW 9-11

254. Principles of Personality Change — Prerequisite: graduate standing in psychology. 3 units, Aut (Bandura) M 10-12

254A. Principles of Personality Change—(See 191.)

255. Graduate Seminar: Selected Topics in Personality and Abnormal Psychology—Prerequisite: consent of instructor. 3 units, Aut (Horowitz) by arrangement

256. Decision Making—(See 156.)

257. Individually Supervised Practicum—Can be repeated for credit. Prerequisites: graduate standing in psychology and consent of instructor. 3-5 units, Aut, Win, Spr (Staff) by arrangement

257A. Practicum in Teaching—Enrollment limited to students serving as teaching assistants in selected psychology courses. Can be repeated for credit. 3-5 units, Aut, Win, Spr (Staff) by arrangement

258. Models of Interactive Systems—Course will consider static and dynamic approaches to the study of selected psychological processes, and attempt to understand the differences between the two approaches. Applications will range from (1) Psychophysics, e.g. (a) threshold estimation by static and dynamic methods, and (b) the use of threshold estimates to study tradeoffs between stimulus variables; to (2) Information Processing, e.g., (a) fixed sample versus sequential sampling models of reaction time, and (b) the tradeoff between speed and accuracy; to (3) Social Interaction, e.g., (a) models for interrelating two streams of observations. Prerequisite: 215 or equivalent. 3 units, Aut (Thomas) M 1:15-3:05 given 1986-87

259. Graduate Seminar in Personality Research—Can be repeated for credit. Prerequisite: graduate standing in psychology. 3 units, Win (Weinberger) M 12:30-2

271. Seminar in Clinical Processes — (Same as Anthropology 271.) This seminar includes practicum training in clinical interviewing and case observation. It is affiliated with a psychiatric ward at the VA Hospital, where each student will conduct interviews and coordinate findings. In weekly case presentations, the seminar will focus on aspects of case formulation as well as on the goals and theories of interviewing. Students should enroll concurrently in Psychology 216. Prerequisite: consent of the instructors.

1-3 units, Spr (Horowitz, Herdt) alternate MTh by arrangement 1:15-3:30

272. Special Topics in Psycholinguistics—Prerequisite: consent of instructor. May be repeated for credit. 3 units, Win (H. Clark) by arrangement

273. Research Design and Procedure—Course covers the design of experiments, quasi-experiments, and surveys; verbal and behavioral measures; sampling; convergent operations; and a variety of low-level procedural decisions that make the difference between a formally-correct study and a really good study. The last section will deal with writing up research for publication. Students from all areas of psychology are welcome, and the final syllabus will reflect the interest of class members. Covers all aspects of research except data analysis. 3 units, Spr (Ellsworth) TTh 3:15-5:05

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

277. Contemporary European Psychology—(Same as Education 275X.) Course introduces the broad range of contemporary European psychological theory and research and its contrasts and complementarities with U.S. work. Cognitive, instructional, and differential psychology will be emphasized but research on human perception, motivation, volition, personality, life-span development, and social behavior will also be addressed. 3 units, Spr (Snow) by arrangement
278. Graduate Seminar: Internal Representation—Can be repeated for credit. Prerequisite: consent of instructor.
   1-3 units, Win (Shepard) T 3:15-5:05

   4 units, Aut (Ford)

280. Doctoral Research—For dissertation. Prerequisite: consent of instructor.
   (Staff) by arrangement

282. Research Seminar on the Analysis and Representation of Similarity Relations—This seminar will review new theoretical and empirical developments regarding the perception and representation of similarities. The geometric approach to similarity will be contrasted with alternative approaches based on feature matching and clustering.
   1-3 units, Aut (A. Tversky) T 4-6

283A. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 386A, Graduate School of Business 494A, and Operations Research 366A.) Seminar aims to study normative and descriptive decision making, particularly in the face of uncertainty. Examines general studies on the way decisions are made and the problems arising in making decision analysis in applied policy contexts. Meets once every two or three weeks throughout the autumn and winter quarters.
   1-2 units, Aut (Arrow, A. Tversky, Wilson) by arrangement

283B. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 386B, Graduate School of Business 494B, Operations Research 366B.) (See 283A.)
   1-2 units, Win (Arrow, A. Tversky, Wilson) by arrangement

284. Neurology for the Non-Neurologist—(See 171.)

286. Applying Cognitive Psychology to Computer Systems—Course surveys broad issues in applying psychology to various domains with emphases on computer-user interaction. The emphasis is on using models of human abilities and limitations in solving real problems. The course covers methodology including model building and testing. The computer related topics include model-based approach to design computer-user interfaces, software psychology, and knowledge representation. Prerequisite: consent of the instructor.
   1-3 units, Win (Pavel) W 1-3
given 1986-87

289A. Advanced Seminar in Perception, Cognition and Human Performance—Research-oriented course 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 1:15-3:00

291. Research Seminar in Social Psychology—Can be repeated for credit. Prerequisite: Consent of the instructor.
   1-3 units, Spr (Wandell) by arrangement

295. Learning in Man and Machine—(Same as Computer Science 528.) Discussion-format seminar will focus on computational methods of learning, covering relevant current research in both artificial intelligence and cognitive psychology. Intended for graduate students in both fields. Students will be expected to give presentations in class on weekly readings and submit, as a final paper, a proposal for a research project. Prerequisites: Previous training in either cognitive psychology or artificial intelligence.
   2-3 units, Win (Bower, Rosenbloom, Gluck) by arrangement

305. Research Seminar in Cognitive and Mathematical Psychology—Can be repeated for credit. Prerequisite: consent of instructor.
   1 unit, Aut, Win, Spr (Staff) F 3:15-4:30

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, Win (Pribram) F 1:15-3:05

309. Research Seminar in Social Perception—Prerequisite: Graduate standing and consent of the instructor.
   1-3 units, Aut (Quattrone) T 2:15

310. Directed Research Seminar in Social Psychology—Prerequisite: Graduate standing and consent of the instructor.
   1-3 units, Aut, Win (Ross) by arrangement

317. The Psychology of Evidence and Trial Procedure—Seminar designed to evaluate various types of legal evidence along two dimensions: competence (i.e., validity vis a vis as
objective criterion) and credibility (i.e., persuasiveness vis a vis the factfinder). Drawing on cognitive and social psychology, specific substantive topics include character testimony, confessions, hearsay, eyewitness reports, statistical and empirical research evidence. In addition, various rules of trial procedure through which evidence is structured for a jury trial will be examined for their impact on adjudicative processes and outcomes, including the order of proof, opening and closing statements, direct and cross examination.

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

351. Issues in Child Custody — (Same as Law 243.) Course seminar limited to 20 graduate and law students. Admission by consent of instructors. Focus will be on how information from psychology and other behavioral sciences can be utilized in the development of legal policies affecting children, primarily child custody decisions. An attempt will be made to apply existing knowledge about child development to the resolution of policy issues in each of these areas and to design research projects that will provide new data relevant to policy makers.

3 units, Aut (Wald, Maccoby) by arrangement

353. Psychopathology and Mental Health Law—(Same as Law 329.) Prerequisite: consent of instructor.

4 units, Spr (Rosenhan) by arrangement

354. Law and Behavioral Science — (Same as Law 307.) Prerequisite: consent of instructor.

3 units, Aut (Rosenhan) by arrangement given 1986-87


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

362. Research Seminar in Child Development and Early Education—(Same as Education 411.) Seminar is 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.

1-3 units, Aut, Win, Spr (Hess, Ford) Th 12-1:15 and by arrangement
tistics 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—(Enroll in Political Science 175.) This course presents a broad historical look at national public policy-making from the New Deal to the present. Competing theories about the rise and development of liberal democratic capitalism are assessed within the general context of domestic policy-making by Congress and the Presidency. Special attention is paid to the role of the national government in the modern American political economy through the examination of selected public policies dealing with employment, economic development, social welfare, and equality. Prerequisite: Political Science 10.
5 units, Spr (Manley)

102. Organizations and Public Policy—(Enroll in Sociology 166.) This course provides concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. Varying conceptions of organizations, both as corporate actors and as social contexts, will be reviewed and evaluated. The several roles of organizations in relation to public policy will be examined, including organizations as decision makers and problem solvers, as change agents, and as clients. 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, Win (Goldworth)

104. Economics and Public Policy—(Enroll in Economics 150.) An examination of the reasons for, the varieties of, and the consequences of government policies in economic affairs. This course will explore the means of policy formation and the means and effects of policies by focusing on specific case materials in three topic areas—market regulation policies (antitrust and commission regulation), tax and income redistribution policies, and macroeconomic stabilization policies. 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, this course will consider such topics as risk assessment in the evaluation of biohazards and medical techniques and technologies; comparisons of such information-gathering techniques as surveys, experiments, or simulation studies; methods of expressing and evaluating uncertainty; and the interpretation of such quantitative techniques of data analysis as regression. Prerequisites: Statistics 60 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 will be on internships in the federal government in Washington, D.C. Objectives are 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)

198. Directed Readings in Public Policy.
1-5 units (Staff) by arrangement

1-5 units (Staff) by arrangement
RELIGIOUS STUDIES

Chairman: Van A. Harvey


Associate Professor: Lee H. Yearley

Assistant Professors: Carl W. Bielefeldt (on leave 1985-86), Hester G. Gelber (on leave 1985-86)

Lecturers: Robert E. Buswell, Anne C. Klein, Paul H. Mosher

Consulting Professor: Robert G. Hamerton-Kelly

Visiting Professor: Manfred H. Vogel (Winter, Spring 1985-86)

Acting Assistant Professors: Harvey B. Aronson, Rose Ann Christian

Mellon Fellow: Daniel R. Gold

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 of Arts 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.

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. As many as 12 units of the 48 may be taken as a coherent program in advanced and graduate courses in other departments of the University. 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 ad-
tion 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 propose other substantial fields must have 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 and 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 designated faculty members are undertaken at a time negotiated with the chairman. 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. Doctoral students in Religious Studies taking the Graduate Humanities Program thereby meet the requirement of a "supporting program" described above.

COURSES

Until the beginning of the last four weeks of the quarter, a student may add units of credit to a fixed unit course provided the student's total registration does not exceed the normal load limits. The increase, subject to the approval of the instructor, may be up to one hundred percent of the published unit value of the course.

Courses listed below numbered 1B-89 expect work at an introductory level. Those numbered 101-289 expect work at an advanced undergraduate level.

INTRODUCTORY COURSES

1B. Comparative Religious Personalities— (DR:3) 
3 units (Berman) given 1986-87
1C. Comparative Religious Thought— Differences and similarities between Christian, Jewish, Hindu, Confucian, Taoist, and Buddhist views (among others) on topics such as mysticism, morality, death, and self-cultivation; relation of religious thought to contemporary
philosophic, sociological, and psychoanalytic thought. Limited enrollment. (DR:3*)
3, 4†, or 5† units, Aut (Aronson) MWTh 9

1D. Religions of the East (Formerly Religious Studies 12)—The religious philosophies of India and China. Theories of self and self-cultivation in Hinduism, Buddhism, Confucianism, and Taoism. Limited enrollment. (DR:3*)
3 or 4† units, Win (Buswell) MWF 10

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, Win (Yearley) MWF 11

1F. Eastern and Western Conceptions of Virtue—The conception of virtues and vices in different traditions. Limited enrollment.
4 units, Spr (Yearley) MWF 11

13. Hinduism—Major Hindu doctrines, myths, and symbolic expressions from Vedic times to the present: the Krsna cults, Yogic experience, and images of the feminine and masculine. Limited enrollment. (DR:3*)
3 units, Spr (Aronson) MWTh 9

14. Introduction to Buddhism—History, thought, and practice of Buddhism. Beginning with fundamentals of Buddhist thought as taught during its first centuries in India, giving attention to changes of emphasis and style as it traveled to Tibet, China, and Japan. Readings centered on primary source material with expositions of this by modern scholars and teachers from within the respective traditions. Limited enrollment. (DR:3*)
3, 4†, or 5† units, Aut (Klein) MWTh 10

18. Zen Buddhism—History, teachings, and practices of Ch'an and Zen Buddhism. Limited enrollment. (DR:3*)
3 or 4† units, Spr (Buswell) MWF 10

23. Judaism—An introductory examination of the main literary forms of expression of Rabbinic Judaism: 1) the legal expression (the Talmud), later rabbinic interpreters, codifications, responsa; 2) the mystical expression (the Zohar), Lurianic Kabbalah, Hasidism; 3) the philosophical expression (Saadia Gaon, Maimonides, and Yehuda Halevy). Limited enrollment. (DR:3)
3 units, Win (Vogel) MWTh 11

24A. Early Christianity—Variety of forms of Christianity at its beginning, heterodox as well as orthodox. Canonical and non-canonical literature (gnostic gospels, the Nag Hammadi Library). (DR:3)
3 units, Aut (Christian) MWTh 11

†For 4 or 5 units, additional section by arrangement.
136. Buddhist Meditation Texts—A comparative examination of the theories and practices of meditation in the Buddhist traditions of India, East Asia, and Tibet.
5 units, Aut (Buswell) MWF 1:15

137. Judaism in the Era of Emancipation—Description of the process of Jewish Emancipation starting in the 18th century, evaluating, on the one hand, the benefits and challenges it presented, and, on the other hand, analyzing the crises and problems which it precipitated. Consideration of the main "responses" which the process elicits within Judaism in the scholarship, religious and cultural perspectives.
5 units, Spr (Vogel) MWF 10

140. Religious Ethics.
5 units (Staff) not given 1985-86

144. Religious Self-Cultivation.
5 units (Yearley) not given 1985-86

147. Modern Christian Thought—An introduction to the important issues and thinkers who have influenced Christian theology (Catholic and Protestant) since World War II: neo-orthodoxy, existentialism, feminism, process theology, liberation theology. (DR:3)
5 units, Win (Harvey) MWF 10

149. Approaches to Religion—An examination of formative theorists on religion and the ways in which their ideas have been applied by contemporary scholars; the logic of argument and limits of knowledge in the study of religion.
5 units, Aut (Gold) MWF 1:15

149A. Comparative Mysticism.
5 units (Staff) not given 1985-86

161. Contemporary Jewish Thought—An introduction to Jewish thought in the 20th century. Description and evaluation of the philosophical-theological contributions of such people as Hermann Cohen, Leo Baeck, Franz Rosenzweig, Martin Buber, Ha-Rav Kuk, and others with respect to current issues and problems in the domain of the philosophy of religion in general and in the domain of Judaism in particular.
5 units, Spr (Vogel) MWF 1:15

166. Theology of Paul.
5 units (Hamerton-Kelly) given 1986-87

167. Medieval and Renaissance Religious Philosophy—(Same as Philosophy 101.)
4 or 5 units (Gelber) not given 1985-86

171. Augustine.
5 units (Staff) not given 1985-86

174. From Kant to Kierkegaard.
5 units (Harvey) not given 1985-86

178. American Religious Thought—(DR:3)
5 units (Staff) not given 1985-86

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

230. Topics in Zen Buddhism—A comparative study of the Chinese, Korean, and Japanese Zen schools, with a focus on the teachings of the Korean Son master, Chinul. Prerequisite: consent of the instructor.
5 units Win (Buswell) MW 4:15-6:05

231. Founders in Myth and History—Limited enrollment.
5 units (Berman) not given 1985-86

232C. The Crucifixion.
5 units (Gelber) not given 1985-86

234B. Mary and Images of the Feminine in Western Christianity.
5 units (Gelber) not given 1995-96

235. Death and Rebirth in Tibetan Wisdom Texts.
5 units (Staff) not given 1985-86

236A. Buddhism and the Play of Wisdom—Introduction to wisdom literature in the Indo-Tibetan tradition. Focus on the interplay between philosophical and meditative traditions through discussion of primary works.
5 units, Win (Klein) MW 2:15-4:05

238. Confucian Ethics—(Same as Asian Languages 331, Philosophy 331.) Prerequisite: consent of the instructor.
5 units, Aut (Nivison) MW 4:15-5:30

238B. Theism, Atheism, and Value—Does the meaningfulness or value of human life presuppose the existence of God? Defenses of and challenges to the affirmative answer. Examination of the question.
5 units, Spr (Christian) MW 2:15-4:05

239. The Golden Rule.
5 units (Nivison) not given 1985-86

241A. Luther and the Radicals—(Same as History 213A.)
5 units Spr (Spitz) W 2:15-4:05
245. Comparative Religious Ethics—Theoretical issues in comparing religious ethics with examples drawn mainly from Western and Chinese sources. Prerequisite: consent of the instructor.
   5 units, Win (Yearley) MW 2:15-4:05

249B. Psychology and Religion—An analysis of psychological and religious models and their relationships to each other.
   5 units, Aut (Aronson) MW 4:15-6:05

250. Human and Divine Beings—Problems of anthropomorphism in religion explored in the relationships between mythic images and living holy persons.
   5 units, Spr (Gold) MW 4:15-6:05

254. Confucianism Since Wang Yang-ming—(Same as Asian Languages 144, Philosophy 124.)
   5 units (Nivison) not given 1985-86

257. Buddhist Theories of Knowledge.
   5 units (Staff) not given 1985-86

258A. Buddhism and the Feminine—An introduction to ideas and images associated with women and the feminine in Buddhist literature, ritual, and society. Particular attention to the background of feminine imagery associated with the central Buddhist goals of compassion and wisdom, and with female Buddhas such as the Great Bliss Queen. Exploration of differences in East-West religious paradigms that bear on cultural characterizations of the feminine.
   5 units, Aut (Klein) MW 4:15-6:05

260. The Thought of Martin Buber—An examination in depth of Buber's distinction between the I-Thou and I-It perspectives (as formulated in I and Thou) and on this basis further examination of its application by Buber to various cultural and social disciplines; for example, the history of religions, biblical studies, mysticism, Hasidism, psychology, sociology, the history of philosophy, ethics, and esthetics.
   5 units, Win (Vogel) MW 4:15-6:05

263. The Book of Job—Job in English translation; issues of interpretation and criticism of current proposals; uses in modern literature. Prerequisite: consent of the instructor.
   5 units, Aut (Good) TTh 2:15-4:05

268. Francis of Assisi.
   5 units (Staff) not given 1985-86

274A. Sigmund Freud.
   5 units (Yearley) not given 1985-86

274D. Friedrich Nietzsche—Theory of culture and religion. Prerequisite: consent of the instructor.
   5 units, Spr (Harvey) MW 4:15-6:05

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

277. Religious Existentialists—(Same as German Studies 179K.)
   5 units (Harvey) not given 1985-86

GRADUATE STUDENT DIRECTED READING

299. Individual Work—Prerequisite: consent of the instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

GRADUATE SEMINARS

302. Problems in the Interpretation of Religion—Required of all graduate students in Religious Studies. Inquiry into historical and conceptual methods in the study of religion; may be repeated for credit. Prerequisite: consent of the instructor.
   4 units, Aut (Staff) given 1986-87

304. The Historical Tradition in the Academic Study of Religion—Required of all graduate students in religious studies; may be repeated for credit. Topic for 1985-86: Freud's analysis of religious action. Prerequisite: consent of the instructor.
   4 units, Aut (Yearley) MW 2:15-4:05

GRADUATE RESEARCH AND TEACHING

Topics vary from year to year based on student initiatives and faculty research interests.

319. East Asian Religions.
   (Bielefeldt, Nivison) by arrangement

   (Berman, Good, Hamerton-Kelly) by arrangement

339. Medieval Western Religions.
   (Berman, Gelber, Mosher) by arrangement

349. Modern European Religions.
   (Harvey) by arrangement

359. American Religions.
   (Harvey) by arrangement

369. Social and Psychological Aspects of Religion—Prerequisite: consent of the instructor and of the department.
   (Staff) by arrangement
379. Religious Thought—Prerequisite: consent of the instructor and of the department. (Staff) by arrangement

389. Theory of Religion—Prerequisite: consent of the instructor and of the department. (Staff) by arrangement

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

392. Candidacy Essays and Examination—Prerequisite: consent of the instructor and of the graduate director.
   10 units, Spr (Staff) by arrangement

   (Staff) by arrangement

CENTER FOR RUSSIAN AND EAST EUROPEAN STUDIES

Committee in Charge: The 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 Schupbach (Slavic), Lawrence Stahlberger (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. Eadelman (Drama), Gregory Freidin (Slavic), Sabine MacCormack (History)

Acting Associate Professor: Coit D. Blacker (Political Science)

Assistant Professors: Monika D. Frenkel (Slavic), Nancy S. Kollmann (History), Condoleezza Rice (Political Science)

Lecturers: Alexander G. Golitzin (Slavic), Jack Kollman (Slavic and Art), Harriet Murav-Lavigne (Slavic), Stephen Popper (Economics), Wojciech Zalewski (Slavic and Stanford Libraries)

Instructor: Vera M. Henzl (Linguistics)

Visiting Professors: Michael Confino (History), Norman Davies (History)

Visiting Associate Professor: Alex Pravda (Political Science)

Affiliated Professors: Sidney Drell (Physics/SLAC), John W. Lewis (Political Science)

Affiliated Staff: Dorothy Atkinson (AAAS), 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.

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SLAVIC LANGUAGES AND LITERATURES

Emeriti: (Professors) Edward J. Brown, Jack A. Posin; (Assistant Professor) Elisabeth Stenbock-Fermor

Chairman: Richard D. Schupbach

Professors: Joseph A. Van Campen, Lazar Fleishman, Joseph Frank, Lawrence L. Stahlberger, William Mills Todd III

Associate Professors: Gregory Freidin, Richard Schupbach

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 35 units selected with the approval of their advisor, to include in any case courses numbered 111, 112, 113, and either 195, 196, 197 or 211, 212, and 213. The remaining units are to be selected from among the following: 114, 115, 116, 167, 168, 169, 187, 188.

In addition to the 35 units mentioned above, students majoring in literature or language who are not enrolled in the Honors program in Humanities (for a description see "Humanities Special Programs" in this bulletin) are to select with the help of their advisor a minimum of three general courses (9 units) in support of their major program.
HONORS PROGRAM IN SLAVIC

Majors with a minimum grade average of "B +" in Russian courses are eligible to participate in the department's Honors Program. Students may do honors work in Russian Literature or in Russian Language. Requirements are listed below.

RUSSIAN LITERATURE

1. Language prerequisites: Three years of Russian, and 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 167-169.
2. At least two additional courses within the department to be chosen from among the following: 191, 195, 196, 197, 211, 212, 213.
3. Slavic 199: Individual Work, 6 to 9 units during the candidate's senior year. To receive honors, the candidate must receive a grade of "B" or better on a thesis or project conducted under the close supervision of a member of the professorial staff.

Recommended

4. Strongly recommended courses in Russian literature: 145, 146, 147, 187, 188.
5. Recommended courses in other departments: Communications 100, 102, 107; Computer Science 105, 106, 109A, or 111; History 120; Linguistics 10, 200, 206, 215, 230, 240, 253; Mathematics 3; Philosophy 57, 181.

GRADUATE PROGRAMS

MASTER OF ARTS

Admission to Candidacy—The requirements for admission to candidacy for a master's degree 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 strengthen their academic preparation. Detailed requirements for the degree are outlined in the School of Education section of this bulletin. The program includes 45 units of which 25 must be in the teaching field and 12 in education. Specific language requirements are established in consultation with the department.

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 given below may be offered.

   either
   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 has to 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.

**Note on 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.

143. **Medieval Russian Art and Architecture**

—(Same as Art 109/209.) Emergence of a Muscovite Russian “national” style based on Byzantine and Kievan Rus’ cultures, European and oriental influences, native traditions and regional schools, 11th-17th centuries. Slide illustrated. Open to all students. (DR:2)

4 units, Win (Kollmann) MWF 1:15

144. **The Art and Architecture of Imperial and Soviet Russia**

—Examines 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 1986-87

145. **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 will cover the first forty years of the nineteenth 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*, will then be 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. **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. This course is a continuation of Slavic 145 but may be taken independently of it. Open to all students, including freshmen. (DR:2)

4 units, Win (Freidin) MWF 10

147. **Survey of Russian Literature in English Translation III: A Fractured Culture**

—(Graduate students register for 247.) The survey’s third quarter will trace some of the major movements in the extraordinary historical and cultural ferment of twentieth-century Russia: literature in exile (Nabokov, Solzhenitsyn, Brodsky); underground literature (Pasternak’s *Dr. Zhivago*, Zamyatin’s *We*, Sinyavsky); and the best of literature officially published (Mayakovsky, Babel, Olesha, Rasputin, Trifonov). This course is a continuation of 145 and 146, but may be taken independently of them. Open to all students, including freshmen. (DR:2)

4 units, Spr (Brown) MWF 10

150. **Romanticism Among the Slavs**

—Concentrates on three representative romantic writers of the first half of the 19th century: Adam Mickiewicz, the Pole, Karel H. Macha, the Czech, and Aleksandr Pushkin, the Russian.

4 units (Stahlberger) not given 1985-86

151. **Fyodor Dostoevsky**

—Reading of major works in English translation with reference to related developments in Russian and European culture and intellectual history. Open to all students including freshmen. Lectures and discussion section. (DR:2)

4 units, Aut (Todd) MWF 11
153. Leo Tolstoy—Reading of major works in English translation including War and Peace, Anna Karenina, and Resurrection. Discussions will also correlate materials from Tolstoy’s social and religious thought. Some comparative reference to the European novel in general, English and French. Open to all students. (DR:2)
4 units, Win (Stahlberger) MWF 11

154. The Russian Drama—A survey of the major Russian plays in English translation from Fonvizin to Mayakovsky, including Gogol and Chekhov. Particular attention will be paid to tradition and innovation in the development of Russian dramatic comedy. Open to all students. Readings and lectures in English.
4 units (Stahlberger) not given 1985-86

UNDERGRADUATE COURSES

By special arrangement with the department, courses numbered 100-159 can be taken for graduate credit. The department urges students to take all three quarters of first-year, second-year, and third-year language series in the same academic year.

1. First-Year Russian A—Completion of Russian 1, 2, and 3 fulfills (DR:4); three-quarter sequence.
5 units, Aut (Schupbach) MTWThF 9, and 1:15

2. First-Year Russian B—Completion of Russian 1, 2, and 3 fulfills (DR:4); three-quarter sequence. Continuation of 1.
5 units, Win (Staff) MTWThF 9, and 1:15

3. First-Year Russian C—Completion of Russian 1, 2, and 3 fulfills (DR:4); three-quarter sequence. Continuation of 2.
5 units, Spr (Staff) MTWThF 9, and 1:15

3 units, Aut (Van Campen, Staff) 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 twentieth-century authors.
3 units, Win (Van Campen, Staff) 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 nineteenth-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, Win (Schupbach) 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 taken from contemporary literature and journalistic sources.
2 units, Aut, Win, Spr (Staff) TTh 1:15

ADVANCED AND GRADUATE COURSES

167-169. Fourth-Year Russian Seminars I-III—Designed for students who would like to perfect their verbal and written skills while concentrating on major problems in Russian cultural history, as reflected in that country’s literature. Following an introduction to critical reading, the students are expected to approach selected texts systematically both as “literature” and as “documents” in the social and intellectual history of Russia. Open to all majors; the seminars are conducted in Russian (oral reports and short compositions are required).

167. Fourth-Year Russian Seminars I—Fundamentals of literary analysis and topics in Russian intellectual history. The course is divided into 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 2:15-3:45
4 units, Win (Fleishman) TTh 2:15-3:45

4 units, Spr (Fleishman) TTh 2:15-3:45

172. Pushkin.
4 units, (Stahlberger) not given 1985-86

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, Aut (Stahlberger) MWF 11

187. Russian Poetry of the Nineteenth Century—A study of the major representatives of Sentimentalism, Romanticism, Realism, Pushkin, Lermontov, Tjutchev and others. Lectures and discussions in English. Readings in Russian. Graduate students may earn 4 units.
3 units, Aut (Zalewski) Th 2:15-4:05

188. Russian Poetry of the Twentieth Century—Course provides 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). Students in this course should also register for 184, Slavic Bibliography.
3 units, Win (Fleishman) MWF 11

189. Old Russian Literature — A study of Russian literature, culture, and thought from the earliest times through the 17th century (some readings will be in the original).
4 units, Spr (Todd) MWF 10

190. Russian Literature of the Eighteenth Century—Emphasis on poetry; theory of genres, the satire, the ode, the mock-epic.
4 units (Stahlberger) not given 1985-86

191. Grammatical Categories of Russian—Major grammatical categories of Russian: case, gender, number in the noun and aspect, tense, voice, mood as well as prefixation and transitivity in the verb are analyzed in some detail. Comparisons are drawn between the Russian and English systems.
3 units, (Schupbach) given 1986-87

193. The Orthodox World—The cultural sphere of the Eastern Orthodox Church comprises areas of the world which have commanded steady attention over the past seventy years, i.e. Russia, the Balkans, and the Middle East. This course is an introductory survey of the history, spirituality, and religious culture of the Eastern Christian peoples with special attention to the analysis of Orthodox theology and spirituality, comparing and contrasting it with the thought and institutions evolved by Western Church, both Protestant and Catholic.
3 units, Aut (Golitzin) by arrangement

195. Advanced Topics in Russian Grammar I: Phonology and Morphology of Russian—Discussion of the phonology and inflectional morphology of contemporary standard Russian with particular emphasis on the relationships between inflectional categories and sound features.
3 units (Van Campen) given 1986-87

196. Advanced Topics in Russian Grammar II: Syntax—Discussion of selected topics in the areas of agreement and government with emphasis on the relationships between the semantics of inflectional categories and syntactic patterning.
3 units (Van Campen) given 1986-87

197. Advanced Topics in Russian Grammar III: Dialects of Russian — Survey of the Slavic languages.
3 units, (Schupbach, Van Campen) given 1986-87

199. Individual Work—Open to Russian majors or students working on special projects. May be repeated for credit. Consent of instructor 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 in this course should also register for 184, Slavic Bibliography. Required of all entering graduate students and all honors majors in Russian literature.
4 units, Aut (Freidin) M 2-4

211. Introduction to Old Church Slavic.
3 units, Aut (Van Campen) MWF 2

212. Reading of Old Church Slavic and Old Russian Texts. Prerequisite: 211.
3 units, Win (Van Campen) MWF 2

213. History of the Russian Literary Language—A survey of the major structural and
semantic changes from the tenth to the nineteenth centuries. Prerequisites: 211 and 212.
3 units (Schupbach) not given 1985-86

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) T 2:15-4:05

221. Studies in Russian Fiction: The Age of Realism—The development of realism over the first two-thirds of the nineteenth century, with special attention to problems of structure as well as to social and philosophical contexts, both Russian and European.
4 units (Todd) not given 1985-86

222. Early Soviet Prose: Osip Mandelstam, Isaac Babel and Mikhail Zoshchenko—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 1985-86

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 will be examined in the contemporary literary and socio-historical context. Particular attention will be paid to non-Party authors, among them, Babel, Eikhenbaum, Mandelstam, Olesha, Tynianov, Zamiatin, and Zoshchenko.
4 units, Spr (Freidin) W 2:15-4:05

224. Readings in the Russian Novel—An intensive study of *The Brothers Karamazov* and its relation to contemporary European and Russian philosophical, literary, and social contexts. Readings in Russian. Open to graduate and advanced undergraduate students.
4 units, Aut (Todd) W 2:4

225. Problems of Romanticism in Russia.
4 units (Staff) not given 1985-86

4 units (Freidin) given 1986-87

227. Boris Pasternak and the Poetry of the Russian Avant Garde—Pasternak’s work will be 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) M 2:15-4:15

229. Russian Versification—History and theory of Russian versification from the 17th to the 20th century.
4 units (Fleishman) not given 1985-86

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, Spr (Brown) given 1986-87

231. Solzhenitsyn—Study of the major work of Solzhenitsyn in the novel, short story, drama, and essay forms, as well as in the genre most characteristic of him: “literary investigation.” No knowledge of Russian is required, but concentrators in Slavic will be expected to do a major portion of the reading in Russian.
4 units (Brown) not given 1985-86

4 units, Win (Freidin) W 2:15-4:05

233. Gogol—A study of his fiction, drama and essays with attention to problems of structuration and refraction of cultural contexts. Also open to undergraduates with advanced training in Russian.
4 units (Todd) given 1985-86

234. 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 1985-86

235. Dostoevsky—A study of Dostoevsky’s shorter works in the context of European thought and literature.
4 units (Todd) not given 1985-86

236. 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, Freiden, Frenkel, Schupbach, Stahlberger, 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 will include theoretical writings by Jakobson, Barthes, Bakhtin, Iser, Lukács, and others. Discussions will analyze these readings and relate them to selected works of Russian and European literature. A seminar for graduate and advanced undergraduate students. Prerequisite: consent of instructor. 4-5 units, Spr (Todd) MW 2-4

300A. Graduate Seminar: Russian Literature as an Institution — 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 (Todd) not given 1985-86

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, Geroy nashego vremeni, Tolstoy’s Ispoved’, Besy, read (in Russian) in the context of semiotic theory. 4 units (Frenkel) not given 1985-86

300C. Introduction to Archival Research in Russian Literature and History. 3 units (Fleishman) not given 1985-86

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.

SOCIETY

Emeriti: (Professors) St. Clair Drake, Dudley Kirk, Richard T. LaPiere
Chairman: John W. Meyer (on leave)
Professors: Joseph Berger (on leave, Autumn), Bernard P. Cohen, Elizabeth G. Cohen, Sanford M. Dornbusch, William J. Goode, Alex Inkeles (on leave), Seymour Martin Lipset, James G. March, John W. Meyer (on leave), Jeffrey Pfeffer (by courtesy), W. Richard Scott, Nancy Tuma (on leave), Morris Zelditch, Jr. (overseas, Spring)
Associate Professor: JoAnne Martin (by courtesy)
Assistant Professors: Patricia R. Barchas, James Baron (by courtesy), Carol Conell, Donald Palmer (by courtesy), Ann Swidler (on leave, Autumn, Spring), Joan Talbert (by courtesy), Henry Walker
Visiting Assistant Professor: Ruth Cronkite

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 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

1. **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.

2. **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.

3. **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.

4. **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.

5. **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.

6. **Research Methods**

   This field of study emphasizes the acquisition of research and analytical skills relating to the collection, reduction and interpretation of data. Students are encouraged to acquire facility with a variety of research gathering techniques — e.g., participant observation, survey research, laboratory studies — as well as to acquire competence in the processing of data, including the acquisition of statistical and computer skills. Direct involvement in a research project is required as a part of this training. Careers related to this type of training include positions as data analyst, jobs in planning and evaluation departments and in applied research organizations.

Most of the courses offered by the department can be categorized as primarily oriented to one of these 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 of 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: 162-169; 260-269; 125, 140, 143, 146, 240.

5. **Comparative Social and Political Institutions**
   Foundation Courses: 140, 141, 142, 143, 144.
   Other Courses: 135-159; 240-259; 109, 111, 119, 282, 283.

6. **Research Methods**
   Courses: 180A, 180B.

**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:

a. Complete the core curriculum requirements (one of the three foundation courses must be taken from the proposed area of specialization), and
b. 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:

a. Complete the core curriculum requirements,

b. Take 381A, Sociological Methodology: Design and Analysis, and

c. Take 10 units of 190 or 192, Undergraduate Directed Research or Undergraduate Research Apprenticeship.

**HONORS PROGRAM IN SOCIOLOGY**

The Honors Program is designed for those energetic and interested students who are capable of carrying out an intensive, individualized program of study. Such programs involve close contact with one or more faculty as the student carries out an independent research project. Projects can often be developed in association with ongoing faculty research.

To be eligible for the Honors Program, the student must have completed an acceptable proposal endorsed by a member of the depart-
mental 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
(SOCIOLOGY)

This degree is designed for students interested in interdisciplinary work with some emphasis on Sociology. The requirements for the bachelor’s degree in Social Sciences (Sociology) are 60 units of course work with 40 units from sociology including an introductory course in sociology and a course in methodology (Sociology 180A and B, for example). The remaining 20 units are chosen from related departments (Communication, Economics, Political Science, Psychology, Anthropology, and Linguistics).

COTERMINAL MASTER’S PROGRAM

Stanford undergraduate students who wish additional training in sociology may apply to the coterminous masters program as described in the “Degrees” section of this bulletin. Information may be obtained from the department secretary.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the School of Education section of this bulletin or address inquiry to the Credential Secretary, School of Education.

GRADUATE PROGRAMS

ADMISSION TO GRADUATE STANDING

Although it is desirable to have had undergraduate preparation in sociology, the department does consider for admission to its graduate program students without such preparation. Admissions forms and forms for requesting financial assistance may be obtained from the Office of Graduate Admissions and, once completed, should be returned to that office. Applicants are required to submit results to the Graduate Record Examination, both the quantitative and the verbal tests. The GRE Advanced Test in Sociology may also be taken, but is not mandatory.

MAJOR OF ARTS

Ordinarily, the department does not admit students who are candidates solely for the master’s degree in sociology. This degree is granted as a step toward the fulfillment of Ph.D. requirements. To receive it, the student must complete 45 units of approved work with an average grade of “B” or better. All course work should be at level 100 or greater and at least 30 of the course units must be taken within the department.

Graduates enrolled in law, medicine, business, education or any other advanced degree program at Stanford may wish to obtain a master’s in Sociology. In this instance the usual admission requirements are waived, but course requirements are determined in consultation with the departmental advisor for doctoral candidates of other departments and schools. Interested students should contact the department secretary for further information. Students may also apply for the co-terminal master’s program as described in the “Degrees” section of this catalogue. Information may be obtained from the department secretary.

DOCTOR OF PHILOSOPHY

The department presumes that all students admitted will be recommended for admission to candidacy. For the first three quarters in residence all students have probationary status. During the Spring Quarter the department decides whether each student not yet admitted to candidacy will be: (1) admitted to candidacy; (2) terminated; or (3) continued on probation for an additional year. This decision is made by the entire faculty of the department and is based upon whether the student is making satisfactory progress toward the goal of a professional career of teaching and research in sociology. The decision to admit the student to candidacy implies that the student’s position in the department is secure, subject only to continued satisfactory progress toward completion of remaining departmental and University requirements.

After admission to candidacy for the Ph.D., the student must: (a) have a master’s degree or its equivalent; (b) complete a research apprenticeship, working for three quarters in a faculty research program and collaborating in associated publications or preparing a report of professional quality based on his or her experiences; (c) complete a teaching apprenticeship, working for three quarters as a teaching assist-
ant under the supervision of a faculty member; (d) develop a thorough grounding in sociological theory and research methods (to accomplish this, five graduate courses are required: Sociology 370A, 370B, 381A, 381B, and 381C. In addition, students entering with little background in statistics are required to take an elementary course in the first quarter after entering; (e) finally, each student must select two fields in sociology as his or her areas of special competence, and pass written examinations in these fields in order to complete the requirements for candidacy. Examples of such fields are small groups, socialization, family and kinship, sociology of education, and comparative institutions. Theory or methods may be offered as a field only when the candidate has an exceptional grasp of material in the area, since competence is assumed for all graduate students.

Finally, the student must pass the University oral examination, and following this, complete a doctoral dissertation. For basic University requirements see the "Degrees" section of this bulletin.

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.

JOINT PROGRAM WITH THE LAW SCHOOL

The faculties of the Law School and the Department of Sociology conduct joint programs leading to either a combined J.D. or J.M. degree with an A.M. degree in Sociology or to a combined J.D. or J.M. degree with a Ph.D. in Sociology. Normally, the student interested in pursuing an A.M. degree in Sociology will complete one full year of his or her law program, applying for admission to the Department of Sociology during the first year of law school. If admitted, the student would be expected to complete 45 semester units (for the J.D. degree) in the law school and meet the sociology department requirements. Applications for a joint program must be approved by the Research and Interdisciplinary Studies Committee of the Law School and by the Sociology Department. Faculty advisors from both the department and the school will participate in the planning and supervise the study program of students admitted to joint degree status.

The joint J.D.-Ph.D. degree program is designed for students who wish to prepare themselves for research or teaching careers in areas relating to legal and sociological concerns. Participation in this program requires application for admission to both the Law School and the Department of Sociology and acceptance by each. Upon admission, the student may elect to begin his or her study program in either the Law School or the Sociology Department. Normally, the student will spend the first full year in one program and the second full year in the other. Thereafter, the student may take courses concurrently until requirements for both degree programs have been met.

COURSES OPEN TO ALL STUDENTS

BASIC COURSES

1A,B,C. Introduction to Sociology—An introduction to the study of social forms and processes and their impact on individual behavior. Emphases vary from quarter to quarter as described below:

5 units

1A. Introduction to Sociology—Surveys 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, Aut (Goode) MWF 11

one section by arrangement

1B. Introduction to Sociology—Surveys 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, Win (Swidler) MWF 1:15

one section by arrangement

1C. 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 set-
things, deviance, and the myth of personality. The rules and processes which determine the nature of our personal experiences will be examined. (DR:5)

5 units, Spr (Staff) MWF 10

one section by arrangement

5. Status, Friendship, and Social Pressure: An Experiential Approach—Examines basic social processes that structure the individual's experience in interpersonal situations. Processes studied include (1) group pressure on individual choices, (2) social control of deviants, (3) operation of status distinctions (such as sex and race), (4) formation of friendships and, (5) formation of intimate relationships (such as love relationships). Through structured exercises and simulation gaming the student first has the opportunity to experience these processes in section meetings. After these laboratory experiences, lectures provide the chance to examine these processes in terms of the theoretical ideas, empirical research, and clinical strategy. Enrollment limited. (DR:4)

3-5 units, Win, Spr (Berger) MWF 10

one 2-hour section M or T 2:15-4:05

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. Numerous interpersonal processes, ideologies, and larger social structures can shape, distort, and inhibit personal intimacy and family life. The course will explore topics such as (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. Use will be made of role-plays and discussions to expand on the readings and lectures. The course is open to all students and does not presuppose any experience in sociology.

5 units, Win (Talley) TTh 7-9 p.m.

one section by arrangement

104. The Sociology of Gender — This course considers the social definitions of masculinity and femininity and examines social inequalities which are based on gender-specific social roles. Specific 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? Through lectures, class discussions, and individual projects students will explore the facts, myths, and theories around this important social issue.

3-5 units, Spr (Staff) MWF 1:15

106. Deviance and Social Control—This course focuses on deviance of all sorts: sexual deviance, drug abuse, mental illness, crime in the streets and crime in the suites (corporate and governmental abuses). The social foundations of the detections, labeling and processing of people as "deviants" will be explored. Examine various institutions and agencies mandated to keep "the public order," how labeled persons are separated from the rest of society both physically and symbolically, and the consequences for those individuals and for society.

3-5 units, Spr (Staff) MWF 11

109. The Criminal Law and the Criminal System—(Same as Law 109, Political Science 183K.) Exploration of the purposes and processes of the criminal law, with emphasis on the actual operation of the system, and application of theory to contemporary problems. Topics will include the police, the trial, sentencing, corrections and "non-victim" crimes.

5 units, Win (Kaplan) TTh 10-11:30

110. Social Policy in America—An examination and evaluation of several policies directed toward the short-run and/or long-run elimination of poverty in American society. Focus is on the intended and unintended costs and benefits of alternative types of government policies and how legislators/administrators choose among different policies directed toward the same goal.

5 units, Win (Staff) TTh 10-11:30

111. Social Issues in Health Care—Provides 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. Areas covered 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 (Staff) MWF 9

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

4 units, Spr (E. Cohen) MW 10-12

114. Corporate Competence—This course is designed for the student anticipating professional work in a corporate setting. Even when one's well-prepared to practice a profession (business management, law, human services, medicine, and so on) the dynamics and pitfalls of organizational life can shape career experience more than one's desires or skills. Combining the instructor's experience as a sociologist, organizational consultant, and therapist, this course presents the insights of the social sciences into the tactics of corporate survival. Topics will 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 and exercises will be used, as well as general lectures and discussions.

5 units, Spr (Talley) TTh 7-9 p.m.

118. Groups, Teams and Organizations—Examines questions such as: 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 will provide direct experience with group and organizational phenomena through extensive use of simulation games, structures exercises and case studies. Lectures and reading will provide tools for analyzing these experiences based on empirical research and theoretical ideas.

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

119. Great Issues in American Society—This course is 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 also given by other faculty and guest lecturers selected for their expertise on each topic. This course assumes no prerequisites and is a valuable first course for someone interested in a sociological analysis of critical issues in American society.

5 units, given 1986-87

SOCIAL PSYCHOLOGY AND INTERPERSONAL BEHAVIOR

120. Interpersonal Relations—This course is concerned with power, exchange, coalition formation, status, conformity, and deviance. Important traditions of research have developed from basic theories of these processes. Emphasis will be on (1) understanding the basic theories, and (2) drawing out their implications for change in a broad range of situations, such as families, work groups, and friendship groups. (DR:4)

5 units, Aut (Staff) MWF 9

121. Introduction to Social Psychology—The main objective of this course is to promote understanding of the individual's relationship to social groups, from the intimate two-person group to the society at large. Both theoretical and experiential perspectives will be employed to illuminate these relationships. The course will include simulation and observation exercises. Among the topics covered will be social pressure and conformity, racism, and sexism, self-evaluation, equity and justice, and the social self. (DR:5)

5 units, Win (Cohen) MWF 10
one section by arrangement

127. Power in Interpersonal Relations — This course examines concepts of power and influence, sources of power, dynamics of power-dependence relations, authority and the legitimation of power. Specific 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. The course includes laboratory exercises which 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 of the funda-
mental social processes underlying the structure of American society. Emphasis is given to two topics: social control, including causes of conformity and deviance and mechanisms producing them; and stratification, including class, sex, and ethnic/racial inequalities. It should be emphasized that the course is one in sociology, not in film or literature. It uses film and literature to try to understand central features of American society but it does not study film or literature as such. Reading includes work by 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 Over the Cuckoo's Nest, The Little Foxes, Personal Best, Streetcar Named Desire, and Harlan County, USA. Films will be shown Wednesday nights.

3-5 units, Win (Zelditch) TTh 10, W 7-9 p.m., and one section Th 1:15, 2:15, 3:15 or 4:15

135. Culture, Economy and Politics in Western Societies—Examines major sociological interpretations of the history of modern Western societies, tracing the role of cultural, economic, social, and political factors in shaping modern industrial society. Focus is on England, France, and the United States. Topics include love and individualism in Western culture; political revolution and the origins of the modern state; class conflict and authority relations in industrial society; and changing ideologies of poverty, madness, and crime. (DR:5)

5 units (Swidler) given 1986-87

137. Status Attainment, Education and Work—(Same as Education 172.) 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 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.) Comparison of legal systems in Western capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social and cultural factors which 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 (Gibbs, Staff) MWT 2:15-3:05

139. Women, Family and the Law—(Same as Feminist Studies 139.) An analysis of changing legal perspectives on women and the family. Readings and class discussion will examine the legal regulations of marriage, unwed cohabitation, marital property, divorce, child support, child custody, abortion, family violence, marriage contracts, and remarriage. Laws and policies in the United States will be compared with selected examples from England, Sweden and France.

3-5 units, Win (Weitzman) MWF 10

141. Politics and Society—A review of the main themes of political sociology: the origins and expansion of the modern state; the linkages between state and society; the impact of the modern world system on national polities; the internal distribution of power and authority; and the structure of political group formation and individual participation in modern states. Emphasizes the modern empirical literature.

5 units (Meyer) given 1986-87

142. The Family—A cross-cultural analysis of family organization and processes in different societies, and over time, with some special attention to the urban family of Western society. Divorce, illegitimacy, courtship, changing sex roles, and the relations between family patterns and social class will be discussed.

5 units, Win (Goode) 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 (Staff) MWF 9

144. Class, Status and Power—Analysis of class system cross-nationally, East and West, and of the processes by which people and classes gain or lose in political power, wealth, and prestige. How elites rule in different class systems, both socialist and capitalist. Class differences in different historical periods. Class elements in revolution and counterrevolution.
The main focus is on 20th century societies, but comparative analyses will focus on other societies.

5 units, Aut (Goode) MWF 10

145. Race and Ethnic Relations — A systematic study of racial and ethnic relations in contemporary perspective. The course will examine 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. Work in Comparative Perspective: Japan and the U.S.—This course compares and contrasts the arrangement of work in the United States with that in Japan in order to reveal how U.S. history and culture have influenced labor institutions. Topics to be considered include the relationship between primary and secondary labor markets, the place of women, human capital, democratization in the workplace, and labor politics.

3-5 units, Spr (Staff) MWF 11

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 11

148. Gender and Social Inequality in Latin America—(Same as Latin American Studies 148.) Proseminar, exploring recent research and theoretical work concerning dominance, gender, and their interrelationships in Latin America. The proseminar will meet twice a week for guided discussions of pertinent readings. Participants wishing to meet additionally to develop and discuss research of their own concerning gender and inequality should enroll in 249.

5 units, Win (Roldan) MW 10-12, and by arrangement

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. Special focus is 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, Spr (Staff) TTh 9-10:30

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. This course explores all three of these kinds of communities and the impact on the ability of people to govern themselves 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 and Values, Technology, Science and Society 155.) This course pursues a sociological analysis of human society on a world-wide basis, that is, all the people inhabiting the earth and the institutions through which their lives are organized are treated as participants in one global social system. Competing models of the emerging world order and its dynamics will be reviewed and compared. Special attention will be given to the question of whether once distinctive societies and cultures are converging on a common standard. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socio-economic stratification of the world population, and education, science and technology as global systems. The course will utilize a mixed lecture-discussion format, with Thursdays from 10-11 set aside for discussion only. (DR:5).

5 units, Win (Inkeles) given 1986-87


5 units, Spr (Arthur) TTh 10-11:50

154. Urban Growth and Change—(Same as Urban Studies 156.) Cities and towns are continually changing: in size, density, composition and internal organization. This course examines causes and consequence of these changes. It will be divided into two main units: one will
focus on processes of change in a city as a whole; the other will concentrate on processes of change in a sub-area of a city (i.e., in a neighborhood). The course will consider consequences of these changes for individuals, families, organized groups and voluntary associations, firms and public institutions.

5 units, (Tuma) given 1986-87

155. Sociology of Science and Technology—Course analyzes science as a social institution, looking at the way science and scientific research are organized, and the impact of this organization on the development of scientific knowledge. Topics include alternative approaches to the sociology of science, models of scientific development, normative and stratification systems of science, communication structures, mobility and career patterns; the course also deals with scientists in high-tech corporations and the relation of science to technology.

5 units, Aut (Staff) MWF 1:15

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, Win (Swidler) given 1986-87

157. Social Movements and Social Protest—This course explores the underside of electoral politics, often referred to as "the politics of disorder." The questions considered include the following: 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 (Connell) MWF 11

158. Revolutionary Processes—A comparative, historical examination of social processes in classical as well as other types of revolutions. Causal theories of revolutions will be reviewed, as well as the dynamics of force and force-threat. The changing roles of peasants and of the military will be analyzed, along with family changes, terrorism, problems of legitimation, and the consequences of revolution.

5 units (Goode) given 1986-87

FORMAL ORGANIZATIONS


5 units, Aut (Scott) MWF 9
one section by arrangement

162. Organizational Cultures—(Same as Graduate School of Business 370.) Organizations have cultures which include, for example, an institutional mythology, jargon, rituals, ceremonies, humor. Through these cultural mechanisms, organizational members communicate their philosophies of management, values, and expectations. This course will draw on recent research on this topic to address such questions as: 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? Students will participate in research projects, including a diagnosis of the culture of a public or private sector institution.

4 units, Aut (Martin) TTh 10-11:45

165. Leadership in Organizations—(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, Aut (March) TTh 8-10

166. Organizations and Public Policy—This course provides concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. Varying conceptions of organizations, both as corporate actors and as social contexts, will be reviewed and evaluated. The several roles of organizations in relation to public policy will be examined, including organizations as decision makers and problem solvers, as change agents, and as clients. Prerequisite: 160 or Industrial Engineering 100.

5 units, Win (Scott) MWF 9 and
one section T or Th at 9

SOCIOLOGICAL THEORY

Examination of the questions these theorists pose and the answers they offer to fundamental problems of the relationship of individuals to society, the distinctive characteristics of modern societies, and the sources of reason and freedom in social life. (DR:3)

5 units, Aut (Staff) TTh 10-11:30

RESEARCH METHODS

180A. Introduction to Sociological Research
—The aim of this course is to provide the consumer of social research with standards by which to evaluate the findings of sociological studies; to present a critical analysis of some basic notions and theories used in sociological analysis. Required of all sociology majors.

3 units, Aut (B. P. Cohen) MWF 11; for associated laboratory, see Sociology 180B

180B. Introduction to Sociological Research: Laboratory—Laboratory exercises consider problems of collecting observations, constructing theory, testing hypotheses and generalizing research results. Required of all sociology majors. Students must enroll concurrently in 180A.

4 units, Aut (B. P. 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, and market researchers as well as social scientists. Course gives instruction in and intensive experience with basic skills useful in designing social scientific research and in collecting social scientific data. Members of the class will design a research project that will shed light on some social scientific issue, collect data that can be used 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 (Staff) TTh 1:15-3:05

182. Data Analysis—Considers various ways to analyze social scientific data. Although there will be lectures dealing with basic statistical techniques used in data analysis, an important part of the course will be students' own analysis of social scientific data. Course is useful 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 data they may have collected. Several data sets on variety of interesting topics will be made 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—Provides an opportunity for a student to work on a project of his or her own choice under the close supervision of a faculty member who has agreed to do the supervision. Prior arrangement required.

1-6 units (Staff) by arrangement

192. Undergraduate Research Apprenticeship—Provides an opportunity for a student to work in an apprentice-like relationship to a specific faculty member or members in an on-going research project. Prior arrangement required.

1-10 units (Staff) by arrangement

193. Undergraduate Honors Seminar—Designed for students participating in, or expecting to apply to the Honors Program.

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

194. Senior Thesis—Provides the opportunity to work intensively on an honors thesis project under faculty supervision (see description of Honors Program). It is assumed that this project will be arranged early in the year of graduation, if not before.

3-10 units (Staff) by arrangement

195. Departmental Seminar for Undergraduate Majors—Designed to introduce students to Sociology as an academic discipline, to acquaint them with career opportunities in the field, and to expose them to current faculty research interests. Required of all sociology majors.

2 units, Aut (Staff) W 12

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS

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. Course work includes reading and evaluating social science research. Features short written assignments and individual feedback.

4-6 units, Win (E. Cohen, Talbert) MW 3:15-5:05

211. Seminar: Bureaucracy, Education and the State—(Same as Education 214S.) Weber

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

221. Theories of Social Psychology — This course examines major theoretical perspectives in interpersonal processes and social psychology. The basic principles and assumptions of each perspective will be examined as well as techniques of investigation and methodological issues. Specific perspectives will include symbolic interaction, field theory and exchange and particular problems associated with perspectives will be treated, 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

229. Status, Expectations, And Rewards — Deals with a wide range of problems concerning the effect of status characteristics, such as race and sex, on the individual’s interpersonal behavior: how status distinctions are maintained; how 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 will be closely 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 (Goode) T 2:15-5:05

239. Seminar: Sociology of Work.

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

240. Seminar: Social Stratification.

5 units (Tuma) given 1986-87

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. Course will cover 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 (E. Cohen) MW 1:15-3:05

245. Seminar: Comparative Studies of Politics and Society — (Same as Political Science 202.) This seminar will focus on analysis of social and political developments in advanced or post-industrial society, with particular emphasis on western Europe and the United States. It will examine the ways in which changes in the technological and class structures have produced new bases for political cleavage and have affected the role of the state.

5 units (Lipset) given 1986-87

247. Democracy and Society in Comparative Perspective — (Same as Political Science 226.) Will focus on the conditions which appear related to the emergence and institutionalization of democracy, as well as the factors making for instability 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, Win (Lipset)

248. Prestige, Status, and Honor as Social Processes — How prestige, respect, honor, and similar rankings are generated or acquired; the relations among power, status, and money; the loss or accumulation of prestige; changes in evaluations over time.

5 units, Win (Goode) T 2:15-5:05

249. Seminar: Gender and Social Inequality in Latin America — (Same as Latin American Studies 248.)

5 units, Win (Roldan) MW 10-12 and by arrangement

255. Seminar: Life-Cycle Processes — Intrasocietal and cross-cultural variations in age related patterns or organization of individuals’ lives.

5 units, (Tuma) given 1986-87

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.) This course is intended to introduce students to the topics of interorganizational relations and the external control of organizational behavior and to provide them with some experience in analyzing and thinking about organization-environment issues. Topics considered include the dimensions of organizational environments, the theoretical status of environment, and how environments are perceived and enacted by organizations; the implications of the resource dependence perspective for the topics of goals, effectiveness, and efficiency; organizational responses to interdependence including internal structural modifications, avoidance, adaptation, and attempts to manage the environment using strategies such as merger, cooptation, and joint ventures;
the analysis of collective structures of interorganizational behavior, and how such structures emerge; and an analysis of some of the social consequences of interorganizational activity. Students will be expected to complete a major term paper in which the analytical concepts are applied to the analysis of a small set of organizations.

4 units, Spr (Palmer) TTh 1:20-3:05

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 will be considered both in terms of vertical power and authority differences and from the perspective of power differences that arise among subunits formally on the same hierarchical level. Topics to be covered include the definition of power and politics, and whether power is a measurable and meaningful concept; the sources and determinants of both individual and subunit power; how power is used in organizations, the conditions under which power and politics dominate organizational activity; the consequences of power and political activity; political tactics; and the implications of a political perspective for issues or organizational structure and design, the stratification of positions within the organization, and for organizational adaptation and change. (Enrollment is limited: Undergraduates or graduate students in sociology who wish to take this course should sign the class list in the Sociology Department office.)

4 units, Win (Pfeffer) TTh 8-9:45 and TTh 10-11:45

264. Topics in Human Resource Management—(Same as Business 300.) Changes in the labor force, the growth of "high technology" industries, and government's increased role in dictating employment practices are among the factors making career management increasingly salient to organizations. This course examines how personnel practices affect organizational members and how firms, in turn, are constrained by their workforces. The impact of organizational arrangements on workers' careers is discussed, as well as how personnel practices affect organizational functioning. The impact of unions, technological change, and affirmative action on human resource management are also examined, as are some recent innovations affecting employment relations, such as "comparable worth" and quality of work life programs.

4 units, Win (Baron) TTh 10-11:45

265. Seminar: The Structure of Organizational Environments—To what extent are the environments of organizations themselves increasingly organized and what implications do such developments have for the structure and functioning of their component organizations? A variety of conceptualizations and research approaches will be reviewed, contrasted, and evaluated. Prerequisite: 160, 260, or equivalent.

5 units, Spr (Scott) given 1986-87

270. Seminar: Topics in Sociological Theory—Close study of a selected number of contemporary theoretical approaches to sociology, including examples drawn from ethnomethodology, functionalism, critical theory, exchange theory, structuralism and conflict theory.

5 units (Goode) given 1986-87

280. Sociology of Religion—This course examines 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) Th 2:15-5:05

282. Seminar: Topics in Comparative and Historical Sociology—A seminar applying comparative and historical approaches to sociological analysis. Topics vary from year to year. In 1983-84, the seminar will explore the employment-relationship. Variation in the nature of careers and in the way work is controlled will be emphasized.

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


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

285. Seminar: Political and Economic Organization of the World System—Reviews current theory and research on the structures of the world economy and polity as they affect the organization and development of national societies. Covers dependency theories, current world-economy theories, and especially world effects on the evolution, dominance, and modern forms of states and regimes.

5 units (Meyer) given 1986-87

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

5 units (Inkeles) given 1986-87

COURSES PRIMARILY FOR GRADUATE STUDENTS

300A,B,C. Graduate Proseminar—Limited to first-year graduate students in Sociology.
2 units, Aut, Win, Spr (Staff) 12

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. Features short written assignments, individual feedback and work with actual research data.
4-6 units, Win (E. Cohen)
MW 3:15-5:05

320A,B,C. Seminar: Frontiers in Social Psychology—Seminar will deal with most recent developments in social/psychological research. It is open to all interested graduate students and advanced undergraduates. It is required of trainees in the NIMH program on evaluational structures and processes.
2 units, Aut, Win (Dornbusch) M 12-1:30
Spr, (Staff)

360A,B,C. Trainee Seminar: Organizations and Mental Health—An ongoing seminar devoted to examining the impact of organizations on mental health of their participants; and the organization of mental health services. Required of trainees but open to other interested students.
2 units, Aut, Win, Spr (Scott, Staff)
T 3:15-5:05

361. Seminar: Social Psychology of Organizations—(Same as Business 671.) Seminar focuses on social psychological theories and research relevant to organizational behavior. In past years the seminar has focused on: organizational culture, mythology, and the creation of knowledge structures such as script or schema; distributive injustice and its relationship to alienation, sabotage, violence, and theft organizational contexts. Prerequisites: enrollment in a Ph.D. program and permission of the instructor.
4 units, Win (Martin) TTh 1:20-3:05

365. Seminar on Advanced Organization Theory—(Same as Political Science 306.) Topics in organization theory for advanced students. Prerequisite: Permission of instructor.
5 units (March) given 1986-87

367. Organizational Analysis—(Same as Business 470, Political Science 307.) A doctoral level introduction to research on organizational decision making and adaptation. Bounded rationality, Information biases, Conflict, Uncertainty and ambiguity. Learning, Selection, Managerial mobility. Symbols and myths. Prerequisite: consent of instructor.
4 units, Win (March) TTh 8-10

370A,B. Basic Problems in Sociological Theory—A two-quarter course on (1) the logical analysis of theories and (2) basic strategies of sociological analysis. Basic concepts required for the logical analysis of theories are introduced in a preliminary way in the first four weeks of the course. These tools are then used for the analysis of various strategies of sociological analysis in the last six weeks of the Autumn and first six weeks of the Winter Quarter. Each strategy is illustrated by the study of one program of theoretical research starting with its origins in the classical literature and carried up to one or more contemporary formulations. The strategies studied vary from year to year but will be selected from among functionalism, historical materialism, human ecology, the theory of action, interactionism, behaviorism, decision-theory, and phenomenology. The last four weeks of the course are used to refine and extend the tools of theory construction, and require a self-directed computer course in logic. Prerequisite: consent of the instructors.
5 units per quarter, Aut (Zelditch)
TTh 1:15-3:05; Win (B. P. Cohen)
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—Considers the basic principles of experimental and non-experimental design and applies them to the various observation plans used in sociological research. Introduces measurement theory. Reviews statistical foundations, including exploratory data analysis and the general linear model. Prerequisite: Statistics 160 or equivalent.
4-6 units, Win (Cronkite) TTh 10-1

382. Sociological Methodology: Quantitative Outcomes—Examines methods for systematic analysis of quantitative features of social pro-
cesses. The first half of the course treats analysis of static relationships, using structural equation methods. The second half addresses the study of social dynamics. Prerequisite: 381A or equivalent.

4-6 units, Spr (Staff) MW 1:15-2:45

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 (Staff) MWF 1:15-3:05

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

395. Thesis. (Staff) by arrangement

CENTER FOR SPACE SCIENCE AND ASTROPHYSICS

Emeriti: (Professors) William A. Bonner, John V. Breakwell, Alan T. Waterman; (Research Professor) Aldo V. daRosa

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, Umran S. Inan, Bruce B. Lusignan, Norman H. Sleep

Assistant Professors: Lambertus Hesselink

Consulting Professor: Owen K. Garriott

Professors (Research): Donald L. Carpenter, C-W. Francis Everitt, Henry T. Howard, John P. Katsurakais, L. R. Owen Storey, G. Leonard Tyler, John F. Vesecky

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 Astro-
nautics, 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 (Wagoner)

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, Walker)

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, Goldwater, Greene, Holton, Johnson, Lawless, Quattrone)

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 Aerothermodynamics—(Enroll in Aeronautics and Astronautics 212.)
3 units, Win (Bershader)

222. Classical Gravitation—(Enroll in Physics 222.)
3 units, Spr (Staff)
alternate years, given 1986-87

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)
3 units, Spr (Spreiter)

235A,B. Space Systems Engineering—(Enroll in Engineering 235A,B.)
3 units, Win, Spr (Banks, Lusignan)

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 (Staff)

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)
3 units, Spr (Breakwell)
alternate years, given 1986-87

279C. Optimal Space Trajectories—(Enroll in Aeronautics and Astronautics 279C.)
3 units, Spr (Breakwell)

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)

348. Ionospheric and Magnetospheric—(Enroll in Electrical Engineering 348.)
3 units, Spr (Banks)

350. STAR Laboratory Seminar in Radioscience.
1 unit, Aut, Win, Spr (Vesecky)

352. Electromagnetic Waves in the Ionosphere and Magnetosphere.
3 units, Spr (Helliwell)
alternate years, given 1986-87

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
3 units, Spr (Tyler)
356. Introduction to Plasma Physics—(Enroll in Electrical Engineering 356.) 3 units, Win (Buneman)

359. Remote Probing of Atmospheric Environment—(Enroll in Electrical Engineering 359.) 3 units, Spr (Staff) alternate years, given 1986-87

360. Solar Physics—(Enroll in Applied Physics 360.) 3 units, Aut (Sturrock)

362. Physical Processes in Stars—(Enroll in Applied Physics 362.) 3 units, Spr (Petrosian)

364. Plasma Physics—(Enroll in Applied Physics 364.) 3 units, Spr (Sturrock) alternate years, given 1986-87

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.) 3 units, Win (Petrosian) alternate years, given 1986-87

368, 369. Gravitation—(Enroll in Physics 368, 369.)

368. 3 units, Aut (Bond, Wagoner)

369. 3 units, Win (Bond, Wagoner)

380A. Astrophysics Seminar — (Enroll in Applied Physics 380A) Experimental Techniques in Space Astronomy. 3 units, Spr (Walker)

392. Astrophysics Laboratory I—(Enroll in Applied Physics 356.) 3 units, Sum (Walker) alternate years, given 1986-87

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 (on leave 85-86), Sylvia Wynter

Associate Professors: Mary Pratt, Tomás Ybarra-Frausto

Assistant Professor: Madeline Sutherland

Senior Lecturers: María-Paz Haro (Director, Undergraduate Language Program), Karin Van den Dool

Lecturer: Bernard Baycroft

Visiting Professors: Nestor G. Canclini; (Autumn), Sergio Fernandez, Heloisa Buarque de Hollanda (Winter)

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.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

Recognizing that students have different interests and reasons for pursuing a major in the Department of Spanish and Portuguese, the following major paths have been designed. Each has different objectives and requirements. Students will wish to consider in conjunction with a faculty advisor which major path corresponds most closely to their own personal and professional objectives.

Literature Emphasis—This path is recommended for those students who enjoy reading literature and wish to acquire a knowledge of the variety of poetry, prose, and drama in the Hispanic world. Courses are intended to provide historical perspective and develop critical skills in approaching literature. Candidates are expected to complete a minimum of 45 units from courses in the department numbered 100 or higher.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); 201 and 202 (Advanced Grammar and Composition); two courses in peninsular literature; two courses in Latin American Literature. Of all the courses taken, two should be literature prior to 1750.

Recommended: Courses in Chicano literature, linguistics, and literary theory.

Literature and Society Emphasis—The aim of this path is to permit more flexibility to students by allowing them to plan a broader major than is possible in the other areas of concentration. The student can combine the study of Spanish, Portuguese, or Latin American Literature with such fields as political science, history, anthropology, and economics. Students must complete a minimum of 35 units in the department from courses numbered 100 or higher, and 25 units in related fields with advisor approval.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); two courses in peninsular literature; two courses in Latin American literature.

Chicano Studies Emphasis—The aim of this path is to permit more flexibility to students in Chicano Studies, allowing them to take courses
in, for instance, the Departments of Linguistics and History, including optional courses in Chicano Studies. Students must design their program in conjunction with Prof. Ybarra-Frausto. Students will also be expected to acquire an adequate knowledge of the roots of Chicano literature. Candidates must complete 35 units in Chicano Studies. In addition, they must take 25 units in Latin American or Peninsular literature from courses numbered 100 or higher in the department.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); two courses in Chicano literature; four courses in Latin American and Peninsular literature.

Language Emphasis—This path is intended for students whose primary interest is in the structure and use of the Spanish language. Students must complete a minimum of 45 units from courses in the department numbered 100 or higher. (Language emphasis path not offered 1985-86.)

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 130, 131, 132 (130B, 131B, 132B) are recommended for students who do not wish to make literature their major area of concentration but wish to continue studying Spanish beyond the second year level.

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 the Overseas Studies (Room 112, Old Union).

Courses taught at Salamanca: Spanish Civilizat; Spanish Literature from 1870 to the Present; History of Spain. Students 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 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 Sao Paulo in Brazil. For credits in these and other programs abroad, consult your advisor.

INTENSIVE SUMMER PROGRAM

Stanford University offers first year intensive language study in Spanish during the summer.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the
COURSES FOR BILINGUAL STUDENTS

The department offers a series of courses especially for bilingual students who need to concentrate on special problems of language or who have particular cultural interests. For specific courses consult the course offerings section. The suffix B indicates bilingual courses.

UNDERGRADUATE HONORS

Majors in the department who wish to be considered for honors at graduation may choose one of two options: (1) An oral examination in the second to the last quarter of their senior year, on a 15-book reading list developed by the student in conjunction with a faculty advisor. The exam will be given by the student's advisor and two other faculty members. (2) A research paper written in consultation with a faculty advisor to be read and approved by the faculty advisor and two other members. The student may register for 5 units of Individual Work with the advisor.

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; can be waived in special cases); Introduction to Literary Theory or an equivalent course; four courses in the department numbered 200 or above which form a coherent program (to be worked out with advisor); reading knowledge of one foreign language other than Spanish (this language may be Portuguese).

In addition, students may take further units of graduate courses in Spanish or Portuguese and/or approved courses in related fields such as Linguistics, Comparative Literature, Philosophy, History of Art, Education. Students planning a career in language teaching may also take part in the 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.

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) Literacy 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 in their second and third years will participate in a teacher apprenticeship program in the Spring Quarter of the first year.

After the first year of study, each student is evaluated by the faculty to determine whether continuation to the Ph.D. is recommended and whether there are particular areas where improvement is needed. For this evaluation, students submit a sample term paper 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. (For further information, consult the departmental Guidelines for Graduate Students.)

Ph.D. candidates must fulfill the requirements for the A.M. before proceeding to the 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. (For further information consult the Departmental Guidelines for Graduate Students.)

The candidate should file a formal application for candidacy as prescribed by the University no later than the end of the second year. As early as possible Ph.D. candidates will be expected to find a topic requiring extensive original research and to choose a member of the department as his or her advisor. The advisor will request the Chairman to appoint a committee to supervise the dissertation. The committee may well advise extra preparation within or outside the department, and time should be allowed for such work. Ph.D. dissertations must be completed and approved within five years from the date of filing the application. Candidates taking more than five years will be required to 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.

**OVERVIEW OF COURSES**

A. General Courses (given in English)
B. First and Second Year Spanish (1-99)
C. Intermediate Courses (100-199)
  - Culture (130-132, 130B-132B)
  - Literature (140-199)
D. Courses for Advanced Undergraduates and Graduates (200-299)
  - Advanced Language and Linguistics (200-209)
  - Peninsular Literature (210-245)
  - Genre Survey Courses (210-213)
  - Medieval and Golden Age Literatures (214-235)
  - Modern and Contemporary Literatures (236-243)
  - 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)
E. Graduate Seminars (300-399)
  - Literary Theory and Methodology (300-313)
  - Peninsular Literature (314-345)
  - Latin American Literature (346-379)
  - Chicano Literature (380-389)
  - Special Topics (390-398)
  - Individual Work (399)
F. Portuguese Program (1-399)
  - Language (1-199)
  - Brazilian Literature (210-245)
  - Graduate Seminars (300-399)

**INFORMATION**

Students interested in languages not listed for a specific language department should contact the Special Language Program, Department of Linguistics.

**SPANISH LANGUAGE PROGRAM**

**Director:** Maria-Paz Haro

Students registering for the first time in a first or second year course must take a placement test if they have studied Spanish before entering Stanford. For courses 11B, 12B, and 13B see special section for bilingual students. (No auditors permitted in language courses.)
INTRODUCTORY COURSES

1. First-Year Spanish (1st quarter)—An introductory course with emphasis on speaking and oral comprehension.
   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: Spanish 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: Spanish 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 is used, offering preparation in listening, speaking, reading and writing the language with oral presentations and small group conversation sections. Written exercises, short compositions, and daily work in the language laboratory are also an integral part of the course. (Classes limited to 15 students. No auditors permitted.)
   9 units, Sum (Staff)

10. Elementary Conversation—(Graduates register for 110.) Conversation practice offered as a supplement to Spanish 2 or Spanish 3. May also be taken when student intends to continue in first year series but current course load does not permit it. Prerequisite: Spanish 1 or equivalent. Given Pass/No Credit only.
    2 units, Aut, Win, Spr (Staff) TTh

11. Second-Year Spanish (1st quarter) — Intensive review of grammatical concepts; composition and conversation based on primarily cultural and literary readings. Prerequisite: Spanish 3 or equivalent.
    4-5 units, Aut, Win, Spr (Staff) MTWThF

12. Second-Year Spanish (2nd quarter)—Continuation of Spanish 11. Prerequisite: Spanish 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: Spanish 12 or equivalent.
    4-5 units, Aut, Win, Spr (Staff) MTWThF

50. Intermediate Conversation — Recommended as a complement to Second Year courses. Prerequisite: Spanish 3 or equivalent. Given Pass/No Credit only.
    3 units, Aut, Win, Spr (Staff) MWF

100. Advanced Conversation—Prerequisite: Spanish 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 Spanish 10.)

SPECIAL COURSES

15, 25, 35. First-Year Individualized Spanish—These courses are particularly suited to students who wish to complete more or less than five units a quarter, have a spotty background in Spanish, 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. Any student who completes more than one course (5 units) of Spanish 15/101S, 25/102S, 35/103S is required to attend Spanish 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. These 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.) Course is geared to achieving a practical, rapid, and immediately useful command of spoken Spanish. It covers such essential topics as the human body, hospital procedures, diagnostics, food, and essential phrases for on-the-spot reference when dealing with Spanish-speaking patients.
    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: Spanish 21M or equivalent.
    3 units, Win (Staff)

23M. Spanish for Medical Personnel—(Graduates register for 123M; same as Family, Community and Preventive Medicine 282.) Continuation of 23M. Prerequisite: Spanish 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: Spanish 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 Spanish 1S, 2S, 3S.)

121M. Spanish for Medical Personnel for Graduate Students—(See 21M.)

122M. Spanish for Medical Personnel for Graduate Students—(See 22M.)

123M. Spanish for Medical Personnel for Graduate Students—(See 23M.)

124. Business Spanish for Graduate Students—(See 24.)

125. Spanish for the Professions—Designed to prepare students for the departmental proficiency exam which must be passed in order to obtain the official transcript notation certifying foreign language proficiency. Prerequisite: Spanish 13 or equivalent.
   3-5 units, Win (Staff)

126. Spanish for Law Students—(See Spanish 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: Spanish 13 or equivalent. For courses 130B, 131B, 132B see special section for bilingual students.

135. Introduction to Chicano Life and Culture—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 offered 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.

130B. Mexican and Chicano Cultural Readings—Includes selected grammatical problems and emphasis on oral expression. (DR:2)
   3-5 units, Aut (Baycroft)

131B. Latin American Cultural Readings and Composition—Includes selected grammatical problems and introduction to literary texts. (DR:2)
   3-5 units, Win (Baycroft)

132B. Hispanic Cultural Readings and Composition—Selected grammatical problems and emphasis on composition. (DR:2)
   3-5 units, Spr (Baycroft)

LITERATURE

Courses will emphasize a broad perspective on Hispanic literature and provide an introduction to literary studies. Prerequisite: Spanish 13 or equivalent.
140. Introduction to Methods of Literary Analysis—Designed for students with little or no background in literary analysis. Introduces basic terminology of literary criticism and examines a variety of critical approaches to literature. Specific literary texts will be discussed in detail in light of readings in literary theory and criticism. Emphasis will vary with individual instructors, but the general purpose of this course is to teach students to read, write, and think about literature. Given annually. Prerequisite: Spanish 13 or equivalent. (DR:2.)

3-5 units, Aut (Ybarra-Frausto)

141A. (Same as Spanish 241.)

145. The Spanish Republic, the Civil War and the Aftermath—Examines various cultural aspects of the period from the Second Republic to the reign of Juan Carlos I (1932-present) paying particular attention to 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 other topics that will be studied.

3-5 units, Win (Sutherland)

151, 152. Spanish Literature—These courses make up the basic introduction to Spanish Peninsular literature. They deal with major works from several periods and genres, and are designed to prepare the student for more specialized 200 level courses. Though designed as a sequence, they need not be taken in sequence. Exact composition of courses will vary from year to year. Given annually. Prerequisite: Spanish 13 or equivalent.

151. Spanish Literature I—Major works of the Middle Ages and the Renaissance. (DR:2)

3-5 units, Aut (Sutherland)

152. Spanish Literature II—Major works from 1800 to the present. (DR:2)

3-5 units, Spr (Sutherland)

151A, 152A. Spanish American Literature—These courses make up the basic introduction to Spanish American literature. They deal with major works from several periods and genres, and are designed to prepare the student for more specialized 200 level courses. Though designed as a sequence, they need not be taken in sequence. Exact composition of courses will vary from year to year. Given annually. Prerequisite: Spanish 13 or equivalent.

151. Spanish American Literature I—Reading masterworks of Latin American literature. (DR:2*)

3-5 units, Win (Fernandez)

152. Spanish American Literature II—Continuation of 151. (DR:2*)

3-5 units, Spr (Pratt)

180. Undergraduate Winter Colloquium: Romances and Corridos: The Oral Literature of Spain and Latin America—This course is chiefly designed to provide a forum where Spanish majors of all paths can come together to do collective reading and research on a selected topic in Hispanic culture. Topics will vary widely from year to year, but will usually involve areas of interest which students would be unlikely to encounter in regular course work. Students are also encouraged to suggest topics for this colloquium. Open to non-majors by consent of instructor. Prerequisite: Spanish 13 or equivalent.

3-5 units, Win (Sutherland)

199. Individual Work—Open only to majors in Spanish, or with special permission.

1-12 units, (Staff) by arrangement

GENERAL COURSES

The courses in this section are given in English and do not require a knowledge of Spanish or Portuguese, although in some instances a reading knowledge may be recommended. Majors taking these courses as a part of their requirements must do assigned work in the language. These courses are open to all students.

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 Spanish 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 will be encouraged to draw from their bicultural, bilingual experience. Knowledge of Spanish and familiarity with barrio dialects essential. (Not open to graduate students or freshmen.)

3-5 units (Islas)

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES (200-299)

ADVANCED LANGUAGE AND LINGUISTICS

200. Spanish Pronunciation and Phonetics.

3 units
201. Advanced Grammar—Problems of grammar at an advanced level.
  3 units, Aut (Gicovate)
  3 units, Win (Baycroft)
203. Problems in Translation—A workshop for advanced language students.
  3 units
204. Introduction to Versification.
  3 units
  3-5 units

PENNINSULAR LITERATURE
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, Win (Wynter)
213. Literary Theory and The Golden Age comedia—Course sets out to propose 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 would be helpful, but it is not a requirement. The texts used will be those which also have been translated into English. Where there are no translations, translated extracts will be 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. Women in Early Spanish Literature—Study works by Spain's early women writers, among them Leonor López, Teresa de Cartagena, Florencio Pinar, Santa Teresa, and María de Zayas. Treatises directed to women, La formación de la mujer cristiana and La perfecta casada, will also be discussed.
  3-5 units (Sutherland)
222. Golden Age Drama from Gil Vincente 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, Win (Fernandez)
227. Don Quijote II—Graduates enroll in 327. Continuation of Spanish 226.
  3-5 units, Spr (Fernandez)
237. The Generation of '98—Social rebellion and literary traditionalism in the writers of the first part of the 20th century, especially Unamuno, Azorin, Baroja, Perez de Ayala, Miró, A. Machado.
  3-5 units, Aut (Gicovate)

LATIN AMERICAN LITERATURE
241. Afro-Hispanic Cultural Worlds: An Introduction—(Same as 141A.) An overview to the literature and thought of Black Latin American writers in the Spanish-speaking Americas as well as in Brazil. The course will also provide 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 African and Afro-American Studies 248.) This course provides 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, Spr (Ybarra-Frausto, Baycroft)
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)
260. La Culture 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 con-
temporary Mexico will be examined. From the Revolution (1910) through the Student Movement of Tlatelolco (1968) salient literary works will be studied in their social context.

3-5 units, Win (Ybarra-Frausto)

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—Study of 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, Aut (Ybarra-Frausto)

281. History of the Chicanos in the U.S.: 19th Century Roots and 20th Century Developments. 3-5 units

282. Chicano-Riquena 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. Examination of some of its singular characteristics: bilinguality, 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 nineteenth 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. Course will focus on Teatro Campesino and Teatro de la Esperanza.

3-5 units (Ybarra-Frausto)

286. 19th Century Chicano Literature—Course will examine 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 (Camarillo)

288A. Undergraduate Colloquium: Chicano Literature and Culture—Centered on literature, the course will examine diverse aspects of Chicano expressive culture showing 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 — (Knowledge of Spanish required.)

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. No prerequisites.

3-5 units, Win (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) MWF 12


3-5 units, Win (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.
Can be taken as a continuing course with Spanish 307.
4-5 units (Pratt)

307. Readings in Latin American Criticism—
Selections from the principal figures in Latin American literary and cultural studies. Course 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—(Same as Linguistics 252, Modern Thought and Literature 310.) Creation of meaning as a social process, ways in which ideology is produced, reproduced, and transformed in linguistic interaction, whether and how American competence models can interlock with theories that see language as constituting social reality and self. Readings on the concept of socially determined meaning, discursive practices in the French tradition, British empirical analyses, American sociolinguistics.
4-5 units, Aut (Pratt)

315. La Celestina—A careful reading of Fernando de Rojas's masterpiece and the major criticism of this important literary text. Other topics that will be considered 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 (Sutherland)

316. The Romancero—Course centers on the romance tradicional, although other ballad genres will also be considered. Critical writings of Catalán, Menéndez Pidal, Propp, Greimas, Piaget, and Segre will be read in conjunction with the ballad texts.
3-5 units, Spr (Sutherland)

320. El libro de Buen Amor—(Undergraduates enroll in Spanish 220.) Allegory, autobiography, and parody in the troubadours, the dolce stil nuovo, and the Libro de Buen Amor.
3-5 units (Sutherland)

352. Twentieth Century Latin American Narrative III: García Márquez and the Reality of Latin America—A critical interpretation of 100 Years of Solitude and "Magic Realism".
3-5 units (Alegria)

3-5 units

356. Latin American Literature of the Colonial Period.
3-5 units

358. Latin American Writing in the Nineteenth Century II.
3-5 units

360. La generación de “Contemporáneos”—A study of a decisive period in contemporary Mexican literature. Particular attention will be given to the works of Villaurrutia, Gorostiza, Pellicer, Torres-Bodet, and to the history of Mexican baroque.
3-5 units, Aut (Fernandez)

399. Individual Work—Exclusively for graduate students in Spanish engaged in special work.
1-12 units, any quarter (Staff)
by arrangement

PORTUGUESE

INTRODUCTORY COURSES

1. First-Year Portuguese (1st quarter)—An introductory course with emphasis on speaking and oral comprehension.
5 units, Aut (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 (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: Portuguese 2 or equivalent.
5 units, Spr (Van den Dool) MTWThF, plus additional work in the Language Laboratory.

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: 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 Portuguese 11 and 12. Prerequisite: 3 or equivalent. Given Pass/No Credit only.
3 units, Aut, Win (Staff) MWF

59. 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: Portuguese 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 COURSES
(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

267. Brazilian Literature I — Survey of literary trends and authors of Brazilian literature.
3-5 units, Win (Hollanda)

268. Brazilian Literature II—Survey of literary trends and authors of Brazilian literature.
3-5 units, Spr (Staff)

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, Win (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

GRADUATE SEMINARS
(300-399)

341. Seminar on Fernando Pessoa.
3-5 units

378. Seminar on Brazilian Modernism.
3-5 units

399. Individual Work—Exclusively for graduate students in Portuguese engaged in special work.
1-2 units, by arrangement

STATISTICS
Emeriti: Quinn McNemar, Rosedith Sitgreaves
Chairman: Herbert Solomon
Professors: Theodore W. Anderson, Thomas M. Cover, Persi Diaconis (on leave), Bradley Efron, Jerome H. Friedman, M. Vernon Johns, Gerald J. Lieberman, Rupert G. Miller, Lincoln E. Moses (on leave), Ingram Olkin, David Siegmund (on leave), Herbert Solomon, Charles Stein, Patrick Suppes, Paul Switzer
Professor of Biostatistics: Byron W. Brown
Assistant Professors: James A. Fill, Iain M. Johnstone, Art B. Owen

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, R. G. Miller, 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.

Computer facilities are available at the Center for Information Processing, which maintains an IBM 30-33 computing system. A DEC 20 system is also available for students’ computer related course work. For use in research and teaching, the department maintains terminal units and its own VAX 750 computer. 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 113S 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.

There is sufficient flexibility to accommodate students with interests in applications to operations research, social sciences, engineering, computing, business, economics, and health.

Students with a strong mathematical background who may wish to go on to a Ph.D. in Statistics should consider applying directly to the Ph.D. program.

A 2.75 letter grade indicator will be required for all statistics courses which are taken for an M.S. degree. All Statistics courses required for the M.S. degree (116, 217, 218, 200, and 3 additional courses) which are offered for letter grades must be taken for letter grades.

MASTER OF SCIENCE: DATA ANALYSIS AND STATISTICAL COMPUTING

The goal of this program is to teach data analytic procedures and their applications to real world problems. Special emphasis is placed on the use of computers and on the design of efficient algorithms for statistical computations. The program is thus more practically oriented than the Ph.D. program and mathematically less demanding. The degree is a terminal degree. Students planning to obtain the Ph.D. degree are advised to apply directly to the Ph.D. program.

Upon entrance to the program, students are expected to have proficiency on the level of Statistics 116, 200 and Computer Science 106. Students lacking in one or both of these areas should enroll in and complete these courses prior to entering the program. These background courses are offered during the summer session as well as during the academic year. Experience in practical applications of statistics and/or a background in mathematical sciences is advantageous.

The course requirement is 42 units of work from offerings in the Statistics Department or
from authorized courses in other departments. Each student will normally fulfill the following requirements for the degree:

2. Mathematics 113 or 113S and Computer Science 111.
3. Additional units to complete the requirements. These are normally taken from the group of courses Statistics 205, 206, 207, 217, 218, Computer Science 145, 234, Operations Research 240.
4. Each student is required to work on a practical project (incorporated in Statistics 229). This can be the development of a reasonably sophisticated computer program or the application of statistical procedures to a current data analytic problem.

A 2.75 letter grade indicator will be required for all statistics courses required for the M.S. degree in Data Analysis and Statistical Computing. All courses which are offered for letter grades must be taken for letter grades. The program normally takes one calendar year to complete.

DOCTOR OF PHILOSOPHY

Students with strong undergraduate mathematics backgrounds are encouraged to apply for the Ph.D. in Statistics. The department offers about 10 graduate fellowships and assistantships 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 15. For details concerning this test see the Information Bulletin. Overseas applicants, who may not receive the Information Bulletin promptly, should write directly to the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540.

The specific course and examination requirements for the Ph.D. are given below. In addition, students are encouraged to avail themselves of the advanced course offerings which may vary from year to year, as well as advanced courses related to statistical topics which may be offered in other departments.

1. *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, Statistical Complexity. Ph.D. students are encouraged to take as many advanced topics courses as can be fitted into the program of studies.

2. *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.

3. *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, 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 two to three years course work students are given an oral examination which covers both the general theory of statistics and probability as well as selected special topics.

4. *Experience*. All candidates for the Ph.D. in Statistics are required as part of their program to obtain experience in research, consulting, and computer programming. In addition, all candidates for the Ph.D. in Statistics are required to serve as a teaching assistant in the department for at least four quarters.

Ph.D. MINOR 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 40-45 units, depending on the degree of difficulty of the courses, whereas the number of units required for a minor averages around 30. This difference of 10-15 units can be made up by the student including in the M.S. program courses from his or her own field which are related to statistics or applications of statistics.
INTRODUCTORY COURSES

Introductory courses for general students with an interest in the problems of descriptive statistics and statistical inference are: Statistics 10, 40, 60, 61, 70. These courses have no mathematical prerequisites; Statistics 40, 60 are approved for the Mathematical Science distribution requirement for undergraduates. Statistics 10 is designed to familiarize the student with the general ideas of descriptive and inferential statistics as used in daily life, e.g., newspaper and magazine reports, polls, etc. It is a terminal course and does not serve as a prerequisite for further work. Statistics 40 covers discrete probability theory, 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 will be used. (Graduate students enroll in 160.) NOTE: Students cannot receive credit for both Statistics 60 and Psychology 60. (DR:6)

5 units, Aut (Switzer) MTWThF 1:15

Win (Staff) MTWThF 1:15
Spr (Anderson) MTWThF 1:15
Sum (Staff) MTWThF 1:15

61. Introduction to Statistical Methods II—(Graduate students register for 161.) Treats chi-square tests, analysis of variance, regression, correlation, nonparametrics, sample surveys, elementary design of experiments. Prerequisite: 60 or consent of instructor.

5 units, Win (Johns) MTWThF 1:15

70. Biostatistics—(Enroll in Family, Community and Preventive Medicine 202.) Statistical reasoning and basic methods. Applications to biology and medicine. Prerequisite: High school algebra.

3 units, Aut (Brown)

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, Spr (Owen) MTWTh 10
Sum (Staff) MTWThF 9

116. Theory of Probability—Probability spaces as models for phenomena with statistical regularity. Discrete spaces (e.g., binomial, hypergeometric, Poisson). Continuous spaces (e.g., normal, exponential) and densities. Random variables, expectation, independence, conditional probability. Introduction to the Laws of Large Numbers and Central Limit Theorem. Prerequisite: Mathematics 44 or equivalent. (DR:6)

3 or 4 units, Aut (Fill) MTWF 10
Spr (Milkr) 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 Operations Research 152.) Theory and computation of optimal selection of decisions under certainty. Linear programming (simplex method and duality theorem), network flows, dynamic programming, convex programming (convex sets and functions, Lagrange multipliers, Kuhn-Tucker conditions, algorithms), integer programming. Applications drawn from problems in pricing resources, production planning, inventory control, transportation, pollution control, personnel assignment, construction management, capacity expansion, and financial management. Prerequisite: Mathematics 43 or consent of instructor.

4 units, Aut (Hillier)

programming, simulation, certainty equivalents and quadratic costs. Prerequisite: 116.

4 units, Win (Taksar)

160. Introduction to Statistical Methods I
---(See 60. For graduate students.)
   5 units, Aut (Switzer) MTWThF 1:15
   Win (Staff) MTWThF 1:15
   Spr (Anderson) MTWThF 1:15
   Sum (Staff) MTWThF 1:15

161. Introduction to Statistical Methods II—
---(See 61. For graduate students.)
   5 units, Win (Miller) 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 (Cover) MTWF
   Win (Solomon) MTWF 11

CONTINUATION COURSES

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: Statistics 116 and Mathematics 113 or 113S, (or equivalent).
   5 units, Win (Owen) MTWThF 2:15

201B. Data Analysis II---Classification and discriminant analysis. Dimensionality reduction. Principal components, factor analysis, multidimensional scaling. Cluster Analysis. Treatment of missing values. Analysis of categorical data. Topics will be discussed from the point of view of their application and the emphasis will be on conceptual rather than theoretical understanding. Prerequisites: Statistics 201A or equivalent.
   3 units, Spr (Friedman) MWF 2:15

202. Introduction to Decision Theory and the Theory of Games---Utility and loss functions; formulation of statistical decision problems, Bayes and minimax procedures; admissibility; comparison of experiments; game trees, strategies, equilibrium points; zero-sum and non-zero-sum games; two person and n-person games. Prerequisite: 200 or 201A.
   3 units, alternate years, given 1986-87

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, Spr (Johns) MWF 1

204. Sampling from Human Populations---An introduction to the theory of sampling from finite populations. Simple random sampling, stratified sampling, cluster sampling, efficiency of various designs, nonresponse models; particular emphasis on applications. Prerequisite: A basic course in statistics (Statistics 61, 110, or 200).
   3 units, Win (Staff) MWF 3:15

205. Introduction to Nonparametric Statistics---Nonparametric analogs of the one- and two-sample t tests and analysis of variance: the sign test, median test, Wilcoxon's tests, and the Kruskal-Wallis and Friedman tests, tests of independence. Nonparametric confidence interval estimates. Prerequisites: Statistics 200. (Concurrent registration in 200 is permitted.)
   3 units, Win (Johns) MWF 10

206. Applied Multivariate Analysis---Introduction to statistical analysis of several quantitative measurements on each observational unit. Emphasis on concepts, methods, computation, interpretation. Examples drawn from substantial fields such as economics, education, geology, psychology. Topics include multiple regression, multivariate analysis of variance, principal components, factor analysis, canonical correlations. Prerequisites: Statistics 200 or 201A. (Concurrent registration in 200 is permitted.)
   3 units, alternate years, given 1986-87

207. Introduction to Time Series Analysis---Time series models used extensively in economics, engineering, physics, geology, etc. Trend fitting, autoregressive schemes, moving average models, periodograms, second order stationary processes, spectral analysis. Prerequisites: Statistics 116 and a basic course in statistics (Statistics 200 or 201A).
   3 units, alternate years, given 1986-87

208. Mathematical Models in Behavioral Sciences: Psychometrics---Examination of mathematical models and applications in psycho-
metrics. Illustrative topics are factor analysis, mental testing, clustering and classification, multidimensional contingency tables. Prerequisite: 60, 61.

3 units, alternate years, given 1986-87

209. Quantitative Methods and Their Application to Public Policy—Focusing upon applications of statistical methods, rather than methodology per se, this course will consider such topics as risk assessment in the evaluation of biohazards and medical techniques and technologies; comparisons of such information-gathering techniques as surveys, experiments, or simulation studies; methods of expressing and evaluating uncertainty; and the interpretation of such quantitative techniques of data analysis as regression. Prerequisites: 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, say, differ with respect to some parameter. Ranking and selecting procedures are statistical techniques for comparing these populations where the goal may be to select the single best population, or perhaps to rank all the populations. These techniques will be illustrated by using actual data from a variety of fields. The course will concentrate on the ideas underlying the material and not on derivations; the course requires knowledge of a first course in statistics.

3 units, alternate years, given 1986-87


217. 3 units, Aut (Johnstone) MWF 2:15
Win (Fill) MWF 10
218. 3 units, Win (Staff) MWF 2:15
Spr (Shepp) MWF 10
217,218. 6 units, Sum (Staff) MTWThF 10-11:50


3 units, Win (Owen) MWF 1:15

229. Selected Topics in Data Analysis—In this seminar each student will choose a topic in the area of statistical computing or data analysis. He/she will read relevant journal articles and give an expository one hour presentation to the class.

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

251. Stochastic Models in Operations Research—(Enroll in Operations Research 251.) Introduction to stochastic modeling. Orientation is applied and directed to students who anticipate doing project work in government or industry which involves stochastic modeling. Emphasis on stress formulation, solution, and analysis of stochastic models in operations research. Topics include queueing theory, inventory theory, Markov decision processes, dynamic programming, reliability theory. Prerequisite: 217.

3 units, Spr (Iglehart)

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; Statistics 217 or the equivalent.

3 units, Spr (Iglehart)

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

COURSES PRIMARILY DESIGNED FOR DOCTORAL STUDENTS

The 230A,B, 233 A,B,C, and 236 A,B,C sequences comprise the fundamental sequence which serves as a general introduction to and prerequisite for further work. Subsequent courses are special topics courses and delve more deeply into these areas.

230A,B. Advanced Probability—Mathematical foundations of probability and stochastic processes: probability spaces, construction of measures, expectation, independence, condi-

230A. 3 units, Win (Chung) MWF 9
230B. 3 units, Spr (Chung) MWF 9

233A, B, C. Applied Statistics—Analysis of variance, multiple regression, components of variance, experimental design, failure of assumptions, randomization, exploratory data analysis, nonparametric methods, robust point and interval estimation, contingency tables, analysis of quantitative data, censored data, and actual case histories. Prerequisite: Statistics 200 and Mathematics 113 or 113S, or consent of instructor.

233A. 3 units, Aut (Miller) MW 11
233B. 3 units, Win (Efron) MW 11
233C. 3 units, Spr (Johnstone) MW 11

236A, B, C. Theoretical Statistics—Decision theory; minimax and Bayes solutions, the concepts of admissibility and invariance. Bounds for the variance of estimators, maximum likelihood estimation, exponential families, tests of hypotheses, confidence intervals. Neyman-Pearson theory, large sample theory, sequential analysis, multiple decision problems. Prerequisite: Statistics 200.

236A. 3 units, Aut (Johnstone) MWF 1:15
236B. 3 units, Win (Johnstone) MW 1:15
236C. 3 units, Spr (Stein) MWF 1:15

240. Linear Programming—(Enroll in Operations Research 240.) This course will survey linear programming, emphasizing standard model formulation, fundamental theorems, variations of the simplex method and parametric programming. Corequisite: Mathematics 113.

3 units, Aut (Eaves)


3 units, Win (Eaves)

260A, B, C. Workshop in Biostatistics—Applications of statistical techniques to current problems in medical science. Intended primarily for doctoral students in statistics. Enrollment for more than two units of credit will involve extra reading or consulting and requires permission of the instructor.

260A. 1-5 units, Aut (Brown, Efron, Miller, Moses) Th 1:15-3:05
260B. 1-5 units, Win (Brown, Efron, Miller, Moses) Th 1:15-3:05
260C. 1-5 units, Spr (Brown, Efron, Miller, Moses) Th 1:15-3:05

262A, B, C. Workshop in Environmental Statistics—A seminar dealing with statistical aspects of pollution and related health effects.

262A. 1-3 units, Aut (Switzer) W 4:15-5:30
262B. 1-3 units, Win (Switzer) W 4:15-5:30
262C. 1-3 units, Spr (Switzer) W 4:15-5:30

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 will 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). (a) Totally positive functions. These arise in a variety of contexts; they possess reproductive and smoothing properties that make them exceedingly useful. (b) Schur functions and majorization. Majorization is a partial ordering that is extremely rich. Applications from a broad class of fields are discussed. (c) Convexity in stochastic orderings. Some of the types of inequalities discussed are: matrix inequalities, moment inequalities, stochastic inequalities, norm inequalities, extremal inequalities.

3 units, alternate years, given 1986-87


317. 3 units, Aut (Fill) MWF 3:15
318. 3 units, Win (Fill) MWF 3:15
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, Win (Anderson) TTh 11-12:15

326A. Sequential Analysis—The Wald sequential probability ratio test, operation characteristics and applications. General theory of optimal stopping with applications to sequential statistical decision problems.

3 units, alternate years, given 1986-87

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, alternate years, given 1986-87

332. Asymptotic Methods in Statistics—Concepts of efficiency, the asymptotic efficiency of maximum likelihood estimators, best asymptotically normal (BAN) estimators, asymptotic behavior of likelihood ratio tests, optimal designs, empirical Bayes methods.

3 units, Aut (Johns) MWF 2:15

333. Robust Estimation—Procedures which continue to be effective when the usual parametric assumptions are violated. The estimation of location for symmetric distributions: M, L, and R estimators, asymptomtics, the influence curve. Robustness in hypothesis testing. Survey of recent literature. Prerequisite: 236A, B, C.

3 units, alternate years, given 1986-87

336A, B. Decision Theory and Statistical Inference—Minimax theorem, admissibility and complete class theorem, formulation of statistical decision problems, sufficient statistics, testing hypotheses, estimation, comparison of experiments, and sequential problems.

336A. 3 units, alternate years, given 1986-87

336B. 3 units, alternate years, given 1986-87


343A. 3 units, alternate years, given 1986-87

350. Topics in Probability Theory—A systematic approach to approximation problems in probability theory is presented. Exchangeable pairs are used to obtain the kernel of the expectation functional, which can often be approximated with the aid of a bit of linear algebra. Some of the standard limit theorems are studied in a different framework. Other applications will be attempted. Prerequisite: Statistics 230A, B.

3 units, Win (Stein) MWF 10

351. Geometrical Probability and Applications—Distribution of points in Euclidean space, random lines in a plane and in space, coverage problems, packing problems, measure and density for sets of geometrical objects, integral geometry for functions of convex plane figures and surfaces. Application of ideas in astronomy, atomic physics, biology, crystallography, physical chemistry, traffic flow and others.

3 units, alternate years, given 1986-87


3 units, Spr (Taksar)


3 units, Spr (Taksar)


4 units, Win (Mandelbaum)

361. Statistical Pattern Recognition and Robustness—(Same as Electrical Engineering 377.) Geometrical and statistical theory of pattern recognition and inference. The theory of

3 units, alternate years, given 1986-87


3 units, alternate years, given 1986-87


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


3 units, alternate years, given 1986-87

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: Larry Ryan (Humanities Special Programs)
Emeritus: (Professor) John Goheen (Philosophy)
Professor: Mark Mancall (on leave)
Lecturers: George Cattermole, Jon Reider, Leigh Sealey, Amy Sims

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 tolerance for ambiguity. Neither the faculty nor the curriculum provide “ready-to-serve” answers to the questions being dealt with; rather, they encourage a sense of intellectual challenge, student initiative and originality.

APPLICATION AND ADMISSION PROCEDURES

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. SLE: 9 units, Aut (Staff)
   TWTh 3:15-5 and TWTh 7-9 p.m.

92. SLE: 9 units, Win (Staff)
   TWTh 3:15-5 and TWTh 7-9 p.m.

93. SLE: 9 units, Spr (Staff)
   TWTh 3:15-5 and TWTh 7-9 p.m.

PROGRAM ON URBAN STUDIES

Director: Leonard Ortolano, Professor of Civil Engineering
The Committee on Urban Studies: Clay Carson, Associate Professor of History; Chairman, Nancy Tuma, Professor of Sociology; Paul Turner, Associate Professor of Art; Lyna Wiggins, Assistant Professor of Civil Engineering; Sylvia Yanagisako, Assistant Professor of Anthropology
Lecturers for Adjunct Courses: Tim Campbell, Gerry Cast, Susan Goltsman, Daniel Iacofano, Randall Rossi, George Sipel, Frederic Stout

GENERAL INFORMATION
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.

HONOR'S PROGRAM IN URBAN STUDIES

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.

REQUIREMENTS FOR A MAJOR IN URBAN STUDIES

CORE 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 proposal portion of the major focusing on an area other than Urban Planning or Architecture and Urban Design should include a course list and description of how the courses fit together to meet the student’s educational objectives. Proposals must be submitted to the Program for approval prior to the end of the student’s junior year.

Urban Studies majors should take Urban Studies 110, Introduction to Urban Studies,
before the end of the Fall 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.
or
or
150. Urban Sociology.
or
151. Urban Growth and Change.
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.

PREREQUISITE COURSES (10 units)

Economics 1. Elementary Economics.
   5 units, Aut, Win, Spr MTWThF
Economics 51. Economic Analysis I.
   5 units, Aut, Win, Spr MTWThF

URBAN STUDIES 625

REQUIRED COURSES TO COMPLETE THE MAJOR
(25-27 units)

Economics 148. Urban Economics—Prerequisites: Economics 1, Economics 51.)
   5 units, Spr
Sociology 182. Data Analysis.
   5 units, Spr MWF
Civil Engineering 234. Land Use Planning and Control.
   3 units, Aut TTh
   5 units, Aut MWF
Computer Sciences 105A. Introduction to Computers.
   4 units, Aut, Win, Spr MWF

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).

Applied Earth Sciences 131. Environmental Earth Sciences II.
   5 units, Win MWF
Applied Earth Sciences 132. Environmental Earth Sciences III.
   5 units, Spr MWF
Urban Studies 183. Transportation Policy—(Enroll in Civil Engineering 135.)
   3 units, Aut MWF
Sociology 181. Research Design and Data Collection.
   5 units, Win TTh

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 Art 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.
PREREQUISITE COURSES (3 units)

Art 40. Basic Drawing—Recommended as a prerequisite for Art 140 for students who have no prior drawing experience.
3 units, Aut, Win, Spr MW

Art 60. Basic Design.
3 units, Aut MW

REQUIRED COURSES TO COMPLETE THE MAJOR (23-27 units)

Art 140. Drawing I.
3 units, Aut, Win, Spr MW

Mechanical Engineering 101. Visual Thinking.
3 units, Aut, Win MW

Art 160K or 160L. Design I—Intermediate Design.
3 units, Win

AT LEAST TWO OF THE FOLLOWING COURSES

5 units, alternate years, given 1986-87

4 units, alternate years, given 1986-87

Art 175A. Modern Architecture I.
4 units, Win MWF

Art 175B. Modern Architecture II.
4 units, Spr MWF

4 units, alternate years, given 1986-87

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).

4 units, Win, Spr MWF

Civil Engineering 180. Elementary Structural Analysis.
4 units, Aut MWF

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:

3 units, Aut, Win MWF

3 units, Win, Spr MWF

3 units, Aut, Win MWF

4 units, Aut, MWF

3 units, Aut, Win MWF

COURSES

110. Introduction to Urban Studies—Provides students with 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 examines 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) TTh 1

120. Utopia and Reality in Modern Urban Planning—(Enroll in Art 280.) Examines 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: Urban Studies 110 (for Urban Studies majors only).
5 units, Win (Clausen, Stout) M 1-3

130. The Politics of U.S. Urban Development—(Enroll in History 255.) An interdisciplinary course in Urban Studies. Examines modern urban life from a variety of perspectives with particular emphasis on urban planning and politics. Uses Palo Alto and surrounding communities as laboratory to examine issues and problems. Students expected to participate in weekly discussions and a class project. Prerequisite: Urban Studies 110 (for Urban Studies majors only).
5 units (Carson)
alternate years, given 1986-87

131. Managing Local Government—Examines urban administration using the urban
executive as a focal point. Topics include the mission and structure of government; policy-making 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-à-vis contemporary urban problems such as productivity, declining resources, housing and transportation. Prominent elected and appointed officials from the area will guest lecture. Prerequisite: Urban Studies 110 (for Urban Studies majors only).

4 units, Spr (Sipel) T 3-5 plus periodic W 3-4

132. Urban Politics—Examines 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, Aut (Sipel, Gregorio) T 3-5 and periodic W 3-4

133. Urbanism and Planning in Latin America—(Graduate students register for Civil Engineering 233.) Seminar examining phenomenon and problems of rapid urban growth and decentralization in important Third World urban centers including Mexico City, Sao Paulo and Rio de Janeiro. Surveys problems in population, housing, social services, transportation and infrastructure. Analyzes planning strategies applied on metropolitan and national levels. Topics include economies and diseconomies of agglomeration, intersectoral competition for urban investment and planning and administrative jurisdiction.

4 units, Win (Campbell) Th 3:15-5:05

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 an examination of case studies and a quarter-long project involving a campus or community group made available through ARLO, students will develop, plan and manage a participatory decision-making process having some urban environmental focus. Course topics include process management; data-gathering methods for public involvement; workshops, facilitation graphics; group dynamics and process design; theories of leadership effectiveness; environmental mediation and conflict management; and public involvement media.

5 units, Aut (Goltsman, Iacofano) Th 2:15-5:05 alternate years, given 1986-87

140. U.S. Urban Life and Culture—(Enroll in History 152.) A survey of the process of American urbanization and its effects on phenomena such as immigration/emigration, the development of an urban culture, ethnicity and race, machine politics, education, poverty and welfare, and the family.

5 units, Spr (Staff) MTWTh 10

141. Race and Ethnicity in American Urban Society: History and Public Policy—(Enroll in History 144.) Compares urban histories of nation's two largest minority groups. Discusses 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) alternate years, given 1986-87

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. This course explores all three of these 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 are continually changing: in size, density, composition and internal organization. This course examines causes and consequences of these changes. It will be divided into two main units: one will focus on processes of change in a city as a whole; the other will concentrate on processes of change in a subarea of a city (i.e., in a neighborhood). The course will consider 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 plus section by arrangement alternate years, given 1986-87

160. Urban Problems in Anthropological Perspective—(Enroll in Anthropology 146.) A series of issues derived from current urban problems are examined from the cross-cultural perspective of anthropology. Topics include the
social consequences of crowding, rural-urban migration, pre-industrial urbanism, changing family and kinship patterns, urban ethnic communities and inter-ethnic relations, urban poverty and stratification, and crime.

5 units (Yanagisako)
alternate years, given 1986-87

161. Women in Cities: A Cross-cultural Perspective—(Enroll in Anthropology 145.) Explores 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 will be 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, the transportation of gender domains, changing family and kinship structures, women's access to 'public' space and activities in cities, and the interrelationship among urbanism, political activism and feminism.

5 units (Yanagisako) MWF 11

170. Introduction to Urban Design—(Enroll in Art 168A.) 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 (Gast) T 2-4, 7-9
plus two Sat Workshops by arrangement

171. Urban Design Studio—(Enroll in Art 168B.) 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. Prerequisites: None required, but Urban Studies 160 is advised. Enrollment limited to 14 students.

5 units, Spr (Gast) MW 2-5 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 (Golsman, Iacobano) Th 2:15-5:05

177. 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: 31.

5 units, Spr (Riordan) MTWTh

178. Mitigating Environmental Costs of High Tech Development—(Graduate students register for Civil Engineering 232.) Seminar examines planning and management systems to control the spillover effects of "high tech" development; e.g., measurement and mitigation of groundwater contamination from semi-conductor industries; assessment of political, and economic barriers to effective regulation and industrial organization; social accounting and corporate responsiveness. Open to juniors and seniors with consent of instructor.

4 units, Win (Daneke) Th 1:15-3:05

180. Introduction to Urban Planning—(Enroll in Civil Engineering 130.) The nature of urbanization and evolution to urban forms; conceptual modeling of urban growth and decay; the rationale for steps in the planning process and basic studies of plan formulation; estimating requirements for commercial, industrial and residential land uses; zoning, growth control and other techniques of plan implementation; and the application of the planning process to typical problems of community growth and development.

3 units, Win (Wiggins) MWF 10

181. Environmental Planning—(Enroll in Civil Engineering 170.) 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. One year of college mathematics and C.E. 170 are recommended, but not required.

3 units, Win (Ortolano) TTh 1:15-2:30
alternate years, given 1986-87
182. Land Use Planning and Control—(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. 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 conservation organizations. Students will carry out case studies or investigations commensurate with standing.

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


3 units, Aut (Moore) MWF 1:15

184. Transportation, Land Use and Energy—(Enroll in Civil Engineering 235 with different assignments for undergraduates.) Examination of the interactions between urban land use patterns, transportation networks, and energy demand; impacts of changes in transportation technology and policy on energy consumption; contrasts between the U.S. and developing countries.

3 units, Win (Mukherjee)

185. Microcomputers in Urban and Environmental Planning—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 word processing, spreadsheets, Land Management Systems (LMS), and statistical mapping as they pertain to architecture, construction, urban design, environmental planning and city planning. Coursework considers organizational changes which may occur in response to technological innovations as well as future directions in the field. Prerequisite: Computer Science 105 or consent of instructor.

4 units, Spr (Wiggins) alternate years, given 1986-87

189. Technology and the Modern City—(Enroll in VTSS 140.) Impact of technology on the development of the modern city from the mid-nineteenth 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) MW 2:15-4:05

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 his or her day-to-day work, impressions of the field in general, and academic background each would recommend for that career. One session will be devoted to graduate school admissions and the degree relevant to these fields.

1 unit, Win (Staff) alternate years, given 1986-87

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.

WESTERN CULTURE PROGRAM

Chairman, Western Culture Program Committee: William P. Mahrt (Associate Professor of Music)

The Western Culture Requirement is part of the system of Distribution Requirements instituted in 1980-81. Since 1980, entering students must complete a three-quarter sequence of courses which are expressly designed to introduce them to major works and historical movements in Western Culture. The eight courses that constitute the Western Culture Program are sponsored by different departments and programs; however, they share a core of readings, insuring that all students will be exposed to certain great works.

The sequences have different formats, but in addition to the core readings they share another important feature. Each sequence provides at least two hours per week of small group instruction with an experienced teacher—often a regular member of the Stanford faculty.

Students are strongly encouraged to fulfill the Western Culture Requirement during their freshman year; however, some students may
choose to defer it. Since the sequences do not all proceed at the same pace, or cover the material in the same order, students must complete one entire sequence to satisfy the Western Culture portion of the Distribution Requirements. The following courses are available in 1985-86. The courses are organized to accommodate all entering freshmen and transfer students, and every effort will be made to assign students to the specific courses that they elect. However, it is not possible to place all students in the courses they list as first choice.

The Structured Liberal Education (SLE) program is also designated as a Western Culture sequence. For details see the SLE section in this bulletin.

GREAT WORKS OF WESTERN CULTURE

Track Chairman: Ronald A. Rebholz (Professor of English)

Students meet for four hours per week in classes of seventeen or fewer to discuss great works of philosophy, religion, imaginative literature, history, and science. These discussions are led by members of the faculty from departments and programs throughout the University. Once a week a lecture by an outstanding scholar helps 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 eighteenth through the twentieth century. (DR:1; three-quarter sequence)
   5 units, Spr (Staff)

EUROPE: FROM THE MIDDLE AGES TO THE PRESENT

Track Chairman: Carolyn C. Lougee (Associate 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. 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 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: Mark W. Edwards (Professor of Classics)

(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, and philosophical and social thought in shaping the Western cultural traditions from the ancient to the contemporary world. Three lectures per week are given by faculty from various departments; students also attend one two-hour discussion seminar per week led by postdoctoral lecturers or advanced doctoral candidates in the Humanities Program. (DR:1; three quarter sequence)
   5 units, Aut, Win, Spr, WThF 11 plus section

IDEAS IN WESTERN CULTURE

Track Chairman: Julius Moravcsik (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 and Reason," and "Self, Society, and Science." 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: Edwin M. Good (Professor of Religious Studies)

(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 (i.e., ideas and worldviews), the material (i.e., technological devices and systems), and the societal (i.e., organizations and institutions). This course is designed to be of equal appeal to all entering students, whether their present academic interests center on the humanities, the social sciences, natural sciences, medicine, or engineering. The course will not require the use of mathematics. Three one-hour lectures per week and a weekly two-hour seminar discussion section. (DR:1; three-quarter sequence)

5 units, Aut, Win, Spr
MTW 10 plus section

CONFLICT AND CHANGE IN WESTERN CULTURE

Track Chairman: John J. Winkler (Associate Professor of Classics)

10, 11, 12. Western Culture—This sequence explores the dynamics of social difference—race, sex, and class—which underlie the most ambitious achievements in the group of cultures (Greek, Roman, Islamic, and European) known as "western." Politics (in a broad sense) and literature are used to illuminate each other, giving a more human perception of social history and a wider contextual understanding of outstanding individual works. Faculty from the humanities and social sciences lecture for three hours a week; small workshop groups meet for two hours each week, during which discussion, debate and student projects will take place. (DR:1; three-quarter sequence)

5 units, Aut, Win, Spr
MTW 10 lectures plus sections

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

LITERATURE AND THE ARTS IN WESTERN CULTURE

Track Chairman: Charles Fifer, 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)
SPECIAL PROGRAMS

PROGRAM FOR INDIVIDUALLY DESIGNED MAJORS

This program is intended for undergraduates who are interested in pursuing an area of scholarly inquiry which falls outside the purview of an established academic department or program of the University. It permits intellectually coherent majors designed by the students themselves with the assistance of faculty members of their choice. 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, Old Union 306, tel. 497-2426.

In designing a major, the student will consult with at least three faculty members from at least two separate departments or programs of the University; one of the faculty members will be selected as the student's "primary" advisor. In helping the student design the major and in signing the proposal requesting approval from the Dean's Advisory Committee on Individually Designed Majors, the faculty members are committing themselves to act as a regular academic advisory group for the student until graduation. The Dean's Advisory Committee on Individually Designed Majors will not consider proposals (or changes in previously approved proposals) unless they have the approval of the faculty advisory group.

THE "COMMITTEE IN CHARGE"

The Program for Individually Designed Majors is administered by the Dean's Advisory Committee on Individually Designed Majors and the Undergraduate Advising Center.

The Committee acts in lieu of a regular department of the University. This role involves certifying the scholarly merit of the program and includes the obligation to consider, approve, and recommend changes in each proposed major.

In carrying out its role, the Committee reserves the right to reject proposals which in its opinion lack scholarly merit or which are not clearly interdisciplinary. Occasionally, the Committee must reject a proposal which, though of considerable academic merit, requires resources not available at Stanford. The Committee also reserves the right to recommend additions to each student's faculty advisory group.

THE PROPOSAL

Detailed written procedures and advice about the preparation of the proposal are available from the Undergraduate Advising Center, (Old Union 306, tel. 497-2426) 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 sixty (60) units, all in courses at or above the 100 level (or their equivalent);

2. A maximum of fifteen (15) of these sixty (60) may be taken on a Pass/No Credit basis;

3. A maximum of five (5) units of these sixty (60) may be taken in individual study or directed reading.

4. Students proposing an Individually Designed Major must submit the completed proposal no later than May 1 of their Junior year (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.

Faculty Director: Carolyn C. Lougee

Freshman-Sophomore Seminar Programs

Dean’s Advisory Committee: Brian Arthur, Audrey Bernfield (ex officio), Darrel Brooks, John Kaplan, Kenneth Lo, Carolyn C. Lougee (ex officio), Thomas Raffin, Eugene Robin

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 20 seminars will be offered in 1985-86; each seminar will have eight to twelve students.

ADMISSION PROCEDURES

Enrollment in Seminars 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, Old Union 590A.

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 497-4305. 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, 590-A Old Union.

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.

The maximum number of students who may enroll for credit in any Undergraduate Special course in one quarter is 40. In some of these courses, the enrollment is limited to fewer students.

Grades in these courses are given in the normal manner, with the Pass/No Credit option available upon the instructor's approval.

A student may apply 12 Undergraduate Special courses, or 36 units of Undergraduate Specials (whichever is lower), toward graduation. Undergraduate Specials satisfy neither Writing nor Distribution Requirements.

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, 590-A Old Union, indicating:

1. A statement of course objectives.
2. The planned approach and an outline of general requirements and/or prerequisites.
3. Specific requirements, definition of special projects, method of evaluation and intended grading system.
4. A reading list identifying required and suggested readings.
5. A week-by-week syllabus which is as detailed as possible and which links readings, lectures, discussions and projects.
6. The name of the instructor(s) and any others who will assist in teaching the course, and statement of the qualifications of these individuals.

Instructors who are not members of the Academic Council must obtain a sponsor’s statement from a Council member indicating support for the course and the qualifications of the proposed instructor(s). The sponsor will be responsible to the Dean’s Advisory Committee on Undergraduate Special Courses for the quality of the course, the performance of the instructor, and the evaluation of individual student performance, in accord with the course description as approved by the Committee.

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 590-A Old Union.

PUBLIC SERVICE CENTER

The newly established Public Service Center coordinates internship and research opportunities for undergraduate and graduate students interested in public service. The Center inherits and expands the resources and duties of the former Action Research Liaison Office (ARLO), which acted as a liaison between community agencies, faculty and students to develop and sponsor student research projects in the community. The Center also will continue the public service internship program begun by the Stanford Center for Innovation in Research and Education (SCIRE). In addition to its primary function of coordinating community internships, research and volunteer work, the Center develops public sector opportunities such as summer fellowships, federal government internships, conferences and workshops.

Information on public service internships and research will be listed at the Center. Students seeking credit for academic work based on public service internships or research will be aided in identifying a faculty member who might accredit their work. It is the responsibility of the students to take the initiative; credit is arranged in the same manner as individual study.

Students interested in public service internships are invited to visit the Public Service Center at Owen House or call (415) 497-0992.
Students interested in private business internships will find them listed at the Career Planning and Placement Center (CPPC). The CPPC also acts as a central, coordinated listing source for all internships. The CPPC telephone number is (415) 497-3963.

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. Each of these areas will be described separately below, beginning with the services to undergraduate and graduate students.

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 at 123 Meyer Library (telephone 497-1326 or 497-2207) and are open from 8:30-12 and 1-5 Monday through Friday.

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—Teaches 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 (Staff)

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. They also learn to develop flexibility in reading speed which enables them to vary reading rate according to familiarity, difficulty, and purpose.
   1 unit, Aut, Win, Spr (Staff)

120. Peer Tutoring: Math and the Sciences—Provides training for those who wish to be paid tutors through CTL. The course 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 CTL 120, but content designed for tutors in the humanities.
   1 unit, Aut, Win, Spr (Staff)

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 TAs in association with the Linguistics Department, a handbook on teaching and a library of teaching materials, an annual orientation—and by working with individuals, groups, and departments on their specific needs. If you are currently teaching or will teach in the future, you are encouraged to drop by the CTL offices at 123 Meyer 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) 497-1326 or 497-2207.
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) 497-1326 or 497-2207 and ask to be placed on the mailing list.

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 FILE

URO is developing a file of faculty research interests so that students with individual research ideas can be directed to an appropriate sponsor. Faculty willing to work with a student on this basis are encouraged to register their research interests with URO.

FUNDING AVAILABLE

Thanks to the generosity of the Firestone Family and other donors, URO now offers two forms of funding. Twenty-five grants of up to $2,500 are awarded in an annual competition to students who commit themselves to a three-quarter research project. The faculty sponsor for students who commit themselves to a three-quarter research project. The faculty sponsor of each major grant winner will receive an unrestricted professional grant of $1,000. In addition seventy-five small grants of up to $500 each are available to students each year for supplies and expenses connected with research. The URO Office has information on applications, deadlines, and criteria.

Students interested in research, and faculty with projects to list should contact the program at 590-A Old Union or call 497-3828.

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: Edwin M. Good

Professors: Herbert Abrams (Radiology), James L. Adams (Industrial Engineering and Engineering Management), Clifford Barnett (Anthropology), Barton J. Bernstein (History), Robert A. Chase (Surgery), Raymond B. Clayton (Psychiatry), Alexander L. Fetter (Physics), Alexander L. George (Political Science), Edwin M. Good (Religious Studies), Alex Inkeles (Sociology) (on leave, 1985-86), 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)
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 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.
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.

For information on which Distribution Requirement Area(s) a given VTSS course satisfies, inquire at the VTSS office, Building 370, Room 372, 497-2565.

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 bachelors degrees in VTSS are as follows:

Professors (Teaching): Gilbert Masters (Civil Engineering), Robert E. McGinn (Industrial Engineering and Engineering Management, and VTSS) (on leave Winter, Spring)
Associate Professors: Peter Galison (Philosophy and Physics), Wilbur R. Knorr (Classics and Philosophy), 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)
Lecturers: Joseph J. Corn (American Studies and VTSS), Charles House (VTSS), Donald E. Jordan (VTSS), Barry Katz (VTSS), Thomas McBride (Law), Richard Meehan (VTSS), Curtis Runnels (VTSS), Londa L. Schiebinger (VTSS), Janet K. Schmidt (VTSS), Rosemary M. Wakeman (VTSS)
Visiting Professors: Amnon Coldworth (VTSS), Volker Rittberger (Political Science)
Visiting Associate Professor: Richard Gillam (History)
A.B. DEGREE
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 (VTSS 121)
   f. Social Perspectives (one of: VTSS 150, 153, 155, 159)
   g. Core Seminar (VTSS 200)
2. Technical Literacy (5 courses)
   a. Computer literacy, normally demonstrated by:
      1) Completing Computer Science 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.

B.S. DEGREE
1. VTSS Core (7 courses; see above)
2. Technical Depth (about 15 to 17 courses)
   a. 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.
   Students are expected to fulfill any prerequisites which may exist for courses required for the above curricula. A maximum of three (3) 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 OF THE PROGRAM
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 or 159
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 Spr, 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, Knorr, 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 (J. Corn, Staff) MTW 10
   
   two-hour section by arrangement

**TECHNICAL LITERACY SEQUENCE**

51, 52, 53. **The Nature of Technology, Mathematics, and Science**—Integrated three-quarter sequence that seeks to enhance a student'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. All three courses must be taken in order to fulfill distribution requirements in areas 6, 7, and 8.

3 units each quarter, Aut Win, Spr (Adams, Fetter, Osserman) MWF 1:15

**CORE COURSES**

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, Third World modernization, and technology in war). (DR: 5)

4 units, Win (Jordan)

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 (Rosenberg) given 1986-87

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, Win (Goldworth) MW 2:15-3:30

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) MW 2:15-4:05

121. The Emergence of Modern Technological Society, 1500-1918—Examination of the interplay of technological change and social and cultural developments from the late Middle Ages to the Second World War. Among the topics considered are: 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, Win (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 different VTSS faculty members. Each session focuses on an important scholarly work of an advanced nature in that faculty member's area of interest.

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

NOTE: See Major Programs for courses which satisfy the Social Perspectives requirement.

OTHER COURSES

106. The Nature of Technology in Modern Society—The nature and function of technology in modern Western society. The relationship between the physical bases of Western societies and their social and value elements; contrasts with several types of non-industrial cultures. The rise of science and the relationship between science and technology. The world views of science and technology as contrasted with those of other disciplines. Changes in the nature of technological organizations underlying the creation of societies of abundance: e.g., production, marketing, and distribution. Edison and the rise of the research and development laboratory. Processes of innovation in the 20th century. The rate of technological change and its social effects. Technology, human needs, and the future. (DR:5 or DR:8)

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

112. Technical Professions and Ethics—Origin and development of the technical professions, especially engineering and the applied sciences, as seen from anthropological, historical, and literary perspectives. Professional ideologies, values, and protocols. Expert-client relations, responsibilities, legal problems, and ethics. Case histories of ethical problems in governmental and corporate settings. Student readings, case studies, and field work.

4 units, Spr (Meehan) TTh 9-10:50

125. The Automobile and American Culture—(Same as American Studies 206.) Origins, development and consequences of people's romance with the automobile: technical evolution, development of the industry, conflicts between safety and styling, workers and assembly lines, legal aspect of mass automobility, car cultures, the impact of cars on cities and suburbs. Approach will be essentially historical but will also utilize materials from literature, film, the arts, and the social sciences.

5 units (J. Corn) given 1986-87

132. The Scientific Revolution—(Same as Philosophy 145 and 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, and Newton. Historical controversies: Yates' thesis on hermeticism and magic; Martin on Protestantism and science; Hessen on the economic basis of scientific change. Readings from 17th century texts and modern historical studies.

4 units, Aut (Lowood) TTh 2:15-3:30

133. History of Modern Physics—(Same as Philosophy 168, History of Science 168, and History 139A.) History of the physical view of the fundamental nature of matter from Maxwell's time to the present. Will discuss the mechanical and electromagnetic world views, special relativity, quantum mechanics and the standard model of elementary particle physics. Will focus on several case studies to illustrate the historical problem orientation of each period, as well as the connection between theory and experiment. Readings: original scientific texts, archival material and secondary sources.

4 units, Aut (Galison) TTh 2:15-3:30

135. Technology Transfer: Silicon Valley to Europe—Transfer of electronics technology from the United States to Europe, using for case studies the Silicon Valley, the major source of electronics technology and investment in Europe, and Ireland, the most rapidly expanding European location for the electronics industry. Examination of the role of electronics manufacturing in the development strategies of underdeveloped regions of Europe including analysis of its social, cultural, political, environmental, and economic impact.

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

136. Food, Technology, and Third World Development—The role of food and food production technologies in international development policy. Topics: technology in national and inter-
national 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.) Survey of 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, Spr (Runnels)

138. Women, Science, and Technology—(Same as History of Science 156.) Introduction to issues concerning gender, science, and technology from 17th century to the present in Europe and America. Examination of current theories of the relationship of gender, science, and technology; history of women's participation in science and technology; women's access to institutions of science and technology; conceptions of gender in scientific texts; women as the object of scientific research and technological innovation; and "alternatives" in the sciences and technology proposed and/or practiced by women.

4 units, Win (Schiebinger) T 2:15-5:05

140. Technology and the Modern City—(Same as Urban Studies 189.) Impact of technology on the development of the modern city from the mid-nineteenth 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) MW 2:15-4:05

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 computation, 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. Primary goal is to enable students to evaluate critically the technical premises underlying national security policies and various political efforts to control nuclear arms. Secondary goal is to involve students in calculations and problem-solving related to nuclear weapons so as to increase their grasp of the reality of nuclear weapons and of the need for responsible involvement in weapons policy discussions. 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: students should have completed or be in the process of completing the Physics 50 or Physics 20 series. Some familiarity with both differential and integral calculus will be assumed.

3 units, Spr (Martoff) MT 3:30-4:45

144. Medicine, Expertise, and Democracy—(Same as History 272.) The rise of modern American medicine, the growth of medical specialization and expertise, and the role of ordinary citizens in technical biomedical decision-making. Who controls or should control new biomedical technologies? What is the role of "democratic" knowledge in an age of expertise? Such questions will be approached through the study of selected case studies, e.g., the retrolental fibroplasia (a form of blindness) tragedy of the 1940s and 1950s; the quest for an artificial heart; the war on cancer; the 1976 swine flu vaccination program; the uses of DES in human medicine; kidney dialysis; and the recombinant DNA controversy, with special attention to the Stanford patent. Additional attention will be given to larger theoretical, interpretive, and historical issues.

5 units, Spr (Gilliam) W 2:15-4:05

145. Chemistry and the Life Sciences in Historical and Philosophical Perspective—Development of chemical and biological ideas in the context of Western social, philosophical and
religious thought, emphasizing the impact of these ideas on the concept of man in the 20th century. Topics include: the enduring human drive to understand and control nature, including the life process; the 17th-century religious roots of the scientific establishment; 18th-century context of the chemical and physiological revolutions; 19th-century Romanticism's impact on science; scientific creativity; tension between vitalistic, and mechanistic, interpretations of life; challenges to traditional values posed by recent biomedical science and technology. Open to juniors and above. Requirement: at least one course in chemistry or biology (or consent of instructor). Limited enrollment. (DR:3)

4 units, (Clayton) MW 1:15-2:05, F 1:15-3:05

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. The series aims to provide 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) Th 7-9 pm

147. Medicine and Technology—An investigation of the effects of technology on medicine and health-care planning. Technologies will include electronic monitoring, artificial organs and devices, life support systems, robotics. Topics will include prosthetics and the disabled, information handling, and evaluation of physician competence using computer technology. Economic and ethical issues will be discussed as well as other current trends in medicine.

3 units, Spr (Chase) MWF 1:15-2:05

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 considered 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 will be 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.) This undergraduate colloquium will focus upon five related areas—the impact of industrialization on work and living patterns, the roles of professionals in directing technology, the problems in bio-medicine of applying and developing technology, the development and uses of technology in weaponry and foreign policy, and the problem of whether there should be limits on the development and uses of technology. The analysis of these problems will, necessarily, require consideration of the society and political economy in which particular technologies have developed. Limited enrollment.

Permission of instructor.

5 units (Bernstein), given 1986-87

152. The Atomic Bomb in History—(Same as History 755.) 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 1986-87

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. The course addresses itself to 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)

154A,B,C,D. Arms Control and Disarmament—(Same as Political Science 138A,B,C, 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 assisted by guest speakers with negotiating experience. 154A and B are prerequisites for 154C and D. 154C (not offered 1985-86) is arms control simulation; 154D is research and tutorial course, supervised by members of arms control faculty.
American culture. Study of three-dimensional and two-dimensional objects, including structures and buildings, arts and crafts, machines and machine-made artifacts. Course reveals American attitudes, values, and beliefs embodied in and reflected by the production, use, collection, and preservation of artifacts.

5 units (J. Corn) given 1986-87

159. Science, Technology, and Change in the International System—(Same as Political Science 247R.) Consideration of the dialectical nature of scientific-technological change as enhancing man’s destructive as well as productive capabilities will serve as a general underpinning on how political-economic relations between states are affected by their respective levels of development and their differential rates of change in the fields of science and technology. Four areas will be singled out for analysis and discussion: the role of science and technology in the development of the first industrialized countries and in their interrelations; scientific-technological dependence and its effects on the transformation of developing countries; science and technology in North-South negotiations over a “new economic order”; and the international political-economic consequences of civilian and military applications of advanced technologies. Seminar course, limited enrollment.

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

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 considered include computers, transportation of goods and people, medicine, utilities, space travel.

3 units, Win (McCarthy) TTh 2:15-3:00

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. Topics include the technological evolution of the piano, violin, and other instruments; the modern piano and the emergence of the pianistic virtuoso; the modern symphony orchestra as a technological ensemble and the emergence of new styles of music, e.g., Romanticism, serial music, and jazz. (DR:2 or DR:8)

4 units, Spr (Good) MW 2:15-4:05
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, West Germany, Sweden, and the U.S.; the productivity and job satisfaction controversy; and work and technology in the future. (DR:5)

4 units, Win (McGinn) given 1986-87

172. Automation and Work—(Same as Industrial Engineering 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, Spr (Adler) TTh 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)

178. Phenomenological Foundations of Cognition, Language and Computation—(Same as Computer Science 378.) Critical analysis of theoretical foundations of cognitive approach to language, thought, and computation. Readings contrast the rationalistic assumptions of current linguistics and artificial intelligence with alternatives drawn from phenomenology, theoretical biology and socially-oriented speech act theory. Emphasizes relevance of theoretical orientation to the design, implementation and impact of computer systems, especially those dealing with language.

3 units, Aut (Winograd)

181. Problem Solving—(Same as Industrial Engineering and Engineering Management 201 and Engineering 190.) An investigation of problem solving with particular emphasis on problem definition, creativity, and interpersonal and organizational factors that influence thinking. Common blocks to problem solving will be explored and methods of dealing with them will be presented. The advantages of integrating various problem solving strategies will be stressed through use of reading, abstracted problem situations, and projects. Open to undergraduates and graduates in any field.

3 units, Spr (Adams) MW 2:15-4:05

182. Environmental Science and Technology —(Same as Civil Engineering 170.) An introduction to the causes, effects and methods of controlling environmental degradation. 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 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. One year of college mathematics and C.E. 170 are recommended, but not required.

3 units, Win (Ortolano) MWF 9

185. Facility Siting—(Same as 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. Review of siting techniques including constraint mapping, optimization procedures and decision analysis. Review of new planning strategies, including environmental dispute resolution. Available to undergraduates with consent of instructor.

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

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
THE WORK OF THE LAW SCHOOL

The School of Law was established as a department of the University in 1893. Its purpose is to provide a thorough legal education for students who are fitted by their maturity and their previous academic training to pursue professional study under university methods of instruction. The curriculum leading to the first professional degree in law (J.D.) constitutes an adequate preparation for the practice of law in any English-speaking jurisdiction. Graduate work leading to the degrees of Master of the Science of Law and Doctor of the Science of Law is also offered. (For full Law School Curriculum and Faculty see the School of Law Programs of Study.) The Law School is on a two-term academic calendar. Registration for the autumn term will be held on September 4, 1985, and spring term will end on June 4, 1986.

COURSES

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. Child Custody, Issues in—(Same as Psychology 351.) Course focuses on how information from psychology and other behavioral sciences can be utilized in the development of legal policies regarding child custody decisions. We also identify research projects that will provide new data relevant to policymakers and focus on ways professionals from various disciplines can 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)

250. Comparative Constitutional Law—Course focuses on developments that, particularly in the last three decades, have radically transformed systems of government in large portions of the world, especially in Europe—new bills of rights, the establishment and growing importance of new constitutional courts, and the European Convention of Human Rights (now binding in 20 Western European nations and increasingly enforced in various domestic courts). The course is divided into two parts. The first examines particular issues in the enforcement of constitutional law—the kinds of courts that hear constitutional cases; the effects of decisions; retroactivity and/or prospectivity. The second part examines particular constitutional law topics, with primary emphasis on decisions in France, Germany, and Italy; decisions under the European Convention of Human Rights and analogous decisions in the U.S. Specific topics: constitutional rights to fair procedure; constitutionality of laws regulating abortion. Cappelletti and Cohen, Comparative Constitutional Adjudication: Cases and Materials. (1978).

3 term units, Aut (Merryman)

307. Law and Behavioral Science—(Same as Psychology 354.) The implications of psychological research and theory for law and legal processes will be explored. Issues to be examined include the notions of responsibility and intention; the reasonable man; insanity; group processes and their effects on juries; stereotyping and arrest; eyewitness testimony; the social psychology of institutions.

2 term units, Aut (Rosenhan)

316. Law in Radically Different Cultures—(Same as Anthropology 157, Political Science 182L, Sociology 138.) Comparison of legal systems in Western capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religi-
toward professional degrees in law. 

392. Psychopathology and Mental Health Law—(Same as Psychology 353.) The course reconsiders the literature on severe psychopathology focusing especially on diagnosis, nature and effects of treatment, predictions of dangerousness to self and others, and assessment of grave disability and competence. The effects of diagnostic stereotyping, current modes of treatment, and our technical ability to predict social behavior are assessed for their legal implications. Law and practice in commitment and conservatorship are considered, as well as issues and case law in right to treatment, patients' rights, informed consent, assessment of malpractice and psychosurgery. Brooks, Law, Psychiatry and the Mental Health System (1974) and Supplement (1980). 

3 units, Spr (Gibbs, Staff) MWTh 2:15

337. Public Policy Towards Abused and Neglected Children—Course will explore the standards that are, and should be, used in defining child abuse and neglect and evaluate various state intervention to protect such children. We will look at the role of various professionals, doctors, lawyers, mental health experts, police, social workers, in dealing with the problems of child abuse and neglect. We also will examine the types of research currently being done and try to identify new research directions. Seminar is limited to 20 graduate and law students and will meet for 15 weeks under the Law School semester system. Permission of the instructor required.

2 units, Win, Spr (Wald)

NONPROFESSIONAL

The following nonprofessional courses, open to juniors and seniors, as well as to graduate students in other departments, may be counted toward the A.B. degree but may not be counted toward professional degrees in law.

105. Introduction to American Law—(Same as American Studies 171, Political Science 183F.) A general introduction to American law for undergraduates, the course will deal 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)

109. The Criminal Law and the Criminal System—(Same as Political Science 183K and Sociology 109.) Exploration of the purposes and processes of the criminal law, with emphasis on the actual operation of the system, and the applications of theory to contemporary problems. Topics will include the police, the role of the attorney, the trial, sentencing, corrections, and "non-victim" crimes. (Open to all undergraduate and graduate students other than law students.)

5 units, Spr (Kaplan) TTh 10-11:30

149. Communication Law—(Same as Communication 149/249.) Course introduces nonlaw students to the issues surrounding government regulation of the mass media. These issues emerge in virtually every aspect of the operation of the print and broadcast media, getting permission to begin broadcasting, what media may do to get a story; legal controls on what media may publish or must publish; constraints on dissemination of the final product. Major attention will be given to decisions of the Supreme Court involving First Amendment issues and to the functioning of the judicial and administrative process. Limited enrollment. Junior standing or above. Undergraduate communication majors should take Communication 110.

5 units, Spr (Franklin) MWTh 11-12:15

150. Regulation, Welfare and Public Policy—This course has two principal objectives: (1) to develop an understanding of the role administrative agencies are currently playing in the resolution of major issues of socioeconomic conflict, and (2) to explore the practical and theoretical limitations of the administrative process as a tool for implementing social change. The core of the course is an examination of the impact of various constituencies in shaping administrative policy in areas such as product safety and environmental protection. In addition, the role of the courts in controlling administrative discretion will be explored.

4 units, Aut (Rabin)

not given 1985-86
The School of Medicine was established as a department of the University in 1908, when the Cooper Medical College in San Francisco was acquired by Stanford University. Until 1959 clinical teaching and some teaching of the basic medical sciences were carried out in San Francisco, while the remainder was conducted on the University campus near Palo Alto.

In 1953 the Trustees of the University determined that the School of Medicine should be consolidated on the University campus in new facilities. Following the development of a new program of medical education, and the construction of the Stanford Medical Center buildings for teaching, research and patient care activities, the school began its operation at Stanford in September 1959.

The Stanford University School of Medicine provides an educational environment that encourages intellectual diversity and offers stimulation and opportunity for self-motivated students who are interested in developing a scholarly, investigative approach to problems in medicine. Accordingly, 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: I. Robert Lehman
Associate Professor: Douglas L. Brutlag

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 procaryotic 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 complete a preliminary application form, submitting it to the department before December 1. Those students subsequently invited to submit a formal application must see to it that all materials pertinent to the formal application are received by the Department of Biochemistry before January 15. All applicants will be notified by April 15 of a decision on the application. Stanford University requires scores from the Graduate Record Examination (verbal, quantitative, and analytical) and in addition applicants must submit scores from the GRE Advanced Test in either Biology or Chemistry.

All applicants are urged to compete for non-Stanford fellowships or scholarships, and American citizens must complete application for a National Science Foundation Predoctoral Traineeship. 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 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).

3 units, Aut (Baldwin, Kaiser, Kornberg, Lehman, 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: Biochemistry 200 and an understanding of basic molecular biology.

5 units, Win (Berg, Brutlag, Davis, Hogness, Lehman, Kornberg) MTWThF 11

202. Cellular and Molecular Basis of Disease — A continuation of the 200-201 series, or to be taken separately by those students who have completed a senior level course in biochemistry elsewhere. Designed to show how current biochemical concepts can be applied to problems in physiology and pathology. Consideration of a specific disease or disease process, along with a brief review of the relevant biochemistry, followed by a discussion of the molecular basis for the disorder.

3 units, Spr, not given 1985-86

211. Molecular Biology of Development—Examines search for molecules and genes that regulate development and the evidence for developmental programs. Includes experimental examples taken largely from microorganisms and simple animals whose biochemistry and genetics have been investigated. Rely on reading current literature.

2 or 3 units, Win (Kaiser)

214. Physical Biochemistry—Discussion of interactions between proteins and nucleic acids. Topics include X-ray structures of complexes, mechanisms of specific and non-specific interactions, methods of measuring complex formation and analysis of the salt dependence of binding. Includes discussion of specific complexes [lac repressor-operator, RNA polymerase-promoter] and non-specific complexes [RNA and DNA single-strand binding proteins]. Prerequisites: Biochemistry 200 and 201 or their equivalents plus 1st year course in physical chemistry.

3 units, Spr (Baldwin)

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)

221. The Teaching of Biochemistry—To be taken by all students as teaching assistants in Biochemistry 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 Ph. D. program in the Department of Biochemistry.

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

222. Research Techniques in Biochemistry and Molecular Biology—Lectures, demonstration, and laboratory practice, including growth of bacteria and viruses, and analysis of macromolecules using ultracentrifugation, restriction enzyme analysis, electrophoresis, autoradiography, and electron microscopy. Enrollment limited at present to students in the Biochemistry Ph.D. program and to those in the Stanford Medical Scientist Training Program.

5 units, Aut (Davis) by arrangement

299. Research.

1-15 units, any quarter (Staff) by arrangement

CELL BIOLOGY

Chairman: Roger D. Kornberg

Professors: Roger D. Kornberg, James A. Spudich, Lubert Stryer, Nigel Unwin

Assistant Professors: Robert Fox, Peter Parham, Peter B. Sargent

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 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—Deals with 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 will be explored in relation to their biological function. Experimental techniques to be discussed include electron microscopy, X-ray diffraction, site-directed mutagenesis, immunocytochemistry, and reconstitution of functional assemblies. Four lectures and one discussion section per week. Prerequisite: knowledge of introductory biochemistry.

5 units, Win (Stryer, Staff)

211. Structure of Cells and Tissues—This course deals with the structural organization of tissues in relation to their function. Topics to be covered 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. Focuses on 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 will be 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—Deals with 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. The regulation of motile assemblies and their evolution will also be discussed. 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 in these areas will be critically analyzed. Course will show 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 genetic techniques. Prerequisite: knowledge of basic biochemistry and cell biology.

3 units, Spr (Spudich) given 1987-88

226. Molecular Immunology—Surveys our 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 will be discussed. Sufficient background information concerning each topic will be provided so that previous knowledge of immunology, though desirable, is not essential. Prerequisite: knowledge of basic biochemistry and cell biology.

3 units, Spr (Parham)

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 will be explored in detail. A variety of experimental approaches used to study membrane channels will be 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)

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. Course will focus on the results of protein crystallography after a brief survey of the methods and their limitations. Major themes will 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 will be discussed. 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) given 1986-87

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) given 1986-87

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 advanced research training in
genetics and related fields of molecular and cellular biology leading to the Ph.D. degree. In addition, a limited number of M.D. candidates can combine research training with their medical studies.

The training program is designed as preparation for a career in biomedical research and teaching. The program is intended to provide students with the conceptual and experimental tools that modern geneticists need to approach a variety of biomedical problems of fundamental or clinical importance.

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. Principal subject areas for research training include molecular and cellular genetics, developmental genetics, biochemical genetics, population genetics, medical genetics, cytogenetics and immunogenetics. There are special opportunities for the application of advanced instrumentation and extensive computer capabilities to a number of problems, including cell detection and sorting, and aspects of human biochemical and population genetics. Interdisciplinary programs can be arranged with other departments in the Medical Center in such fields as clinical genetics, pharmacogenetics, prenatal diagnosis, development, and immunology.

Students select their area of research specialization after they have explored the various research opportunities available in the department by rotation through some of the laboratories of the faculty. The usual course of study for the Ph.D. involves four to five years of graduate work, concentrated mainly on 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.

Accepted students who are U.S. citizens may qualify for full-support stipends under an NIH-supported training grant. Stipends are also available through other sources. Applicants are strongly encouraged to apply independently for National Science Foundation and other fellowships.

For further information on the availability of the following courses, consult the quarterly Time Schedule, or inquire at the department office. Additional courses in genetics are included in the listings of the Department of Biological Sciences, the Program in Human Biology and the Department of Medical Microbiology.

For basic University requirements for the Ph.D. degree, see the "Degrees" section of this bulletin.

**COURSES**

201. 202. Human Genetics—Theoretical and experimental basis for modern genetics emphasizing examples from humans where possible. Lectures and reading in molecular genetics, gene regulation, immunogenetics, cell genetics and genetic considerations in clinical medicine. These courses are intended for advanced undergraduate and graduate as well as medical students.

- 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, given 1986-87

206. Gene Expression During Development—Course will cover selected topics in developmental biology especially molecular aspects of embryogenesis and eucaryotic gene expression. Emphasis will be placed on experimental approaches and on critically evaluating the scientific literature.

- 3 units, Win (Korn)

207. Oncogenes: The Control of Cell Proliferation—Oncogenes will be 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 will be discussed, including their mutation and rearrangement. Finally, the function of these gene products in the cell will be examined. Course will focus primarily on eukaryotic, especially mammalian, cells and will consist of lectures and discussion of literature.

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

Biochemical basis of certain inherited diseases. Plant genetics and applications of biotechnology in improving important crop plants. The course is intended for graduate students, medical students and advanced undergraduates with good knowledge of biochemistry, biology and basic genetics.

3 units, Aut (Ganesan) by arrangement

260. Supervised Study—Prerequisite: consent of instructor.
   any quarter, (Staff) by arrangement

270. Genetics Seminar.
   any quarter, (Staff) by arrangement

299. Directed Reading.
   any quarter, (Staff) by arrangement

399. Individual Research.
   any quarter (Staff) by arrangement

HEALTH SERVICES RESEARCH

MASTER OF SCIENCE PROGRAM IN THE DEPARTMENT OF FAMILY, COMMUNITY AND PREVENTIVE MEDICINE

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.

The Division offers courses for medical and other graduate students in masters and doctoral programs as well as for advanced undergraduates; programs of study and research training leading to a Master of Science degree in Health Services Research; and doctoral and postdoctoral research opportunities and training.

The master's degree program in Health Services Research (M.S. in HSR) is designed to complement training in the medical and social sciences in preparation for careers in health services or health policy; for example, careers in medicine and nursing, in which responsibilities in administration and health policy are anticipated, and careers in health policy analysis in government, consulting firms, health planning agencies, education, business, or the law. The program provides specialized training in selected areas of health care policy and other health-related topics, in research methodology, and in the application of these skills to a specific research problem. Coursework requirements, based on an individually-designed multidisciplinary curriculum, allow students to design a program of study suited to their individual backgrounds and interests.

Applications will be considered from persons in the following categories:

1. Medical students interested in problems of health care delivery and policy who seek additional training in the applied social sciences. Medical students who intend to pursue careers involving administration may wish to consider coursework in the Graduate School of Business.

2. Graduate students in 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.

3. Physicians, nurses, or other professionals in health-related fields who have completed an advanced degree and wish to acquire additional training in health services research.

4. College graduates who have completed a relevant undergraduate degree and who have demonstrated interest in health policy or health services research.

5. Stanford undergraduates majoring in a relevant discipline (e.g., human biology, sociology, economics), who can arrange to fulfill the requirements for the M.S. in HSR coterminal with receipt of the undergraduate degree.

Application for admission should be made to the Office of Graduate Studies prior to March 15 for enrollment the following fall. To apply, students must complete an HSR application, which includes: scores from the Graduate Record Examination, the English Proficiency Exam (if applicable), undergraduate (and, if applicable, graduate) academic transcript, three letters of recommendation, and a tentative outline of the proposed program of study and research to fulfill the M.S. in HSR requirements. If possible, an appropriate faculty advisor should be identified prior to admission, based on the student’s area of interest.

Applications will be reviewed and candidates selected for interviews by May 1. At least two interviews are strongly recommended: one should be with an assigned FCPM faculty member; the other may be arranged by the student, if desired, and might appropriately be the student's intended faculty advisor.

A limited number of students will be admitted each year. In addition to general academic
standards, priority will be given to students with training or work experience related to health care. Students will be notified of admission decisions by June 15.

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 of this course 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 (Staff) MWF 11-11:50

256. Economics of Health and Medical Care — (Same as Economics 156/256.) Description of problems and institutions, review of analytical studies, and discussion of policy issues. Topics covered include mortality and morbidity, physicians and other personnel, hospitals, the drug industry, national health insurance and health maintenance organizations. Open to graduate students, undergraduate economic majors (seniors and juniors), or by permission of instructor. (Graduate Students enroll in 256.) Prerequisite: Preparation in micro theory and some statistics desirable. Prerequisite: 51 plus some background in math or statistics.

5 units, Spr (Fuchs) given 1986-87

279. Management of Hospitals and Other Health Care Institutions—Covers various administrative aspects of health care institutions. Among those discussed are: organizational elements of hospitals, administration, financial issues and problems, hospital departmental relationships, quality of patient care, principal external pressures (both governmental and non-governmental), consumerism, and community influence.

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 units, Aut, Win, Spr (Bunker) alternate M 3:30-5:30

391. Political Economy of Health Care— (Same as Business 391.) The purposes of this course include informing students about the financial and public policy context in which the health care system operates, and about the issues in public policy in controlling one of the largest and fastest growing items of public expenditure. The course examines the main issues relating to financing and organization for delivery of health care in the United States, how various existing and proposed financing and organizational arrangements affect the allocation of resources, fee-for-service practice and health maintenance organizations, hospital investment decisions and regional planning, health care costs and national health insurance.

4 units, Aut (Enthoven) MF 8-10

394. Cost-Benefit Analysis in Health Care— (Same as Business 392.) How do you do cost-benefit analysis when the "output" is difficult or impossible to measure? The course will begin with study and discussion of the main literature on the principles of cost-benefit analysis applied to health care. It will then focus on a critical review of a number of actual studies. The emphasis will be on insights into the art of practical application. Prerequisites: Business 200, Micro Economics. Business 309, Public Sector Economics is recommended.

4 units, Spr (Enthoven) MF 8-10
PROGRAM IN HEARING AND SPEECH SCIENCES

Emeriti: (Professors) Virgil A. Anderson, Jon Eisenson
Director: Earl D. Schubert
Professor: Earl D. Schubert
Associate Professor: Dorothy A. Huntington

Cooperating in the offerings of the Program is:
Clara N. Bush, Professor of Linguistics

OFFERINGS AND FACILITIES

The aims of the Program are two-fold: (a) to make available to doctoral and postdoctoral students the material essential to a complete understanding of behavioral and physiological aspects of normal and defective processes of human communication; and (b) to provide, at the undergraduate level, a systematic understanding of these processes as a complement to formal study in such disciplines as psychology, biology, linguistics, 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

220. Instrumental Phonetics—(Same as Linguistics 215.) Techniques of instrumental research in speech perception and production. Theory and instrumentation for analysis and manipulation of speech signals. Laboratory course. Given any quarter. Prerequisite: consent of instructor.
2-4 units, (Huntington) any quarter, 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) by arrangement

231. Speech Perception—(Same as Linguistics 115.) Perceptual and physiological correlates of the acoustic constituents of speech. Prerequisite: course in phonetics, course 230 or consent of instructor.
3 units, Win (Huntington) by arrangement

2-3 units, any quarter (Schubert) by arrangement

299. The Auditory Process—(Same as Psychology 231.) A systematic survey of our current knowledge of the operation of the auditory system. Emphasis is placed on acquiring a knowledge of the acoustic signal, and on an understanding of the methods of measuring a sensory process.
3 units, Aut (Schubert) by arrangement

300. Independent Study—Advanced individual study under direction in fields or subjects of special interest. Maximum 12 units in any one quarter.
any quarter, (Staff) by arrangement

301. Research—Individual research projects under direction. Maximum 12 units in any one quarter.
any quarter, (Staff) by arrangement

308. Special Topics in Speech Science.
3-4 units, Spr (Huntington, Bush) by arrangement
310. Experimental Phonetics—(Same as Linguistics 216.) In-depth coverage of the motor, acoustic, and perceptual correlates of speech. Material will vary, hence may be repeated any quarter for credit. Prerequisite: consent of instructor.

4 units, any quarter (Huntington) by arrangement

392. Selected Topics in Psychoacoustics—
(Same as Psychology 232.) A detailed study of the normal auditory mechanism with particular emphasis on the use of psychoacoustic methods of analysis. Evaluation of current theories regarding auditory processing of information.

3-4 units (Schubert) any quarter by arrangement

393. Peripheral Auditory Mechanisms—
(Same as Psychology 233.) Study of the mechanics and electrophysiology of the middle and inner ear. Analysis of the ear as a transducer and of the neural encoding process.

3 units, Spr (Schubert) by arrangement

394. Central Auditory Mechanisms—Anatomy and electrophysiology of auditory nervous system. Emphasis will be placed on a review of correlates to perceptual phenomena.

3 units, any quarter (Staff) by arrangement

400. Doctoral Research.
1-15 units, any quarter (Staff) by arrangement

MEDICAL INFORMATION SCIENCES PROGRAM

Committee: Edward H. Shortliffe, Associate Professor of Medicine and by courtesy of Computer Science, Chairman and Program Director; Bruce G. Buchanan, Professor of Computer Science (Research); Edward A. Feigenbaum, Professor of Computer Science; Michael L. Genesereth, Assistant Professor of Computer Science; Richard L. Popp, Professor of Medicine; Allen K. Ream, Associate Professor of Anesthesia; Harold C. Sox, Jr., Associate Professor of Medicine (Clinical); Gio C. M. Wiederhold, Associate Professor of Medicine (Research) and Computer Science (Research); Leslie Zatz, Professor of Radiology.

Co-Director: Lawrence M. Fagan (Medical Computer Science)

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 Computing or Medical Decision Making. The faculty members in the Program are drawn from the Departments of Anesthesiology; Biochemistry; Computer Science; Economics; Electrical Engineering; Engineering-Economic Systems; Family, Community, and Preventive Medicine; Genetics; Medicine; Obstetrics and Gynecology; Pathology; Psychology; Radiology; Statistics and Biostatistics; Surgery; and the Graduate Schools of Business and Education. Opportunities for research are not limited to the specific faculty and departments represented on the list of participating faculty.

Participating Faculty:
Anesthesia: John P. Bunker (Professor), Allen K. Ream (Associate Professor)

Biochemistry: Douglas L. Brutlag (Associate Professor)

Computer Science: Thomas O. Binford (Professor), Bruce G. Buchanan (Professor), Edward A. Feigenbaum (Professor), Michael L. Genesereth (Assistant Professor), Edward H. Shortliffe (Associate Professor), Gio Wiederhold (Associate Professor)

Economics: Victor R. Fuchs (Professor)

Electrical Engineering: Susan S. Owicki (Associate Professor), Albert Macovski (Professor), Gio Wiederhold (Associate Professor)

Engineering-Economic Systems: Ronald A. Howard (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), Lawrence Crapo (Associate Professor), James F. Fries (Associate Professor), Charlotte Jacobs (Assistant Professor), Laurence Kedes (Professor), Roy H. Maffly (Professor), Richard L. Popp (Professor), Edward H. Shortliffe (Associate Professor), Harold C. Sox, Jr. (Associate 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 (Assistant Professor)

Statistics and Biostatistics: Byron W. Brown Jr. (Professor)

Surgery: Michael Eliastam (Associate Professor)
Graduate School of Business: Alain C. Ent- 
hoven (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 expand-
ing 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 Pro-
gram has a network of Hewlett-Packard 9836 
and Xerox 1108 professional workstations. 
These high performance machines are available 
for coursework and research projects by train-
ees in the program.

GRADUATE PROGRAMS

MASTER OF SCIENCE

The University's basic requirements for the 
master's degree are discussed in the section 
"Degrees" in this bulletin. The Medical Informa-
tion Sciences Program offers both masters 
and doctoral degrees with students selecting to 
subspecialize in either medical computing or 
medical decision making. In all degree pro-
grams 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 com-
prehensive exam in that area before the grad-
uate degree will be granted. In addition, all 
degree candidates must pass an oral examina-
tion that tests the student's ability to integrate 
the various components of the curriculum and 
and to relate them to the overall field of Medical 
Information Sciences (MIS). The program's 
masters degrees are intended as terminal pro-
fessional degrees. Admissions to a masters pro-
gram may negatively affect the outcome of a 
subsequent application to the Ph.D. program, 
and 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 aug-
mented depending upon the interests and prior 
experience of the student. Deviations from the 
core curriculum outlined below must be justi-
fied 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 comple-
ment other opportunities in applied medical 
research that exist at Stanford (e.g. Program on 
Engineering in Biology and Medicine, Gradu-
ate 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 Univer-
sity.

CORE CURRICULUM

All students are expected to participate regu-
larly 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 Clin-
ical Diagnosis (MIS 202) and Introduction to 
Clinical Environments (MIS 205).

2. Computer Science (9 units): The student is 
expected to acquire a knowledge of the use of 
computers, computer organization, and pro-
gramming. It is assumed that students will 
have had prior computing experience at least 
equivalent to CS 105 or 108A,B. None of 
these courses may be counted towards the 
degree requirement if it is taken at Stanford. 
In addition, all students are required to take 
7 units of courses in the computer science 
department, and these must 
include CS 108C and CS 261 if similar 
courses have not been taken previously. At 
least 6 units must be taken in courses num-
bered 135 or higher.

3. Decision Making (14-16 units): Students will 
be expected to learn basic probability the-
ory, Bayesian statistics, decision analysis tech-
niques, and experimental design tech-
niques. It is assumed that students will have 
had a prior course in statistics at least equiva-
 lent to Statistics 60. Required courses are 
Statistics 201A and 201B (Data Analysis); 
Statistics 116 (Theory of Probability) or EES 
221 (Probabilistic Analysis); EES 231 (Deci-
sion Analysis). Statistics 225 is highly recom-
mended.

4. Medical Computer Science (9 units): All stu-
dents are expected to acquire a general 
knowledge of the state-of-the-art and future 
frontiers for medical computer science. Re-
quired courses are MIS 210 (Computer 
Applications in Medicine), MIS 211A (Com-
puter-Assisted Medical Decision Making), 
and MIS 211B (Project Course).
5. Health Policy/Social Issues (7 units): Candidates will be expected to be familiar with key issues regarding public health policy, financing, ethics, and legal topics. Required courses are FCPM 200 (Health and Society) and Human Biology 40 (Public Decision Making Regarding Human Health).

Note that the core curriculum generally entails a minimum of 46 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 (CS 108 C) and a total of 15 units of formal coursework in computer science, including three of the following: CS 135, 223A, B, 245.

3. Same as core curriculum.

4. Same as core curriculum.

5. Same as core curriculum.

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 course work 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.

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 lec-
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—This one quarter course is designed for students who are not enrolled in the MD program or do not have an MD degree. Students will spend one afternoon per week 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 will introduce them to the medical wards, outpatient clinics, emergency room, operating room, intensive care unit, psychiatry ward, and rehabilitation ward. Meeting time will be 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.) This teaches 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 will be 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, Medicine 219.) This one quarter lecture series provides an overview of medical computer science activities in both research and applied environments. Topics covered 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, Shortliffe, Wiederhold) TTh 12:15

211A. Computer-Assisted Medical Decision Making—(Same as Medicine 211A, Computer Science 271A). An introduction to medical decision making techniques and to methods for their implementation in decision support systems. Course emphasis will be on Bayesian statistics, decision analysis, and artificial intelligence (expert systems).

3 units, Win (Shortliffe) TTh 12:15

211B. Continuation of MIS 211A—(Same as Medicine 211B, Computer Science 271B). Intended for students who have completed 211A and wish to implement some of those ideas in a computer project. Computer programming will be required in most projects. Prerequisite: 211A. Meets twice weekly.

3 units, Spr (Fagen, Shortliffe, Buchanan) TTh 12:15

229. Seminar on Rule-Based Expert Systems—(Computer Science students may enroll in 329.) Provides an 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 directions for the 1980's. The emphasis will be on an analysis of the research lessons of MYCIN and related projects in the KSL, the strengths and limitations of the rule-based approach to knowledge representation, and the way in which AI research evolves as new ideas and concepts are discovered. Prerequisites: At least one course in artificial intelligence and familiarity with LISP.

2 units, Win (Buchanan, Shortliffe) Th 3:15-4:45

235. Medical Decision Analysis—(Same as Engineering-Economics Systems 235, Computer Science 371.) Introduction to the use of decision analysis in medical practice. In close cooperation with participating physicians, 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-Economic Systems 31 and 231, or equivalent and some familiarity with
computer programming. No formal medical background is required.

3 units, Spr (Holtzman) M 3:15-5:30

299. Directed Reading and Research—Students 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: Stanley Falkow
Professors: Stanley Falkow, Hugh O. McDevitt, Leon T. Rosenberg, Bruce A. D. Stocker
Associate Professor: Abdul Matin, Robert J. Roantree
Assistant Professors: John C. Boothroyd, Mark M. Davis, Edward S. Mocarski, Gary K. Schoolnik, Lucy S. Tompkins
Professor (Teaching): John P. Steward

OFFERINGS AND FACILITIES

The department of Medical Microbiology offers programs leading to degrees of Bachelor of Science and Ph.D. (Master of Science awarded only in exceptional circumstances). In addition, research experience is offered to medical students in the course of an M.D. program and to postdoctoral trainees. The current research interests of the department include microbial genetics and molecular biology as related to the pathogenic process; microbial physiology with special emphasis on energetics and regulation; molecular and genetic studies of the immune system; structure and function of animal viruses, and molecular biology of parasites.

UNDERGRADUATE PROGRAM

BACHELOR OF SCIENCE

Requirements include: Mathematics, including calculus, 9 units; Biological Sciences, 15 units; Chemistry, 20 units (Chemistry 31, 33, 35, 36, 131, 135 or equivalent); Physics, 12 units. Specific course requirements are the following: Medical Microbiology 101, 102, 103, 203, 204, and 206; Biochemistry 200.

Students in this program can arrange to take units in research (see 199—Undergraduate Research). Under exceptional circumstances, a student may be awarded a degree “with Distinction” for excellence in research.

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 complete 45 quarter units of work related to microbiology; at least 25 of these units should concern research devoted to a thesis. The thesis must be approved by at least two members of the department faculty. There will also be an oral examination, which may cover the general fields of the department's offerings.

DOCTOR OF PHILOSOPHY

Application, Admission, and Financial Aid—Prospective Ph.D. candidates should possess a bachelor's degree with background in biology, including some experience in biochemistry and molecular biology, and chemistry. Formal application should be made through the Graduate Admissions Office, which will submit completed applications to the department. Deadline for receipt of applications with all supporting materials is January 1.

An applicant must file a report of scores on the 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 course providing an introduction to the biology of bacteria, bacteriophages, and animal viruses. Coverage will include bacterial anatomy, genetics, and physiology, as well as antibiotic action, immunology, and host-parasite relationships. Prerequisites: Chemistry 31, 33, and 35; Biological Sciences 41 recommended.

5 units, Aut (Roantree) MWF 1:15
lab MWF 2:15-4:05

102. Principles of Immunology — This is an introductory course in which the basic facts of immune responses in vertebrates are covered. Immune-like reactions in nonvertebrate animals, as well as in plants and bacteria, are briefly covered as well.

3 units, Win (Rosenberg) TTh 1:15

103. Undergraduate Medical Microbiology — Lecture covering the principles of pathogenic microbiology in more breadth and depth than General Microbiology 101. Topics include host-parasite relationships as they pertain to bacterial, viral, and parasitologic infections. Their diagnosis, treatment and prevention will be discussed.

3 units, Spr (Roantree, Falkow, Mickelsen) MWF 1:15

198. Undergraduate Directed Reading—Prerequisites: Consent of instructor.

18 units maximum, any quarter (Staff)
by arrangement

Subcategories include:

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.)

1-18 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.) This is designed to provide direct experience in understanding immunology using problems. Each week 3-5 problems are handed out to be corrected and discussed. Prerequisite: Simultaneous enrollment in Immunology (200).

1 unit, Spr (Rosenberg, Weissman, McDevitt) by arrangement

201. Advanced Immunology—Course is designed to provide an advanced immunology course aimed primarily at graduate students in the basic medical sciences, postdoctoral fellows, and those who want an emphasis on current research in molecular and cellular immunology, mechanisms of cellular interaction, mechanisms of immediate hypersensitivity, lymphocyte signaling systems and the cell biology of the immune response. The final examination will be in the form of a research proposal analogous to an NIH grant application.

5 units, Win (McDevitt, Weissman, Davis) MWF 4:15-5:45

202. Medical Microbiology—Lectures and laboratory demonstrations covering the fundamentals of pathogenic microbiology, with parti-
cular reference to bacteria, and animal viruses. Includes a discussion of some aspects of immunology, laboratory diagnosis, and preventive measures. Limited to medical students and those graduate students who have the consent of the instructor.

6 units, Aut (Falkow) WF 1:15-4:05

202A. Clinical Correlations in Medical Microbiology—Course is designed to provide an increased understanding of the clinical aspects of infectious disease agents. Each week simulated case histories are provided for discussion and comment. No final exam. Maximum 30 students. Prerequisite: Simultaneous enrollment in Medical Microbiology 202. Sign-up list requested.

2 units, Aut (Falkow) Th 1:15-3:05

203. Bacterial Physiology and Ecology—For graduate and advanced undergraduate students. Bacterial nutrition and growth kinetics; bacterial phenotype during nutrient-limited growth; structure and function; terminal energy-yielding pathways (aerobic and anaerobic respiratory chains, proton translocation, oxidative phosphorylation, nutrient transport); and special bacterial groups or processes. Prerequisites: Biological Sciences 40 and 41.

3 units, Win (Matin) MWF 1:15

204. Bacterial Genetics—A course of lectures (optional minilab may be available) on inheritance in bacteria. Prerequisites: Biological Sciences 41 and Med. Micro. 101 (or equivalents): consent of instructor for minilab.

3-4 units, Win (Stocke) MWF 9, lab MWF 2:15, or by arrangement

206. Animal Viruses—For graduate and advanced undergraduate students. Lectures will cover the molecular biology of virus replication with emphasis on the host-virus interaction. Prerequisites: Med. Micro. 101 or 202, Biochemistry 200, or consent of instructor. Suggested: Biological Sciences 213 and Biochemistry 201.

3 units, Spr (Mocarski) MWF 9

207. Pathogenesis of Infectious Diseases—The major emphasis of this course is to provide a better understanding of the molecular mechanisms employed by microorganisms to bring about the infection of animal and human hosts. In addition to formal instruction, there will be class discussion of recent literature pertaining to microbial pathogenicity, as well as normal and acquired host surface mechanisms. Prerequisite: consent of instructor. Sign-up list requested.

2 units, Win (Falkow) W 3:15-5:05

208. Topics in Virology—In depth discussion of current literature in a topical area of the molecular biology of viruses. Student participation in presentations required. May be taken repeatedly.

1 unit, Win (Mocarski) M 10

209. Molecular Parasitology—An advanced seminar course dealing with the molecular biology of parasites, with particular reference to the protozoa. Topics will include antigenic variation, molecular cloning of protective antigens, gene amplification, kinetoplast DNA and host-parasite interactions. (A background in parasitology is recommended, 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 Medical Bacteriology—This course will integrate 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 instructors. Sign-up list requested.

2 units, Win (Schoolnik, Uyeda, Falkow) Th 2:15-4:05

270. Seminar—Reports, discussions on selected topics by departmental and outside speakers.

1 unit, Aut, Win, Spr (Staff) W 12

299. Directed Reading—Prerequisites: consent of instructor.

18 units maximum, any quarter (Staff) by arrangement

399. Graduate Research—Students who have satisfactorily completed necessary foundation courses may elect research work in: general bacteriology, bacteria 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 Professor: Carla J. Shatz

Assistant Professors: Richard Aldrich, Eric I. Knudsen, J.H. Pate Skene, Bruce C. Wallace

**GRADUATE PROGRAMS**

Graduate students in the department obtain the degree of Doctor of Philosophy through the
interdepartmental Neurosciences Ph.D. Program. Remission of fees and a personal stipend are available to those students accepted. Application should be made through the Graduate Admissions Office which will submit completed applications to the department. Applicants are encouraged to familiarize themselves with the research interests of the faculty and, if possible, to indicate their preference on the application form. Medical students are also encouraged to enroll in the Ph.D. Program. The requirements of the Ph.D. program will be fitted to the individual interests and time schedules of the student. Postdoctoral training is available to graduates holding Ph.D. or M.D. degrees and further information should be sought directly from the faculty member concerned.

Research interests of the department include mechanisms of visual transduction and information transmission in vertebrate retina, 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 Neurobiology Department offers a one quarter course on the structure and function of the nervous system open to medical students, qualified students and advanced undergraduates. Advanced courses given by the department are open to students who have completed the basic course.

200. The Nervous System—An introduction to structure and function of the nervous system, including neurophysiology, neurochemistry and neuroanatomy. Topics range from the properties of neurons to the mechanisms and organization underlying higher functions. The course is designed to present a coherent framework as a preparation for neurology, neuropathology and clinical medicine in general, as well as for more advanced work in neurobiology. In addition to the lectures and neuroanatomy laboratories, there will be frequent, informal seminars with students in small groups, and demonstrations. This is an integrated course in which the neuroanatomy and neurobiology components must be taken together. Final exam will be given. No limitation. No prerequisites.

9 units, Win (Aldrich, Baylor, Knudsen, McMahan, Shatz, Shooter, Skene)
M 1:15-5:15, W 1:15-5:15;
F 1:15-5:15 (2nd year stud.);
M 1:15-4:15, W 1:15-2:15,
Th 2:15-5:15, F 1:15-5:15
(1st year stud.)

215. Neurobiology Techniques—For medical students and graduate students in the Neurosciences Program. Students will learn to use microscope techniques that enable study of synaptic components. The techniques will include, light and electron microscopy, histology, immunocytochemistry, autoradiography, freeze-fracture and photography.

3 units, Aut, Win, Spr (McMahan)
MWF 8-9

216. Membrane Biophysics Seminar—Course is for students who have some previous background in neurobiology (for example Neurobiology 200) and who are curious about the basic mechanisms of signalling in nerve cells. Topics are covered in depth by reading and discussing original research papers with emphasis on concepts, quantitative analysis of experimental results, and critical evaluation of evidence. Topics will include gating mechanisms in voltage-sensitive and chemosensitive ionic channels as well as ionic mechanisms in sensory transduction. The format consists of student presentations and small group discussions.

3 units, Spr (Aldrich, Baylor)

270. Neurobiology Seminar—Prerequisite: consent of instructor.
any quarter (Staff) by arrangement

199. Directed Reading (Undergraduate)—Prerequisite: consent of instructor.
any quarter (Staff) by arrangement

299. Directed Reading—Prerequisite: consent of instructor.
any quarter (Staff) by arrangement

399. Individual Research—Prerequisite: consent of instructor.
any quarter (staff) by arrangement

(Staff)

NEUROSCIENCES PROGRAM

For information, see listing under Dean of Graduate Studies and Research section of this bulletin.
Emeriti: (Professors) Bruno Gerstl, David Glick, Lelland J. Rather
Acting Chairman: Klaus G. Bensch
Associate Professors: Margaret E. Billingham, Charles B. Carrington, Gerald R. Crabtree, Edgar G. Engleman, F. Carl Grumet, Howard H. Sussman, Roger A. Warnke
Assistant Professors: Eugene C. Butcher, Steven K. H. Foung, Steven C. Quay, Robert V. Rouse, Jeffrey L. Sklar
Professor (Research): Lawrence F. Eng
Professors (Clinical): Lysia K. Forno (Neuropathology), Jon C. Kosek
Associate Professor (Clinical): Michael R. Hendrickson
Lecturer: Glen B. Haydon
Visiting Professor Emeritus: Henry Urich
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 Assistant Professors: P. Joanne Cornbleet, Charles Lombard
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: Robert Shiurba
Senior Research Associate: Teresa S-F Wang
Research Associates: Nitin Damle, Roger Schultz, Nahid Moheghpour, Susan Watson

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.
2 units, Win (Kosek, Fajardo, Forno, Quay, Chen, Rouse, Egbert) TTh 3:15-5:05, VAH (I-B 228), maximum 12 minimum 5 students

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, Aut, Win, 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 mechanix description of the various sources of contrast in the electron microscope image.
1 unit, Spr (Haydon) by arrangement
213. Gross Autopsy Pathology Laboratory—
Students examine and discuss unfixed dissected organs from current autopsies and correlate the autopsy findings with a brief history. Prerequisites: Currently taking or previously completed Pathology B, C, or D.
1 unit, Aut, Win (Sklar, Bensch),
MF 1:15-3:15

220. Immunology—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 Biochemistry 200-201) and Histology.
3 units, (tutorials offered for additional unit), Spr (Weissman, Rosenberg, McDevitt) MWF 9

220A. Problem Solving in Immunology—This is designed to provide direct experience in understanding immunology using problems. Each week 3-5 problems are handed out to be corrected and discussed. Prerequisite: Simultaneous enrollment in Medical Microbiology 200 (Pathology 220).
1 unit, Spr (Weissman, Rosenberg, McDevitt) W 5:15-6:15, Fleischmann Labs.

230A, B, C. General and Special Pathology—A three-quarter course providing an introduction to general principles in general pathology followed by a detailed description of the pathology of human disease based upon disordered structure and function of individual organ systems (special pathology). Taught in lecture and laboratory discussion groups. An examination after part A and B as well as a final examination will be given. Course Director: Dr. H. Sussman. Advisors: Drs. R. Kempson and K. Bensch.
230A. General and Special Pathology.
4 units, Spr (Friedberg, Staff)
MWF 1:15-3:15

230B. Special Pathology.
4 units, Aut (Hendrickson, Staff)
MW 11-12, TTh 9-11

230C. Special Pathology.
4 units, Win (Warnke, Staff)
MW 11-12, TTh 9-11

271. Immunology/Viral Oncology Literature Reviews—Weekly literature reviews requiring student presentation of 1-3 papers per meeting in detail. Each student will present 1-3 times per year. This course is designed for students working in immunology or virology laboratories. See also Interdepartmental listings for Medical Scientist Training Program Seminars.
2 units, any quarter (Weissman, Butcher)
M 5-6:30

381. Practical Introduction to Electron Microscopic Techniques—Laboratory course providing 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 understanding of electron microscopy.
1-4 units, Aut, Win, Spr (Haydon) by arrangement

290. Research in Experimental Neuropathology—Introduction to research methods in experimental neuropathology for students interested in a long-term project in this area. Work consists of participation in neuropathology research under the close supervision of a staff member in neuropathology. Facilities available include electron microscopy, tissue culture, neurochemistry and immunocytochemistry with antibody and molecular probes. Prerequisite: Consent of instructor.
1-15 units, Spr (Eng, Forno)

292. DNA Repair and Mutagenesis—(Same as Biological Sciences 205, Radiology 205.) Interactions of mutagens and carcinogens with DNA. Response of living systems to damaged genetic material, including molecular mechanisms for DNA repair. Enzymology of DNA modification and repair. Inducible repair responses and "error-prone" mechanisms. Human hereditary deficiencies in DNA repair. Relationships of DNA repair and mutagenesis to carcinogenesis. Prerequisites: Biological Sciences 21 and/or current consent of instructor.
3 units, Spr (Hanawalt, Friedberg, K. Smith) alternate years, given 1986-87

299. Directed Reading — Prerequisite: consent of faculty member
1-15 units, any quarter (Korn, 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 molecular, cellular and clinical-pathologic levels are encouraged to seek out faculty advisors. The department is fully equipped for all modern research and maintains an active and vigorous postdoctoral research training program. Prerequisites: consent of the instructor.
1-15 units, any quarter (Korn, Staff) by arrangement
**PHARMACOLOGY**

*Emeritus: (Professor) Robert H. Dreisbach*

*Chairman: Tag E. Mansour*

*Professors: Avram Goldstein, Dora B. Goldstein, Sumner M. Kalman, Tag E. Mansour; By courtesy: Leo Hollister, Kenneth Melmon, Ferid Murad*

*Associate Professors: Terrence Blaschke (Jointly with Medicine) Gordon Ringold, Howard Schulman, James P. Whitlock, Jr.*

*Assistant Professors: Helen M. Blau, Richard A. Roth; By courtesy: Phyllis Gardner, Brian Hoffman, Richard D. Mamelok, Stephen Peroutka*

*Consulting Professors: Ralph I. Dorfman, 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. Postdoctoral research training is available to graduates having the Ph.D. or M.D. degree. Research opportunities also exist for medical students, graduate students, and a limited number of undergraduate students.

The Ph.D. program is designed for students with a background in biology, chemistry, physics, or mathematics who wish to pursue a career in research in a field that lies between biology and medicine. Modern pharmacology is concerned with understanding the mechanisms of drug action at the cellular and molecular levels, and utilizing this knowledge for the rational development of new drugs, and their proper use in man.

Research in molecular pharmacology seeks to extend our knowledge of the interactions of chemical agents with biological systems at the molecular level in order to shed more light on the precise mechanisms whereby drugs exert their specific effects. The major fields of research interest in the department are molecular pharmacology, biochemical pharmacology, cellular regulatory mechanisms in carbohydrate metabolism that may be amenable to pharmacologic manipulations, 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.

**BASIC COURSES**

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 course on the principles of pharmacology and the major drug groups used in medicine. Major topics include the drug-receptor interaction, kinetic aspects of drug absorption, distribution and elimination, drug metabolism, hormones, toxicology, chemotherapeutic agents, antibiotics, antiparasitic drugs, and the anticancer agents. The emphasis will be 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 to be considered include the drugs affecting the central nervous system, and drugs affecting the peripheral nervous system the cardiovascular system, and the kidney. The 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 COURSES**

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.

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, Aut (Whitlock) F 9-10:50
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 will participate in problem-solving exercises by analyzing appropriate literature.
  2 units, Win (Blaschke) F 9-10:50

225. Frontiers of Pharmacology: Biogenic Amine Receptors—Lectures and discussions on the localization, characterization and control of different biogenic amine receptors. Emphasis will be on biochemical and molecular aspects of these receptors in vertebrate as well as invertebrate animals. Weekly lecture and weekly group analysis of assigned papers. Prerequisites: Biochemistry 200 or equivalent.
  2 units, Spr (Mansour) T 3:15-5:05

270. Research Seminar—Weekly seminars by outside speakers on current research in pharmacology. Seminars presented will be reviewed and discussed in a separate conference with a member of the faculty.
  2 units, Aut, Win, Spr (Staff) Th 4:15-6:05 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

COURSES REGULARLY OFFERED, BUT NOT DURING 1985-86

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—This course will include discussions of heavy metals, chlorinated hydrocarbons and other organic pesticides, components of smog, asbestos, contaminants of food and water, and the casual use of medicinal products. Drugs will be discussed in terms of their misuse or overuse and the attendant hazards.
  2 units, (Kalman) by arrangement

207. Molecular Mechanisms of Hormone Action—An advanced course dealing with mechanisms for transduction and transmission of biological signals. Topics will include molecular basis for the action of steroid and thyroid hormones, growth factors, and polypeptide hormones. Open to graduate students, medical students and advanced undergraduates. To include lectures and discussions.
  2 units, (Ringold) 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

230. Membranes and Signal Transduction—The diverse mechanisms by which hormones and neurotransmitters interact with cell surface receptors will be analyzed. Emphasis will be placed on molecular mechanisms by which various stimuli are transduced into an intracellular signal. The course will consist of student led seminars and weekly group analysis of assigned papers.
  2 units (Schulman) by arrangement

231. Regulations of Gene Expression in Differentiation—The course will focus on the role of cytoplasmic regulators in the expression of nuclear genes. Model biological systems for the study of differentiation and development will be analyzed at a cellular, biochemical level. A lecture and student discussion course of recent research developments.
  2 units (Blau) by arrangement

PHYSIOLOGY

Emeriti: (Professors) Frederick A. Fuhrman, Ronald Grant
Acting Chairman: Eugene D. Robin
Professors: Julian M. Davidson, Rex L. Jamison (jointly with Medicine), Eugene D. Robin
Acting Associate Professor: Erla R. Smith
Consulting Associate Professor: Noel Thompson

PROGRAMS OF STUDY

The Department of Physiology offers required and elective courses for students in the School of Medicine, open also to other qualified students with the consent of the instructor. The main emphasis is on training of medical and postdoctoral students. For a very limited number of highly qualified students, the department offers the Ph. D. degree, but not the master’s or bachelor’s degrees.

GRADUATE PROGRAMS

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. In the case of certain students, especially those with degrees in engineering or physics, the department will consider admission even if the above requirements have not been met. In those cases the students will be expected to complete the requirements during their graduate studies.

Emphasis is placed on providing all graduate students with a strong background in the laboratory study of major physiological phenomena, from which they may undertake highly individual courses of advanced research and study.

The total course of study is expected to occupy four 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

Research assistantships are occasionally available to postdoctoral fellows, or graduate students who have completed substantial work toward the Ph.D. degree in Physiology. Tuition aid may be awarded to students holding research assistantships. Graduate students who are also medical students are eligible for financial aid from the Office of Student Affairs, Stanford Medical School.

In general, graduate students must expect to find the majority of their financial support outside the University.

COURSES

200. Clinical Physiology - (Cell, 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. Prerequisites: an understanding of general biochemistry.

   6 units, Aut (M. Perlroth, E. Robin)
   MW 9-10:50, TTh 11-11:50


   6 units (201-4 units; 202-2 units), Win
   (Endocrinology: J. Davidson, D. Feldman, J. Hoffman, J. Kriss, R. Marcos,
    G. Reaven; Gastrintestinal:
    A. Cooper, G. 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. Prerequisites: an understanding of general biochemistry.

   6 units (203-3 units; 204-3 units), Spr
   (Respiratory: E. Robin; Renal:
    R. Jamison, R. Maffly, T. Meyer)
   MTF 8-9:50

205. Introduction to Mathematical Methods in Physiology and Chemistry—Course will examine 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 will be emphasized.

   2 units, (Davidson) not given 1985-86

211. Thoracic and Abdominal Anatomy and Physiology—Course is intended for those 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. Primary attention given to the major organs and vessels in these body compartments. Material is presented by 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, not given 1985-86

213. Special Topics in Physiology—A seminar course of guided reading and discussion in both introductory and advanced physiological topics. Topics are agreed upon by an individual instructor and interested students. Prerequisite: consent of instructor.

(Staff) by arrangement

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)

218. Surgical Physiology—A course designed to demonstrate surgical techniques and procedures involved in large animal surgery.

1-2 units, Aut, Spr (Robin, Collins)

219. Advances in Physiological Research—A seminar course to present current research topics in physiology. Speakers will be Stanford faculty, physiology graduate students, and guest lecturers. Seminar group to meet alternate weeks.

1 unit, Aut, Spr (Smith) 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

Chairman: Malcolm A. Bagshaw


Associate Professors: J. Martin Brown, Sarah S. Donaldson, Dieter R. Enzmann, Don R. Goffinet, Richard T. Hoppe, Daniel S. Kapp, Stuart W. Young

Associate Professor of Radiology (Research): Tien-wen T. Wiedmann

Assistant Professors: Diana F. Guthaner, James Lear, Cyrus S. Safai, F. Graham Sommer

Professors of Radiology (Clinical): William H. Marshall, Jr., Bruce R. Parker, James F. Silverman

Professor of Radiology (Teaching): Peter Fessenend

PROGRAMS OF STUDY

Although the Department of Radiology does not offer degrees, its faculty teaches a variety of courses open to medical students, graduate students and undergraduates. The department also accepts students in other curricula as advisees for study and research. Graduate students in the biophysics curriculum, for example, may choose Radiological Sciences as a major and pursue their dissertation in this field; similarly, students in the Cancer Biology Ph.D. Program may major in Radiobiology. Undergraduate students may also arrange individual research projects under the supervision of Radiology faculty.

Radiology is a discipline which is focused around the use of radiation as a diagnostic, as a therapeutic and as a research tool. The fundamental and applied research within the department reflects this broad spectrum: in diagnostic radiology as the discipline relates to anatomy, pathology and physiology; in therapeutic radiology and clinical oncology; in radiobiology and tumor biology; and in the application of nuclear medicine techniques to the study of physiology and pathology.

At the present time, the major areas of basic research investigation in the department include: DNA repair in bacterial and mammalian cells after ultraviolet and ionizing irradiation;
the role of error-prone DNA repair in spontaneous and radiation mutagenesis; effects of heat, drugs and radiation on the killing and repair of mammalian cells both in vitro and in vivo; studies of cell kinetics and reoxygenation in animal tumors after irradiation, chemotherapy, heat, and combinations of these modalities; studies of the effect of radiation on the microvasculature and blood flow in normal and malignant tissues; radiosensitization of tumors in vivo with a variety of drugs; studies of the late effects of radiation on a variety of normal tissues in young and adult animals; an in depth investigation of the role of viruses in the etiology of animal and human tumors; 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, and digital fluoroscopy; 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.) Course is concerned with various aspects of cancer as a biological phenomenon and as a clinical, emotional and societal problem. The diagnosis and treatment of human neoplasms, their psychosocial and economic impact, the organization of cancer care and research will be discussed. There will be detailed considerations of the specific control mechanisms operative in vitro and/or in vivo and a delineation of their influence in an attempt to characterize the differences between normal and malignant growth.

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 radiobiological 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—This course is intended primarily for residents or fellows in the Radiotherapy Division training program; however, medical or postgraduate students interested in radiotherapy can take the course. Focus is on the basic radiobiological processes underlying the treatment of malignant disease by radiation. Carcinogenesis and mutagenesis by radiation will also be covered. 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.) Interactions of mutagens and carcinogens with DNA. Response of living systems to damaged genetic material, including molecular mechanisms for DNA repair. Enzymology and DNA modification and repair. Inducible repair responses and “error-prone” mechanisms. Human hereditary deficiencies in DNA repair. Relationships of DNA repair and mutagenesis to carcinogenesis. Prerequisite: Biology 21 and/or consent of instructor.

3 units, Spr (Hanawalt, Freidberg, K. C. Smith) TTh 1:15,

241,242,243. Molecular and Cellular Aspects of Cancer Biology—This course is given over three academic quarters and covers primarily three major subject areas: cancer cell biology, carcinogenesis, and fundamental principles of therapy. Each of these should occupy approximately one academic quarter. This course is not intended to replace other specialized courses offered under departmental headings, but will give a comprehensive view of the major, relevant scientific bases and advances in areas directly relating to the understanding and control of neoplastic growth. The course will be organized and coordinated by E. C. Friedberg (Dept. Pathology), and its faculty will be drawn almost exclusively from the list of Stanford faculty participating in the Cancer Biology Program.

242. 3 units, Win (Staff) dhr

243. 3 units, Spr

299. Research.

any quarter, (Staff) by arrangement
Vice Provost and Dean of Graduate Studies:
Elizabeth C. Traugott

Associate Deans of Graduate Studies: Cecilia P. Burgiaga, Karlene N. Dickey

The Vice Provost and Dean of Graduate Studies is generally responsible for 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

SPECIAL Ph.D. PROGRAM

The Graduate Division Special Program is designed for students working on a Ph.D. whose study plans do not fall within the province of any one department. Applications to the Graduate Special Program must be approved by the Committee on Graduate Studies.

Applicants to the Graduate Special Program must have been admitted to a doctoral program in a school or department at Stanford University. Admission to the Graduate Special Program must be approved before the end of the third year of graduate study at Stanford. Applicants must have completed all departmental requirements, including any qualifying examinations, which normally fall within the time of enrollment in the original department. Students who have failed a qualifying examination must have passed a reexamination before an application to Graduate Special status will be considered.) Students beyond the second year of graduate study at the time of application must have been admitted to candidacy in the department in which they are currently enrolled.

Applicants to the Graduate Special Program must obtain the agreement of a member of the Academic Council to act as committee chair. In addition, applicants must obtain the agreement of three other Academic Council members to serve on the committee. At least two of the committee should be tenured professors. Committee members should be chosen to represent the student's various fields of interest and must be from at least two academic departments. Applicants must also 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.

Consideration for admission to the Graduate Special Program will be given only where it can be determined that the proposed program cannot be accommodated in any existing department.

Further information about the program and details of application procedures are available from the Graduate Program Office (Building 590, Room 104).

Students registering for special research under the guidance of their committee or for the Ph.D. dissertation should use the following course numbers:

400. Research
by arrangement

401. Ph.D. Dissertation
by arrangement

BIOPHYSICS PROGRAM

Committee on Biophysics: Robert D. Simon, Professor of Biological Sciences, Chairman; 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 p.m., not given 1985-86

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 will be expected to participate.
1 unit, Aut, Win, Spr (Staff)
by arrangement

Other courses recommended to Biophysics students:
Chemistry 287, 289, 291; Biological Sciences 205, 211, 252, 255; Cell Biology 211, 224; Radiology 201; Applied Physics 130, 232, 233;
Physics 170, 171, 172, 230, 234.
Committee on Cancer Biology: Errol C. Friedberg, Professor of Pathology (Chairman and Program Director); Robert F. Kallman, Professor of Radiology; Laurence H. Kedes, Associate Professor of Medicine; Virginia Walbot, Associate Professor of Biological Sciences; Irving L. Weissman, Professor of Pathology; Paul A. Wender, Professor of Chemistry.

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—This course will be given over three academic quarters and will cover primarily three major subject areas: cancer cell biology, carcinogenesis, and fundamental principles of therapy. Each of these should occupy approximately one academic quarter. This course is not intended to replace other specialized courses offered under departmental headings, but will give a comprehensive view of the major, relevant scientific bases and advances in areas directly relating to the understanding and control of neoplastic growth. The course will be organized and coordinated by Professor Friedberg, and its faculty will be drawn from faculty at Stanford and from expert guest lecturers.

241. 3 units; Aut (Staff) TTh 4:15-5:35
242. 3 units, Win (Staff) TTh 4:15-5:35
243. 3 units, Spr (Staff) TTh 4:15-5:35
251, 252, 253. Special Topics in Cancer Biology — Tentatively, series of four minicourses each quarter, each consisting of 2-6 hours of lectures. Minicourses will be given by different lecturers and will cover topics of major importance in cancer research. Students may enroll for two, three or four of the minicourses each quarter; and units will be given proportionately.

251. 1-2 units, Aut (Staff) TTh 4:15-5:35, alternate years, given 1986-87
252. 1-2 units, Win (Staff) TTh 4:15-5:35 alternate years, given 1986-87
253. 1-2 units, Spr (Staff) TTh 4:15-5:35, alternate years, given 1986-87

NEUROSCIENCES PROGRAM

Committee: Jack D. Barchas, Professor of Psychiatry and Behavioral Sciences; Denis A. Baylor, Professor of Neurobiology; Barry W. Connors, Assistant Professor of Neurology; Corey Goodman, Associate Professor of Biological Sciences; Eric I. Knudsen, Assistant Professor of Neurobiology; David A. Prince, Professor of Neurology; Peter B. Sargent, Assistant Professor of Structural Biology; Richard Thompson, Professor of Psychology; Stuart Thompson, Associate Professor of Biology; Jeffrey J. Wine, Associate Professor of Psychology; Student Members: Sascha du Lac, Matthew Waldor; Stephen G. Waxman, Professor of Neurology (Chairman)

The Neurosciences Program is an interdepartmental program which offers instruction and research opportunities leading to a Ph. D. in Neurosciences. The program is administratively under the aegis of the Dean of Graduate Studies. The Faculty of the Program is drawn from the Departments of Biological Sciences, Anesthesiology, Mechanical Engineering, Neurobiology, Neurology, Pathology, Pharmacology, Physiology, Psychology, Psychiatry, Cell Biology and Surgery.

Participating Faculty:

ANESTHESIA
Joan E. Kendig (Associate Professor of Biology in Anesthesia)

BIOLOGICAL SCIENCES
William F. Gilly (Assistant Professor), Corey S. Goodman (Assistant Professor), H. Craig Heller (Associate Professor), Richard H. Scheller (Assistant Professor), Stuart Thompson (Associate Professor)

CELL BIOLOGY
Peter B. Sargent (Assistant Professor), 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), Jeffrey 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), Stephen G. Waxman (Professor), Michael Weinrich (Assistant Professor)

NEUROSURGERY
Richard H. Britt (Assistant Professor)

PATHOLOGY
Lawrence F. Eng (Professor, Research)

PHARMACOLOGY
Dora Goldstein (Professor), Howard Schulman (Assistant Professor)

PHYSIOLOGY
Julian M. Davidson (Professor)

PSYCHIATRY AND BEHAVIORAL SCIENCE
Patricia R. Barchas (Assistant Professor), Jack D. Barchas (Nancy Friend Pritzker Professor), Phillip A. Berger (Associate Professor), Roland D. Ciaranello (Associate Professor), William C. Dement (Professor); Seymour Levine (Professor), John Madden (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 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 bio-behavioral aspects of the subject.

It is anticipated that the required course work will be completed by the end of the second year. Successful passing of a comprehensive oral preliminary examination given by the student's advisory committee is required for admission to Ph.D. candidacy. This examination is usually taken in the second year of study and must be completed by the end of the second year. Students are strongly encouraged to begin research on entry or at the latest during the winter quarter of the first year. The student will be required to present a Ph.D. thesis which is the result of independent investigation and which contributes to knowledge in an area of neuroscience and to defend his or her thesis in a University oral examination, including a public seminar.

Medical students may also participate in this program provided they meet the prerequisites and satisfy all the requirements of the graduate program as listed above. The timing of the program may be adjusted to fit in with their special circumstances.

**SELECTED COURSES**

The course selections of individual departments participating in the Neurosciences Program should also be consulted for complete offerings.

**Biological Sciences 153. Introductory Neurobiology**— (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 (Wine) not given 1985-86*

**Biological Sciences 154. Cellular and Molecular Neurobiology**— (Same as Psychology 107.) 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.

*3 units, Win (Scheller)*

**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 1985-86*

**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**— Ethological studies of behavior with an emphasis on understanding physiological substrates of simple behavior. Prerequisites: 43 or Hum Bio 033A or Psych 107 or consent of instructor.

*4 units, Aut (Wine) TTh 1:15-2:30*

**Biological Sciences 222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques**— Course presents an advanced treatment of membranes physiology and several modern experimental techniques. Emphasis will be 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 advanced undergraduates. Taught at Hopkins Marine Station. Apply to Hopkins.

*6 units, Sum (Gilly, S. Thompson)*
Biological Sciences 307. Seminar in Developmental and Molecular Neurobiology.

Aut, Win, Spr (Goodman, Scheller)

Human Biology 167. Neurochemical Aspects of Behavioral Disorders in Children—This course consists of a series of lectures which cover principles of neurotransmitter dynamics as they relate to our understanding of behavioral disorders in children. Current hypotheses concerning the neurochemical and neurobiological basis of behavior disorders in children will be discussed. Clinical syndromes including infantile autism, childhood schizophrenia, and hyperkinetic syndromes and childhood depression will be discussed in terms of disturbed neurochemical of neurophysiological functioning. The course is limited to junior and/or senior students. Prerequisites: Human Biology or Biology Core or permission of the instructor. In addition, Human Biology 111, Human Biology 163 and organic chemistry are strongly recommended.

4 units, Win (Ciaranello) not given 1985-86

Human Biology 196. Advanced Neurochemistry Seminar—Seminar intended for students 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 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 will be on critical reading and evaluation of current literature, and coherent presentation of topic material. Enrollment limited to eight Human Biology Seniors. Prerequisites: Permission of the instructor plus either 167 or Biochemistry 200 and Neurobiology 200.

3 units, Spr (Ciaranello)

Mechanical Engineering 282. Neuromuscular Biomechanics—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) not given 1985-86

Neurobiology 200. The Nervous System—An introduction to structure and function of the nervous system, including neurophysiology, neurochemistry and neuroanatomy. Topics range from the properties of neurons to the mechanisms and organization underlying higher functions. The course is designed to present a coherent framework as a preparation for neurology, neuropathology and clinical medicine in general, as well as for more advanced work in neurobiology. In addition to the lectures and neuroanatomy laboratories, there will be frequent, informal seminars with students in small groups, and demonstrations. This is an integrated course in which the neuroanatomy and neurobiology components must be taken together. Final exam will be given. No limitation. No prerequisites.

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 covered will include neurotransmitter metabolism, neurohormones and peptides, nerve growth factor and regeneration. Emphasis will be placed on the study of original papers and on student presentations. Prerequisites: Neurobiology 200 or equivalent.

3 units, Spr (Shooter) not given 1985-86

Neurobiology 213. Functional Organization and Development of the Central Nervous System—An advanced seminar and reading course which will examine the way in which the vertebrate brain processes and codes information, and the role of experience in establishing neural connections. Attention will be focused on the visual, auditory and somatosensory systems. Emphasis will be placed on the study of original papers and on student presentations. Prerequisites: Neurobiology 200 or the equivalent.

3 units, Win (Knudsen, Shatz) not given 1985-86

Neurobiology 215. Neurobiology Techniques—For medical students and graduate students in the Neurosciences Program. Students will learn to use microscope techniques that enable study of synaptic components. The techniques will include, light and electron microscopy, histochemistry, immunocytochemistry, autoradiography, freeze-fracture and photography.

3 units, Aut, Win, Spr (McMahan)

Neurobiology 216. Membrane Biophysics Seminar—Course is for students who have some background in neurobiology (for example, Neurobiology 200) and who are curious about the basic mechanisms of signalling in nerve cells. Selected topics are covered in depth by reading and discussion original research papers. The emphasis is on concepts, quantitative analysis of experimental results, and critical evaluation of evidence. Topics will include gating
mechanisms in voltage-sensitive and chemosensitive ionic channels as well as ionic mechanisms in sensory transduction. The format consists of student presentations and small group discussions.

3 units, Spr (Aldrich, Baylor)

Neurobiology 217. Extracellular Matrix — Examines current views on the structure, function and regulation of extracellular matrix in a variety of tissues, but with emphasis on the nervous system. Prerequisites: Introductory courses in cell biology and biochemistry.

3 units, Win (McMahan) not given 1985-86

Neurobiology 222. Cellular Electrobiology: Control of Function by Membrane Voltage— (Same as Biological Sciences 222.) A course designed to provide an in-depth exposure to contemporary ideas in cellular electrophysiology. It will involve lectures, student presentations of recent research papers and laboratory work. Voltage-control of function in nerve and muscle cells will be covered in considerable detail, with emphasis on gating currents and single-channel currents. Use of membrane voltage by other cell types and processes will also be surveyed. The final three-four weeks of the course will be devoted to laboratory work on one or two marine invertebrate preparations in which electricity plays an "unconventional", perhaps little understood, but biologically important role.

5 units, Win (Gilly) not given 1985-86

Neurology 204. Physiology of Mammalian Central Nervous System—Laboratory course designed for advanced students interested in neurological sciences. Introduction to a variety of techniques used in current research in physiology of mammalian central nervous system. No final exam. Limited to 8 students. Prerequisites: consent of instructors.

4 units, Spr (J. Kocsis, B. Connors)

by arrangement, not given 1985-86

Neurology 205. Clinical Neuroscience— Format will include 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 will be 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 1985-86

Physiology 210. Neuroendocrinology—A lecture and discussion course on selected topics of current interest in the general area of nervous and endocrine system interrelationships. Special emphasis will be placed on mechanisms for control of pituitary function and behavioral aspects of neuroendocrinology. Prerequisites: basic knowledge of Neurophysiology, Neuroanatomy and Endocrinology; consent of instructor.

2 units, Spr (Davidson) not given 1985-86

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 (Wine) not given 1985-86

Psychology 147. Animal Behavior: Neurobiological Aspects—(Same as Biological Sciences 164.) Etological 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)

Psychology 206. Behavioral Neuroscience — The focus of this course is on neurobiological substrates of behavior. Topic areas are for the most part organized in terms of categories of behavior. The neuroanatomical, neurophysiological, neurochemical, hormonal and pharmacological aspects of these behavioral phenomena will be explored.

3 units, Spr (R. Thompson, Staff) not given 1985-86

Psychology 227. Seminar: Cellular Neurophysiological Approaches to Behavior— A detailed consideration of selected examples of current research that have solved or are close to solving persistent problems. We will also try to identify problems and preparations which might profitably be explored. Sample topics: the Mauthner cell system; the function of muscle spindles; efferent control of sensory input.

3 units, Spr (Wine) by arrangement

Psychology 306. Seminar in Brain Substrates of Learning and Memory.

1-3 units, Aut (Thompson) not given 1985-86


1-3 units, Spr (Wine)
The Vice Provost and Dean of Research and Academic Information Systems is responsible for those interdisciplinary research laboratories, centers, and institutes in which the disciplines involved in each unit extend beyond the scope of any one of the organized schools of the University.

The Independent Labs and Centers reporting to this Dean include the Center for Economic Policy Research, Center for Materials Research, Center for Research in International Studies, Center for Research on Women, Hansen Laboratories of Physics, Institute for Mathematical Studies in the Social Sciences (including the Center for Study of Language and Information), International Strategic Institute at Stanford, Stanford Center for Chicano Research, Stanford Humanities Center, and Stanford Synchrotron Radiation Laboratory.

Following is a description of the activities of each of these organizations including the research activities and, where applicable, courses offered.

**Center for Economic Policy Research**

*Director*: 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; Silicon Valley Research Project (SVRP), 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).

**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.
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): Stephen Harris*
*Associate Director: Marshall O'Neil*
*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 a free electron laser. 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.

**STANFORD HUMANITIES CENTER**

*Director: Bliss Carnochan*
*Associate Director: Morton Sosna*

The Stanford Humanities Center was founded in 1980 as part of President Donald Kennedy's effort to strengthen research and teaching in the humanities at Stanford. In addition to the Director and Associate Director, the center consists of six Stanford Faculty Fellows (internal fellows), five to seven 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.

The general aims of the Stanford Humanities Center are to promote humanistic studies and interests in three main ways: by operating a fellowship program mainly concerned with research; by supplementing and otherwise strengthening humanistic teaching at Stanford; and by conducting studies of problems in the area of the humanities broadly defined, and of their relationship to other disciplines. In 1985-86, the center will continue to sponsor colloquia, seminars, and lecture series concerning various aspects of humanistic study. The center also sponsors conferences on a variety of topics, which during 1985-86 will include "Sports, Culture and Society." The Fellows, who are selected on the basis of an open competition, are primarily given opportunities for their own research but also contribute to the intellectual life of the Stanford community, usually by giving a regular course or seminar within a particular department, or by leading other center activities.

Departments through which Fellows teach courses include Anthropology, Classics, Comparative Literature, English, Feminist Studies, French and Italian, History, and Philosophy.

During 1985-86 the center will continue its small program aimed at undergraduates. One Faculty Fellow, Regenia Gagnier (English) will be on duty in Rogers House throughout the registration period of the quarter, and at regular office hours the rest of the quarter, to assist students in selecting an appropriate series of humanities courses for their purposes. Freshmen and sophomores who may be considering majoring in one of the humanities disciplines and who are interested in getting more specific information on what various Stanford programs have to offer are especially encouraged to approach this advisor. She will be prepared to offer advice both on deciding upon a major and on this decision’s implications for students’ future careers. There is also a small reading room for undergraduates, and occasional lectures, colloquia and discussions.

**CENTER FOR RESEARCH IN INTERNATIONAL STUDIES (CRIS)**

*Director: Robert E. Ward*
*Associate Director: Ronald Herring*

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: 415 497-4581).

CRIS neither offers courses nor confers degrees. These academic functions are performed by the schools, departments, and programs with which CRIS is associated.

AREA STUDIES PROGRAMS

Note: For course information in Latin American Studies, and in Russian and East European Studies see listings under the School of Humanities and Sciences.

Stanford has four interdisciplinary language and area programs: East Asian Studies, Latin American Studies*, Russian and East European Studies*, and African Studies. These are separately organized as centers responsible for coordinating the University's resources in all schools and departments for teaching and research relating to each of these areas. The relevant faculty members from these schools and departments constitute the staff of the four centers. The great majority of area-related courses and seminars are offered by the school or department concerned, not directly by the centers. Undergraduate degree programs are coordinated by staff associated with each of the area programs. Special graduate programs leading to the A.M. in Latin American Studies, East Asian Studies and Russian and East European Studies are available and are described separately in this bulletin. The area studies programs do not offer the Ph.D. but qualified doctoral candidates may develop an area specialization within their discipline. Students may also design a cross-disciplinary specialization which emphasizes the area interest within an individually organized program of interdisciplinary preparation.

UNDERGRADUATE PROGRAM

A special interdisciplinary program in International Relations, including an undergraduate major, has been developed in response to initiatives to review this aspect of the international studies curriculum. The relevant course offerings are described under the rubric "International Relations Program" in the School of Humanities and Sciences section of this bulletin.
AFRICAN STUDIES

Emeriti: St. Clair Drake (Anthropology and Sociology), William O. Jones (Food Research Institute)

Chairman: William R. Leben (Linguistics)

Professors: David B. Abernethy (Political Science), Martin Carnoy (Education), James L. Gibbs, Jr. (Anthropology), William B. Gould (Law), Joseph H. Greenberg (Anthropology & Linguistics), 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 & Comparative Literature), Richard Roberts (History)

Curators: Peter Duignan (Senior Fellow Hoover Institution), Karen Fung (Senior Librarian)

The aim of the Committee on African Studies is to develop 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 sponsored by departments and programs throughout the university. A sampling of courses is listed below.

UNDERGRADUATE STUDY

Undergraduates who wish can choose an African studies focus among several alternative paths:

1. A major in a traditionally defined academic department (e.g. Political Science, History, Anthropology, etc.) These departments afford ample opportunity to enroll in courses outside the major, leaving the student free to pursue the interdisciplinary study of Africa.

2. Interdepartmental majors, such as African and Afro-American Studies or International Relations, which offer coordinated and comprehensive interdisciplinary course sequences, permitting a concentration in African Studies.

3. An individually designed major in African Studies. Under the supervision of a faculty advisor, and two other faculty members, the student can plan a program of study focused on Africa which draws courses from any department or school within the university. If approved by the Dean's Advisory Committee on Individually Designed Majors, the program becomes the curriculum for the A.B. degree.

Undergraduates can study for a year in Africa. In recent years, students have been able to enroll at the University of Nairobi, Kenya, and at Universite du Benin, Togo. Students should check with the Overseas Studies Office to see what arrangements are currently available.

GRADUATE STUDY

At the graduate level, Stanford offers the following possibilities for those who wish to become specialists in African Studies.

1. As a field of concentration within the regular master's and 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. Other departments, programs, and institutes permit students to specialize in African Studies as well. The new M.A. 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 M.A. 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 M.A., 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

For (DR) notations, see respective departments.

Introduction to African and Afro-American Studies — (Enroll in African and Afro-American Studies 105 or Anthropology 105). A lecture course introducing 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 covered 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. The course also considers why particular ideas developed at particular times and examines the relationship between African and Afro-American Studies and other academic disciplines. Optional discussion sections will be arranged. No prerequisite. (DR:5*)
5 units, Aut (Carson, Davis, Gibbs, Jackson, Wynter)
section by arrangement

Women and Development in Africa — (Enroll in African and Afro-American Studies 109, 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 independence; 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. No formal prerequisites.
4 units, Spr (Samoff)

Core Seminar: Africa and the Black Diaspora: An Introduction to its Literature, Thought and Cultural Worlds — (Enroll in African and Afro-American Studies 114.) Provides 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)

4 units (Staff)

African Societies and Cultures — (Enroll in Anthropology 108.) This course, through a combination of lecture, discussion, 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, and the use of art and oral literature to consolidate and express ethnic power.
5 units, Spr (Donham)

Law in Radically Different Cultures — (Enroll in Anthropology 157, Law 316 or Human Biology 147.) (Graduate students register in Anthropology 257.) Comparison of legal systems in Western, capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social, and cultural factors which contributed to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights — especially at death, the handling of anti-social or “criminal” behavior, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. This course is open to law students, graduate students in other departments and to juniors and seniors.

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*)
5 units, Aut (Fox, Roberts, Kahn)

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*)
5 units, Win (Abernethy, Collier, Duus)
Introduction to African History—(Enroll in History 148.) Survey of African cultures, societies, economies, and politics from earliest times to the present; state building, the slave trade, colonialism, nationalism, and independence.

4-5 units, Aut (Jackson)

Africa in the Twentieth Century—(Enroll in History 148C.) Transformation of African societies during colonial rule. Resistance to colonial conquest; decline of the old elite and rise of the new one; conflicting ideologies and consciousness; nationalism; decolonization. (DR:5*)

5 units, Spr (R. Roberts)

Undergraduate Seminar: The Colonial State and Society in Africa—(Enroll in History 248S.)
5 units, Win (R. Roberts)

Undergraduate Colloquium: Palestine and the Arab-Israel Conflict—(Enroll in History 288.)
5 units, Aut (Beinin)

Graduate Colloquium: The End of Slavery in Africa and the Americas—(Enroll in History 348A.)
5 units, Spr (R. Roberts)

Graduate Colloquium: Problems on the Economic History of West Africa—(Enroll in History 348C.)
5 units, Aut (R. Roberts)

Graduate Colloquium: History and Anthropology—(Enroll in History 349.)
5 units, Aut (K. Jackson, Rosaldo)

Graduate Colloquium: Labor and Politics in the Third World—(Enroll in History 389.)
5 units, Spr (Beinin)

Graduate Seminar: The Colonial State and Society in Africa—(Enroll in History 448A.)
5 units, Win (R. Roberts)

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, Aut (Abernethy, Samoff)

Southern Africa: Race, Class and Political Change—(Enroll in Political Science 118B.) Examines the political history of the region's ten countries, with special attention to relations among racial and ethnic groups. Analyzes diplomatic, economic, and military interactions among these states, and the impact of movements, corporations, and international organizations based outside the region. Particular attention to domestic politics and foreign policy of South Africa. (DR:5*)

5 units, Spr (Abernethy)


5 units, Aut (Samoff)

Political and Ethical Aspects of Foreign Aid—(Enroll in Political Science 132D.) Uses general and case study materials to examine characteristics of bilateral and multilateral "official development assistance"; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems posed in the allocation, monitoring, and evaluation of development assistance. Special attention paid to international disaster relief operations.

5 units, Win (Abernethy)

Seminar: Multinational Corporations and the Third World—(Enroll in Political Science 140M.) Employs case studies to analyze interests and resources of multinational corporations (MNCs); patterns and trends in MNC relationships with Third World Governments; economic, social, cultural and political impacts of MNC activity. How persuasive are conservative, liberal, and radical perspectives on the role MNCs play in Latin America, Africa and Asia? Prerequisite: FS35 or equivalent.

5 units, Win (Abernethy)

Universals and Typology of Language—(Enroll in Linguistics 100.) Characteristics of human language, as suggested by structural comparisons of the world's languages. Basic grammatical categories, preferred sound systems; methods of description and classification. Implications of cross-linguistic comparisons for language history, language learning and language disorder. Prerequisite: an introductory linguistics course.

4 units, Win (Ferguson)

Practicum in Phonology and Morphology—(Enroll in Linguistics 223.) Practice in problem-solving, using data from a lesser known language. The course is designed to increase proficiency in dealing with linguistic evidence and to contribute to scholarship in lesser-known languages.

4 units, (Leben)
Structure of Hausa—(Enroll in Linguistics 285.) A sketch of Hausa syntax, morphology and phonology with emphasis on points of current theoretical interest. Prerequisite: Linguistics 220 and 230 or consent of instructor.

4 units (Leben)

Language Change — (Enroll in Linguistics 245 or Anthropology 245.) The nature of linguistic change in phonology, grammar and semantics, problems of internal and comparative reconstruction, and basic issues in the explanation of diachronic processes in language. Prerequisite: Linguistics 120 or consent of instructor.

4 units, Win

Beginning Swahili—(Enroll in Linguistics 606 A,B,C.) Swahili is the major lingua franca of East Africa. Conversation, grammar, reading. Successful completion of 606C may fulfill the foreign language requirement.

5 units, Aut, Win, Spr

Intermediate Swahili—(Enroll in Linguistics 607 A,B,C.)

3-5 units, Aut, Win, Spr (Staff)

Beginning Hausa—(Enroll in Linguistics 602 A,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.

5 units, Aut, Win, Spr (Leben)

Beginning Yoruba—(Enroll in Linguistics 610 A,B,C)

3 units, Aut, Win, Spr (Leben)

Intermediate Yoruba—(Enroll in Linguistics 611 A,B,C)

3 units, Aut, Win, Spr (Staff)

(Any other African language can be taught, through the Special Language Program, provided a tutor is available. Some languages which have been taught in the past are: Amharic, Kikuyu, Twi, Ewe, and Oromo.)

The World Food Economy — (Enroll in Food Research 103 or Economics 106.) Examines 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 associated with economic development. The 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 related to the design of rural development strategies is stressed. Prerequisite: Economics 1 or equivalent understanding of economics; Economics 51 recommended.

3 units, Spr (Pearson)

International Trade Policy—(Enroll in Food Research 166, or Economics 166.) (May be taken as 266 by graduate students.) Formulation and effects of selected government policies affecting international trade. Trade 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.

5 units, Spr (Pearson)

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 (Pearson) TTh 11-11:50

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). Beginning with those images, this 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 in this class will develop a basic familiarity with the contemporary African situation and with the use of film as an instructional medium. There are no prerequisites, and no particular background is assumed. Those students who have already done some work on Africa will be expected to focus on the images of Africa projected to external audiences. (IDE)

4 units, Aut (Samoff) alternate years, given 1986-87

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 (Carnoy) M 12-2:05

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 (Arias) 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)
4 units, Spr (Weiler) alternate years, given 1986-87

Implementing Educational Reform—(Enroll in Educational 209X.) 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. No formal Prerequisites; previous Third World course work and/or professional experience and familiarity with Education 306A-D topics helpful. (IDE)
4 units (Samoff) alternate years, given 1986-87

Teaching a Global Perspective—(Enroll in Education 217X.) 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 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.
4 units, Spr (Grossman) by arrangement

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 — e.g., 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, Textor) 7:30-9:30 pm workshops by arrangement

Social Structure of World Society—(Enroll in Education 231, or Sociology 152.) This course pursues a sociological analysis of society on a world-wide basis, that is, all the people inhabiting the earth and the institutions through which their lives are organized, are treated as participants in one global social system. Competing models of the emerging world order will be reviewed and compared. Among the topics to be covered will be the worldwide population dynamics, the nature of the world economy, communication of person on a global scale, socio-economic stratification of the world population and education, science and technology as global systems. (IDE)
5 units, Aut (Inkeles) and by arrangement

Education and Work—(Enroll in Education 277X.) The course will examine traditional models of socio-economic structure and educational change, concentrating on the relationship between education and work. Emphasis will be put on functionalist and dialectical models. The literature covered by the course will include work done in the U.S., Europe and the Third World. Specific case studies will be used to illustrate the models. The course is open to students from all areas.
5 units (Carnoy) alternate years, given 1986-87

Education and Economic Development—(Enroll in Education 306A.) An introduction into the analysis of the role of education in economic
growth and development. Case material will consider development problems both in the U.S. and abroad. Discussion sections will deal with special economic aspects of educational development. (IDE, SSE)

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

**Education and Political Change** — (Enroll in Education 306B or Political Science 221.) Introduction to the analysis of the relations between education and politics from a comparative perspective. 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, Win (Samoff) T-Th 2:15-4:05

**Sociology of Development and Education**—(Enroll in Education 306D.) This course offers a systematic comparison between modernization and dependence approaches to development, emphasizing the different treatment education receives in each of them, and the consequent different approach toward educational reforms in developing countries. (IDE, SSE)

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

**Knowledge and Legitimation: The Politics of Educational Research**—(Enroll in Education 307X or Pol. Sci. 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 seminar for doctoral students; consent of instructor required. (IDE, SSE)

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

**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 of 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 (Samoff, Arnowe)

408B. Research Workshop in IDE II.
2-5 units, Win (Textor)
MW 3:15-5:05

408B. Research Workshop in IDE III.
2-5 units, Aut (Arnowe, Weiler)
MW 3:15-5:05

**EAST ASIAN STUDIES**

See listings under the School of Humanities and Sciences for other course listings.

**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-Uni-
Inter-University Center for Japanese Language Studies in Tokyo

The Inter-University Center for Japanese Language Studies in Tokyo, Japan, is a cooperative enterprise of 12 major academic institutions in the United States and Canada, with Stanford University as the administrative agency. The purpose of the Center is to provide qualified graduate and undergraduate students with intensive audio-lingual Japanese language instruction, as well as to further the students' familiarity with Japanese texts and materials preparatory or leading to research in given disciplinary or professional fields. The location of the Center in Tokyo provides maximum opportunities for students to gain fluency in both the written and spoken language in a Japanese-speaking and Japanese cultural environment. Language study is carried on in small classes or in individual tutorial sessions by Japanese instructors. Advanced and post-doctoral students may be given opportunities for specialized work in the language, as well as other individual study, dependent upon programs established by their home institutions.

The academic year at the Center is equivalent to four full quarters, beginning in early September. Any student may apply for admission provided that he or she (a) is a student in good standing, and is a degree candidate at an accredited university or college, or provides sufficient evidence of intending to enroll in a graduate program after attending the center; (b) will have successfully completed prior to attendance a minimum of two years of Japanese or its equivalent at the college level; and (c) takes a written screening examination in the Japanese language.

Stanford students attending the Inter-University Center for credit should enroll in Asian Languages J400 Advanced Language Training (15 units per quarter). This course will be graded on a Pass/No Credit basis.

For further information please write to the attention of IUC at:
Center for Research in International Studies
Room 200, Lou Henry Hoover Building
Stanford University
Stanford, California 94305
brings four to six fellows to the center each year from the United States and abroad, principally in the social sciences. In addition, beginning with the 1984-85 year, the center has included as resident fellows several mid-career scientists and journalists.

**CENTER FOR MATERIALS RESEARCH (CMR)**

*Director:* T. H. Geballe  
*Assistant Director:* R. P. Girouard  
*Director, Crystal Science Division:* R. S. Feigelson  
*Affiliated Faculty:* Currently 80 members from the following departments: Aeronautics and Astronautics, Applied Earth Sciences, Applied Physics, Chemical Engineering, Chemistry, Civil Engineering, Electrical Engineering, Geology, Materials Science and Engineering, Mechanical Engineering, Physics, Hansen Laboratories, and the Stanford Synchrotron Radiation Laboratory.

The Stanford University Center for Materials Research (CMR), located in the McCullough Building, is one of 14 university laboratories throughout the United States supported by the Division of Materials Research of the National Science Foundation under its Materials Research Laboratory (MRL) Program.

The purpose of the MRL Program is to support major central research facilities, to provide seed money for funding junior faculty or provide initial funding for established faculty who are changing research fields, and to support coherent multi-investigator projects in major thrust areas requiring expertise in two or more materials related disciplines—so-called "Thrust" research.

To fulfill these goals CMR operates extensive materials characterization facilities and, at the present time, sponsors eleven seed programs and six multi-investigator, multidiscipline Thrust programs. CMR's professional staff also conducts research programs in Crystal Synthesis and Vapor Phase Synthesis.

**INSTITUTE FOR MATHEMATICAL STUDIES IN THE SOCIAL SCIENCES**

*Director:* Patrick Suppes  
*Assistant Director:* Joyce Firstenberger  

IMSSS is a research institute primarily funded by gifts, government grants and contracts. It was founded in 1959. The current major emphases are on research in computer-assisted instruction, mathematical economics, and situated language. The staff includes research associates, graduate student research assistants, programmers, and faculty.

**CENTER FOR RESEARCH ON WOMEN (CROW)**

*Acting Director:* Marilyn Yalom (Lecturer in Modern Thought and Literature)  
*Assistant Director:* Estela Estrada  

The Center for Research on Women is administered by Marilyn Yalom, Acting Director and Lecturer in Modern Thought and Literature, and the Policy Board consisting of faculty, staff, undergraduate and graduate students, and community representatives.

*CROW Faculty and Academic Staff Affiliates:* Beatriz Arias, Assistant Professor, Education; Barbara Babcock, Professor, Law; James Baron, Assistant Professor, Graduate School of Business; Helen M. Blau, Assistant Professor, Pharmacology; Judith C. Brown, Associate Professor, History; Albert M. Camarillo, Associate Professor, History; Terry Castle, Assistant Professor, English; Elizabeth Cohen, Professor, Education, Sociology; Jane F. Collier, Associate Professor, Anthropology; Joseph J. Corn, Lecturer, Humanities and Sciences; Wanda M. Corn, Associate Professor, Art; Carl N. Degler, Margaret Byrne Professor of American History; Diana Dutton, Assistant Professor, Family, Community and Preventive Medicine, Sociology; John Felstiner, Professor, English, Jean Fetter, Dean of Admissions; Michele Fisher, Director, Center for Teaching and Learning; Estelle Freedman, Associate Professor, History; Regenia A. Gagnier, Assistant Professor, English; Albert J. Gelpi, Coe Professor of American Literature, Chairman, English; Barbara Gelpi, Associate Professor, English; Shirley Brice Heath, Associate Professor, Education; Arturo Islas, Associate Professor, English; Herbert P. Leider-
man, Professor, Psychiatry; Iris Litt, Associate Professor, Pediatrics; Carolyn C. Lougee, Associate Professor, History; Milbrey McLaughlin, Associate Professor, Education; Eleanor Maccoby, The Barbara Kimball Browning Professor, Psychology; Joanne Martin, Associate Professor, Graduate School of Business; Diane W. Middlebrook, Professor, English Chairman, Feminist Studies; William F. Miller, Professor, Graduate School of Business, Computer Science; Robert Mnookin, Professor, Law; Mary Pratt, Associate Professor, Spanish & Portuguese; Deborah L. Rhode, Associate Professor, Law; Sandra L. Richards, Assistant Professor, Drama; David Spiegel, Associate Professor, Psychiatry; Myra H. Strober, Associate Professor, Education; Ann Swidler, Assistant Professor, Sociology; Joan E. Talbert, Assistant Professor, Education; Nancy Tuma, Professor, Sociology; David B. Tyack, Professor, Education, History; Michael Wald, Professor, Law; Henry A. Walker, Assistant Professor, Sociology; Lenore J. Weitzman, Associate Professor, Sociology; Jack Winkler, Associate Professor, Classics; Sylvia Wynter, Professor, Spanish and Portuguese; Marilyn Yalom, Lecturer, Modern Thought and Literature; Acting Director, CROW; Sylvia J. Yanagisako, Associate Professor, Anthropology; Laraine T. Zappert, Clinical Psychologist; Research Associate, CROW.

The center acts as an organizational and administrative focus for gender-related, interdisciplinary education and research whose major objectives are:

1. To conduct research on women and gender-related issues.
2. To stimulate gender-related research among Stanford faculty members, graduate and undergraduate students and CROW Affiliated Scholars.
3. To disseminate research and educational findings to the larger Stanford community including presentation of lecture series and campus conferences.

Courses are not offered through the center, but are offered within academic departments. Course information may be located under “Feminist Studies.”

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; a 40-inch diameter, cylindrical bubble chamber which operates in a hybrid mode with triggering counters; and a large aperture superconducting solenoid spectrometer system (LASS) for studies of multihadron final states. An electron-positron storage ring facility (SPEAR) is engaged in a full research program with colliding beams each of 3.7 GeV energy. The SPEAR facility was used in the discovery of the psi particle for which the 1976 Nobel Prize in physics was awarded, 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 of 18 GeV yield center-of-mass interaction energies of 36 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 Hansen Laboratory. PEP offers six interaction regions, five of which 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. A detector designed to search for very rare particle decays is presently being built for the latter interaction region and this area of research, that is, rare and exotic particles, is getting increasing emphasis with all the detectors at PEP. 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 natural 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 1984, physicists from 68 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 both with bubble chamber and electronic techniques, studies of decay properties of weakly interacting particles, and the study of electron-positron annihilation to form hadrons, leptons, and photons. The work in theoretical physics deals with all phases of elementary particle theory.

Stanford graduate students may, with the approval of their departments, carry out research for the Ph.D. degree with members of the SLAC faculty. Graduate students from other universities also participate in the research programs of visiting groups. Research assistantships are available for qualified students by arrangement with individual faculty members. There are also opportunities for summer employment in the research groups at the Center. Interested students should apply to Professor David Leith, Graduate Student Advisor.
The Stanford Synchrotron Radiation Laboratory (SSRL) is a national research facility for the utilization of synchrotron radiation for research in the natural sciences and engineering and is supported by the Department of Energy and the National Institutes of Health. Synchrotron radiation is electromagnetic radiation emitted by relativistic charged particles curving in magnetic fields. The radiation emitted from the storage ring SPEAR 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. Development of advanced sources of synchrotron radiation and associated instrumentation is also a major undertaking of the facility. SSRL is a user-oriented facility which welcomes proposals for experiments from all qualified scientists including graduate students.
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ON WAR, REVOLUTION
AND PEACE

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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 twentieth century.

The library includes one of the largest private archives in the United States, and has outstand-
ing 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 important in world affairs, publications of ephemeral societies and of resistance and underground movements, and the publications and records of national and international bodies, both official and unofficial, as well as books and pamphlets, many of them rare and irreplaceable. The materials are open to all Stanford students, faculty, and staff, and to scholars from outside the University.

The Institution has a resident research staff of historians, economists, educators, political scientists, and sociologists. The International Studies Program and the Domestic Studies Program publish basic research, documentary studies, and current public policy analysis.

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, national security, and the role of education in war, revolution, peace, and development. 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. Peter J. Duignan coordinates the International Studies Program.

Within the International Studies Program, the Institution has initiated a program involving research in national security affairs. The Program’s approach is multi-disciplinary, encompassing the strategic, economic social, historical, and political dimensions of national security priorities. The program 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 program is coordinated by Dennis L. Bark.

The Institution has expanded its Domestic Studies Program, which has become 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, and related subjects. Thomas G. Moore 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 12-15 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 Hall and senior research fellow Thomas E. MacCurdy on joint appointments with the Economics Department; senior fellow Seymour Martin Lipset on joint appointment as the Caroline S. G. Munro Professor of Political Science and with the Sociology Department; senior fellow James G. March on joint appointment as the Fred H. Merrill Professor of Management with the Graduate School of Business and with the Departments of Political Science and Sociology and, by courtesy, Education; senior research fellow John 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. Professors Kenneth J. Arrow and Michael Boskin in Economics; 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; deputy archivist Robert Hessen teaches in the Graduate School of Business; and senior research fellow James B. Stockdale offers an undergraduate seminar.

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. In addition to the five Nobel laureates associated with the Hoover Institution, fourteen staff members are fellows or
Arts and Sciences, nine are fellows of the American Association for the Advancement of Science, eight are members of the National Academy of Sciences, four are 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.

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**Associate Director for Research Services:** Paul H. Mosher
**Assistant Director for Technical Services (Acting):** Cynthia I. Gozzi
**Collection Development Officer:** Michael T. Ryan
**Library Development Officer:** Brigitte Carnochan

**Department Chiefs:** Carol Fleishauer (Acquisition, Acting); Tamara Frost (Catalog); Carolyn Henderson (Personnel); James Knox (General Reference, Acting); Joan Knox (Access Services); Jerry C. Persons (Systems Office); Michael T. Ryan (Special Collections); Elizabeth M. Salzer (Meyer Library); Michael V. Sullivan (Science); David Thompson (Serials, Acting); Roberto Trujillo (Foreign Languages & Area Collections); Carol A. Turner (Government Documents)

**Branch Librarians:** Alan Baldrige (Hopkins Marine Station); Barbara Celone (Crubbery Education); Charlotte R. Dersken (Braner Earth Sciences); Henry Lowood (Physics); Harry P. Llull (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); Michael V. Sullivan (Engineering); Beth Weil (Falconer Biology)

**Curators—Collection Development Program:** Position Vacant (English and American Literature Collections); James M. Breedlove (Latin American Collections); Peter R. Frank (Germanic Collections); James Knox (U.S. and British History Collections); Roxanne L. Nilan (University Archives); Mary Jane Parrine (Romance Language and Humanities Collections); Alexander Ross (Art and Architecture Collections); Michael T. Ryan (Special Collections); Roberto Trujillo (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
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 also included in the Information Bulletin.

The formal courses listed below are intended to serve those students for whom a more extended study of bibliographic organization is useful.

**COURSES**

**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)

**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. Will include 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)

**French and Italian 397. Colloquium on Research Methods in French and Italian Studies**—As an introduction to library resources in French and Italian studies, the course will help graduate students do research more effectively and to impart that knowledge to their own students. The seminar format allows participants to benefit from shared observations on research methods. Includes broad coverage of basic reference works and bibliographies as well as an emphasis on students' particular fields of interest. Designed for graduate students, though undergraduates may enroll with instructor's permission.

3 units, Aut (Parrine)

**German 300A. Introduction to German Studies**—Bibliographical research is a time consuming task until one acquires the necessary skills to find, to know and to handle the essential bibliographies, reference works, etc. in the vast field of German studies—culture, literature, history, political science, and so on. It is the aim of this course to enable students to find all facts and information needed for study and research by themselves and in the shortest possible time.

3 units, Aut (Frank)

**Latin American Studies 260. Colloquium on Latin American Bibliography**—This course is directed to the needs of beginning graduate students. Its purpose is two-fold: to acquaint the student with the principal resources for Latin American studies in the humanities and social sciences and to teach the mechanics of utilizing the bibliographic data available for the study of Latin America in the Stanford University Libraries.

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 (Persons)

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, Aut (Zalewski)

INFORMATION SERVICES

ACADEMIC COMPUTING AND INFORMATION SYSTEMS (ACIS)

Vice Provost and Dean of Research and Academic Computing and Information Systems: Robert L. Street

In addition to his responsibilities for the 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.
call forwarding, speed dialing, and call conferences.

While I.T.S. staff provide 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 I.T.S. systems and facilities efficiently.

The courses and seminars described below are offered to help new I.T.S. clients learn to use the facilities and services independently. The courses are non-credit but do require registration through I.T.S. A few require a fee. 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 I.T.S. Information Center in Forsythe Hall, 497-4391. 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 497-1055 for information).

Part-time work is sometimes available for undergraduates. Inquiries should be addressed to the Human Resources Office, 497-9656.

## COURSES

### I. ORIENTATION SEMINARS

**26A,B. 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

**32A,B. Fundamental Computer Concepts and the Microcomputer**—A videotaped 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 are explained, as well as the more popular applications of their use: word processing, spread sheets, and data bases, in the videotape "Learning Concept: Introduction to Personal Computers." Computer terminology is defined throughout these tapes. There will be opportunity for questions and discussions.  
0 units, Aut, Win, Spr, Sum

**35A. 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

**40A. Introduction to the IBM XT and DOS 3.0**—Presents features distinguishing the XT model, and typical configurations and costs of hardware. Shows how to choose between the XT and the IBM PC. Describes functions and purpose of DOS 3.0, the disk operating system. Discusses daily living with the XT and DOS 3.0, including creating and using batch files to simplify access to programs in subdirectories.  
0 units, Aut, Win, Spr, Sum

**48A,B,C. Introduction to the IBM PC**—For persons who have little or no experience with microcomputers. Part One of the course is a two-hour lecture that introduces IBM PC hardware and software concepts. Emphasis is on "survival skills"—information all PC users should know. Part One also provides brief demonstrations of popular IBM PC software programs. Part Two is an optional hands-on laboratory where students will become familiar 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

**50A. BBC Computer Programme**—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

### II. TEXT EDITING AND FORMATTING

#### A. MAINFRAME

**1A,B. Introduction to WYLBUR**—Introduces WYLBUR, the text editor on the IBM 3084. 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. Demonstrates how to use a terminal to edit, print, and store information. Attendance at one of the ITS orientation seminars required.  
0 units, Aut, Win, Spr, Sum
3A. Accelerated Introduction to WYLBUR — Covers the same material as the Introduction to WYLBUR class, but in half the time. Designed 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. Those without previous computing experience should enroll in the Introduction to WYLBUR. Attendance at one of the orientation seminars required.

0 units, Aut, Win, Spr, Sum

9A. 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. WYLBUR knowledge required.

0 units, Aut, Win, Spr, Sum

52A. 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 will be considered.

0 units, Aut, Spr

59A. Introduction to TeX — TeX is a high-quality typesetting program. Introduces basic TeX concepts and fundamental TeX typesetting commands (the PLAIN TeX macros). Demonstrates elementary page layout and document design with TeX. Intended for those with little or no prior TeX experience. WYLBUR knowledge required.

0 units, To be announced.

B. MICROCOMPUTER

60A. Typography for Microcomputers — Explores 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

III. DATA BASE MANAGEMENT

6A. 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 is on the basic ideas behind SPIRES. Simple applications are developed. Useful for anyone interested in developing a data base application. Basic WYLBUR knowledge and programming concepts required; knowledge of SPIRES searching and updating recommended.

0 units, Aut, Win, Spr, Sum

7A,B. Introduction to SPIRES — Emphasizes 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. Basic WYLBUR knowledge required.

0 units, Aut, Win, Spr, Sum

30A. 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. Introduction to SPIRES, SPIRES Concepts and Facilities, and some programming experience required.

0 units, Aut, Spr

46A. 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. SPIRES Introduction and knowledge of $REPORT format required.

0 units, Aut, Win, Spr

61A. 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. Completion of SPIRES for Programmers class required.

0 units, Win, Sum

IV. JOB CONTROL LANGUAGE

5A. Batch Processing — Explains the batch job system, including basic Job Control Language (JCL) and the WYLBUR commands used to
submit and control batch jobs. Topics include batch processing concepts; syntax of JOB, EXEC, DD, JOBPARM, SETUP, and OUTPUT statements; basic input/output concepts; and disk, tape, and SYSOUT (printer) data set specifications. Covers efficient use of tape and disk; introduces data set utility programs. Knowledge of WYLBUR and of the language and/or package you intend to use required.

0 units, Aut, Spr

V. STATISTICAL APPLICATIONS PACKAGES

The following two courses are offered by ACIS (Academic Computing and Information Systems), in cooperation with ITS.

15A. 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 IBM 3084 and the general structure and capabilities of the SAS language. WYLBUR and Batch Processing knowledge required.

0 units, Aut, Win, Spr, Sum

14A,B. SPSS-X Overview—SPSS-X, the new and greatly enhanced version of the Statistical Package for the Social Sciences, is an integrated system of computer routines used for analysis and management of data. This course is a brief introduction to general formats and conventions of SPSS-X control statements and the Job Control Language (JCL) necessary for running SPSS-X programs on the IBM 3084. WYLBUR and Batch Processing knowledge required.

0 units, Aut, Win, Spr

VI. GRAPHICS

The following course is offered by ACIS, in cooperation with ITS.

47A. 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. WYLBUR, SAS and Batch Processing knowledge required.

0 units, Aut, Spr

VII. APPLICATION PACKAGES

37A. ADMIN: Administrative Applications for the Office—Covers administrative applications available on the IBM 3084 through the ADMIN command. Demonstrates 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. Basic WYLBUR knowledge required.

0 units, Aut, Spr

56A,B. 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. No registration required.

0 units, Aut, Spr

MICROCOMPUTER

62A. Office Applications in Lotus 1-2-3—Applying Lotus 1-2-3 to common office tasks. Introduces data management concepts and techniques. Shows how to decide if 1-2-3 is the right choice for the problem at hand. Examples drawn from budgeting, grant tracking, managing lists of information and micro/mainframe data transfer.

0 units, Aut, Win, Spr, Sum

IX. COMMUNICATIONS/NETWORKS:

24A. 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

The following three courses are offered by ACIS, in cooperation with ITS.

20A. CONTACT/EMS—Introduces basic concepts of electronic mail, with focus on CONTACT/EMS, the system based on Stanford’s IBM 3084. Topics include sending, receiving, filing, retrieving, and “tickling” mail. Special topics include addressing messages by personal name, distribution lists, and an automatic answering feature. Other mail systems will be discussed. Basic WYLBUR knowledge required.

0 units, Aut, Win, Spr

36A. Departmental Networks—Covers the networking of microcomputers and minicomputers within Stanford University’s departments, advantages and disadvantages of networking, network configurations, and industry standards.

0 units, Win

45A,B.C. Micro/Mainframe Communications Using Samson—Emphasizes use of Samson for file transfer between an IBM PC and the IBM 3084 mainframe computer on campus. SAMSON, a computer program developed at ITS, makes an IBM PC work like a terminal connected to the IBM 3084. Basic WYLBUR
knowledge and knowledge of basic microcomputer concepts required.

0 units, Aut, Win, Spr, Sum

63A. Cross-Campus Networks—Explains services available on the Stanford University Network (SUNet), including video and instructional television networks, as well as the interconnection of departmental networks. Covers services available via campus telecommunication equipment.

0 units, Win

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 (Elmer) and a Faculty Author Development (FAD) program to promote the development of instructional software. IRIS cooperates in a Stanford plan to encourage the acquisition and use of personal computers on campus (Microdisc) and administers 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, 497-1055.

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 and main office are located in the Center for Educational Research at Stanford (CERAS) building. Terminal clusters that provide access to LOTS are located in CERAS, Terman Engineering, and Meyer Library. Terminals and 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 at CERAS. 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, Mini-tab, NAg, and IMSL.

LOTS Two operates personal computers that are suitable for word-processing and other purposes; information about these is available at the recreation center desk at Tresidder Union. (LOTS Two also houses other LOTS activities such as the Waterloo Microcomputer Cluster and Project SUNDEC.)

LOTS operates an IBM 4381, two DEC VAX-11/780, and a DECSYSTEM-20 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, 497-3214. 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. The course includes information about obtaining accounts, an introduction to the file system, and a demonstration of the use of the editor to create and run a program.

0 units, Aut, Win, Spr, Sum

10. Introduction to FORTRAN—It is assumed that the student knows FORTRAN already. The particular features of FORTRAN available at LOTS are discussed. Persons not already familiar with FORTRAN should consider taking
the course, Introduction to FORTRAN offered by Information Technology Services (ITS), or 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 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 engaged in the planning, design, and installation 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 exploring opportunities to increase both the speed of communications and Stanford's access to a variety of outside networks and supercomputing centers. Courses on departmental and cross-campus networks are offered in cooperation with Information Technologies Services. For information about these courses, other seminars, and tutorials, contact Networking Systems, 497-3909.

VIDEO EDUCATION SYSTEMS (VES)

Implementing these goals, Video Education Systems, directed by Mary Lou Allen, is charged with developing instructional, research and other institutional capabilities in video and cable television at Stanford. The VES director is also director of the Stanford Instructional Television Network (SITN) thus assuring close cooperation among these activities.

The Special Projects division, directed by Bill H. Washburn, is responsible primarily for the University's Project Ramus, a joint initiative with International Business Machines (IBM) to support innovative applications of computing to the educational process.
PROGRAM IN ACOUSTICS AND NOISE

Chairman: Krishnamurty Karamcheti
Vice Chairman: Daniel Bershader

Professors: Daniel Bershader, I-Dee Chang, Chi-Chang Chao, Krishnamurty Karamcheti (Aeronautics and Astronautics); Gordon S. Kino, Robert L. White (Electrical Engineering); James P. Johnston, Charles R. Steele (Mechanical Engineering); Joseph B. Keller, Harold Levine (Mathematics); Earl D. Schubert (Hearing and Speech Sciences); John M. Chowning (Music); Roger N. Shepard (Psychology); Edwin M. Good (Values, Technology, Science and Society)

Professors (Research): Ronald Alexander (Communications), Bertram A. Auld (Applied Physics)

Lecturer: A. Ahumada (Aeronautics and Astronautics)

Acting Assistant Professor: Elizabeth A. Cohen (Physics)

Consulting Professor: Vincent Salmon (Aeronautics and Astronautics)

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: (a) 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 (b) to make available to students the programs of study essential to acquire some special training in the field of Acoustics and Noise while majoring in their own chosen disciplines or obtain a degree in acoustics under an "Individually Designed Major." 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.

Students who wish to major in Acoustics and Noise may elect to create an Individually Designed Major in that field in consultation with the Program Faculty and the Dean's Advisory Committee on Individually Designed Majors.

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.

UNDERGRADUATE COURSES

AERONAUTICS AND ASTRONAUTICS
135. Introductory Acoustics
136. Introduction to Psychoacoustics
139. Room Acoustics

MECHANICAL ENGINEERING
138. Noise Pollution

PHYSICS
14. Physics of Music

PSYCHOLOGY
102. Perception

VALUES, TECHNOLOGY, SCIENCE AND SOCIETY
165. Technology and Musical Expression
COURSES FOR GRADUATES
AND UNDERGRADUATES

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
252. Acoustic Waves in Solids II

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

GRADUATE COURSES
ELECTRICAL ENGINEERING
323. Acoustic Devices

HEARING AND SPEECH SCIENCES
392. Selected Topics in Psychoacoustics
393. Peripheral Auditory Mechanisms
394. Central Auditory Mechanisms

STATEMENT OF NONDISCRIMINATORY POLICY

Stanford University admits students of either sex and any race, color, or national and ethnic origin to all the rights, privileges, programs, and activities generally accorded or made available to students at the University. It does not discriminate against students on the basis of sex, race, color, handicap, or national and ethnic origin in the administration of its educational policies, admissions policies, scholarships and loan programs, and athletic and other University-administered programs.

TITLE IX OF THE EDUCATION AMENDMENTS OF 1972

It is the policy of Stanford University to comply with Title IX of the Education Amendments of 1972 and its Regulation, which prohibit discrimination on the basis of sex. Sally Mahoney, Associate Provost and Registrar, has been appointed to coordinate the University's efforts to comply with the law. Anyone who believes that in some respect Stanford is not in compliance with Title IX and its Regulations should contact Ms. Mahoney at (415) 497-1550.

REHABILITATION ACT OF 1973

In its programs, activities and employment, Stanford University does not discriminate on the basis of handicap. 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) 497-3483.
These University Publications contain information of general interest. Many Schools and Departments publish pamphlets of a more specific nature, and should be contacted directly for a complete listing.

**About Visiting Stanford**—available at the Admissions Office.

**Academic Staff Handbook**—available at the Provost’s Office.

**Administrative Guide**—(guide to administrative organization, policies, and procedures) inquire at the Controller’s Office.

**A Guide to Archival and Manuscript Collections**—available from Stanford University Archives.

**African Studies**—available at the Center for Research in International Studies.

**Associated Students of Stanford University: Constitution and By-Laws**—inquire at ASSU Office.

**ASSU Course Guide**—(review of selected courses through tabulation of questionnaires) inquire at the ASSU Office.

**Black Students at Stanford**—available at Admissions Office.

**Campus Report**—University’s weekly faculty/staff newspaper: available at the Post Office, Old Union lobby, Tresidder Union, and News & Publications.

**Committee and Senate Handbook**—available at the Academic Secretary’s Office.

**Conference Planning at Stanford**—available at the Conference Office.

**Endowed Professorships at Stanford University**—limited quantity—inquire at the Office of Development.

**Facts: Stanford University**—available at the Office of Development.

**Faculty Handbook**—available at the Provost’s Office.

**Faculty/Staff Directory**—on sale at Stanford Bookstore.

**Financial Aids Information for Entering Undergraduates**—available at Financial Aids Office.

**Food Service at Stanford University: Student Dining Information**—available at the Food Services Office.

**Graduate Division, Stanford University, Application Booklet**—available at the Graduate Admissions Office.

**Graduate Opportunities for Chicano Students**

**Graduate Opportunities for Native American Students**.

**Graduate Opportunities for Minority Students at Stanford University**—available Graduate Admissions Office.

**Access Stanford** (a guide for the physically limited)—available at the Dean of Student Affairs Office.

**Guide to Stanford University Resources for Graduate Students**—available at Dean of Student Affairs Office.

**Information Bulletin**—(general administrative procedures; rules governing withdrawal, leaves of absence; fee listings, etc.)—available at Registrar’s Information Window.

**Information for Prospective Graduate Applicants from Other Countries**—available at Office of Graduate Admissions.

**Information for Prospective Undergraduate Applicants from Other Countries**—available at Admissions Office.

**Interdisciplinary Undergraduate Program in International Relations**—available from the School of Humanities and Sciences.

**Library guides** (available at any major library):

**Guides to the Stanford University Libraries**—(a series of information booklets).

**Libraries of Stanford University (Map)**

**Libraries of Stanford University: Hours for Academic Year 1983-84**

**Selected Facts: Stanford University Libraries**

**Life off the Farm**—on sale at the Rental Housing Office.

**The Lively Arts at Stanford**—current season brochure available at the University Events and Services Office.

**Native Americans at Stanford**—available at the Admissions Office.

**Parents’ Guide to Stanford**—available at the Residential Education Office.

**Public Events Policy and Practices Manual**—inquire at University Events and Services Office.

**Regulations Governing Student Conduct and Procedures for Their Enforcement**—available at the Office of the President.

**Rosters of the Senate, Advisory Board and various committees**—available at the Academic Secretary’s Office.

**Sponsored Projects Manual**—available at Sponsored Projects Office.

**Staff Handbook**—available at Benefits Section, Personnel Office.

**Stanford from the Beginning**—booklet on sale at Visitor Information Office, Memorial Court; Hoover Tower information desk; Bookstore; and Tresidder Union Store.

**Stanford from the Foothills to the Bay**—published by Stanford Alumni Association and the Stanford Historical Society; available at Bowman Alumni House and the Bookstore.

**Stanford Musem**—published by the Stanford Alumni Association.
Stanford Memorial Church—booklet on sale at Stanford Bookstore and Visitor Information Centers located at main entrance to the Quad and in the Hoover Tower lobby.

The Stanford Observer—University’s monthly newspaper: available at News & Publications, free to alumni and parents.


Stanford Para Mi? !Seguro Que Si!—available at the Admissions Office.

Stanford Today—available at Admissions Office.

Stanford University Bulletins:
Available at the Registrar’s Office:
Information

Summer Session
Quarterly Time Schedule
Available at the School or Department:
Hopkins Marine Station
School of Law
Graduate School of Business
School of Medicine
Overseas Studies

Stanford’s Red Barn—booklet published by the Stanford Historical Society. On sale at Visitor Information Office, Memorial Court; Hoover Tower information desk; Bookstore.
COURSES CERTIFIED FOR 1985-86
AS FULFILLING THE
UNDERGRADUATE DISTRIBUTION
REQUIREMENTS

Information regarding the Distribution Requirements may be found in the “Degrees” section of this bulletin, p. 10-12. 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 1985-86. The symbol (*) indicates courses 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 1985-86 which satisfy Distribution Requirements are listed at the end of this section following Area 8.

AREA 1: WESTERN CULTURE

English 7, 8, 9; Literature and the Arts in Western Culture (entire sequence must be completed)

Western Culture 1, 2, 3; Great Works of 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)

VTSS 1, 2, 3; Western Culture and Technology (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; Ancient & 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 & History 65); Medieval Culture & Society
*Asian Languages 91; (same as History 91); Traditional East Asian Civilization
*Asian Languages 110; Japanese-Western Literature & Cultural Interaction
*Asian Languages 114; Haiku
*Asian Languages 131; Chinese Poetry & 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: Middle Period
*Asian Languages 138; Modern Japanese Literature in Translation
*Asian Languages 176; Chinese Myths, Legends, & 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; (same as Drama 151); Greek Tragedy
Classics 21; Comedy and Romance
Drama 1; Introduction to Drama
Drama 2; Introduction to Theatrical Style
Drama 59; (same as English 73); Shakespeare
Drama 150; Contemporary Black American Playwrights
Drama 151; (same as Classic 12); Greek Tragedy
Drama 152; (same as English 142); Medieval & Renaissance Drama
Drama 154; Romantic and Early Realistic Drama
Drama 155; Modern Drama 1800-1918
Drama 157; American Drama since 1920
English 5; Introduction to Literature
English 10; Masterpieces of English Literature I
English 11; Masterpieces of English Literature II
English 12; Masterpieces of American Literature
English 30; Introduction to the Novel
English 40; Introduction to Modern Drama
English 50; Poetry
English 60/160A; The English Bible as Literature
*English 68/168; American Indian Mythology
English 73; (Same as Drama 59); Shakespeare
English 79/179A; Hemingway and Fitzgerald
English 142; (same as Drama 152); Medieval and Renaissance Drama
German Studies 32A/132; Culture of Modernism
German Studies 60A; Introduction to Medieval Literature
German Studies 71A; Modern German Novel
German Studies 83A; Faust in the Western Tradition
German Studies 153; Contemporary Drama
German Studies 154; Modern Short Prose
History 63; (same as Art 65, Medieval Studies 65); Medieval Culture and Society
*History 91; (same as Asian Languages 91); Traditional East Asian Civilization
Italian 146; Dante
Medieval Studies 65; (same as Art 65, History 65); Medieval Culture and Society
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 121; Old Testament
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; Tolstoy
SLE 91, 92, 93; Structured Liberal Education (entire sequence must be taken 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

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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 & 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; American Art 1900-1945
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

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 128; Survey of Italian Literature I: 13th-16th Centuries
Italian 129; 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: 20th Century Latin American Fiction
*Spanish 162; Spanish-American Literature II: Contemporary Latin American Poems and Songs

AREA 3: PHILOSOPHICAL, SOCIAL, AND RELIGIOUS THOUGHT

*Anthropology 21; (same as History 21, Political Science 21) The World Outside the West: Change and Tradition Before the Age of European Imperialism (Anthropology 22 must also be completed)

*Anthropology 22; (same as History 22, Political Science 22) The World Outside the West in the Age of European Imperialism (Anthropology 21 must also be completed)

Anthropology 153; Anthropology of Religion

*Asian Languages 46; (same as Philosophy 46 and Philosophy 120); Introduction to Chinese Philosophy

*Asian Languages 91; (same as History 91); Traditional East Asian Civilization

Biology 51; Scientific Philosophy and Bioethics

Classics 3; Democracy and Imperialism
Classics 8; Classical Politics
Classics 18; Greek Mythology
Classics 65; (same as Philosophy 100); Ancient Philosophy

Classics 138A; (same as History of Science 138A, Philosophy 138A); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 and also satisfies Area 6 when taken in sequence with Classics 138B)

Classics 138B; (same as History of Science 138B, Philosophy 138B); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 and also satisfies Area 6 when taken in sequence with Classics 138A)

Classics 138C; (same as History of Science 138C, Philosophy 138C); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 only)

Economics 100; Economic Theory in Historical Perspective
Economics 120; The Marxist and Radical Tradition
French 115; Introduction to Existentialism
French 290; Civilization I: 17e & 18e siecle
German Studies 33A/133; Culture and Civilization III

*History 21; (same as Anthropology 21, Political Science 21) The World Outside the West: Change and Tradition before the Age of European Imperialism (History 22 must also be completed)

*History 22; (same as Anthropology 22, Political Science 22) The World Outside the West in the Age of European Imperialism (History 21 must also be completed)

*History 91 (same as Asian Languages 91); Traditional East Asian Civilization

History 105A; The History of Socialism and Marxism

History 110; (same as Religious Studies 126); Age of Reformation

History 136; European Thought in the 18th Century

History 136A; European Thought in the 19th Century

History 136B; European Thought in the 20th Century

*History 187A; The Middle East 570-1718

History of Science 138A; (same as Classics 138A, Philosophy 138A); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 and also satisfies Area 6 when taken in sequence with History of Science 138B)

History of Science 138B; (same as Classics 138B, Philosophy 138B); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 and also satisfies Area 6 when taken in sequence with History of Science 138A)

History of Science 138C; (same as Classics 138C, Philosophy 138C); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 only)

History of Science 145; (same as Philosophy 145, VTSS 133); The Scientific Revolution

Humanities 90; Introduction to the Humanities

Philosophy 10; God, Self, and World

Philosophy 20; Introduction to Moral Philosophy

Philosophy 30; Public Morality: Introduction to Political Philosophy

*Philosophy 46; (same as Asian Languages 46, Philosophy 120); Introduction to Chinese Philosophy

Philosophy 60; (same as VTSS 131); Philosophy of Scientific Knowledge

Philosophy 100; (same as Classics 65) Ancient Philosophy

Philosophy 102; Modern Philosophy

*Philosophy 120; (same as Asian Languages 46, Philosophy 46); Introduction to Chinese Philosophy

Philosophy 138A; (same as History of Science 138A and Classics 138A); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 and also satisfies Area 6 when taken in sequence with Philosophy 138B)

Philosophy 138B; (same as History of Science 138B, Classics 138B); Introduction to the Exact Sciences: Cosmology (satisfies
Area 3 and also satisfies Area 6 when taken in sequence with Philosophy 138A)
Philosophy 138C; (same as History of Science 138C, Classics 138C); Introduction to the Exact Sciences: Cosmology (satisfies Area 3 only)
Political Science 21; (same as Anthropology 21, History 21); The World Outside the West: Change and Tradition Before the Age of European Imperialism (Political Science 22 must also be completed)
*Political Science 22; (same as Anthropology 22, History 22); The World Outside the West in the Age of European Imperialism (Political Science 21 must also be completed)
Political Science 50; Freedom and Order in Western Political Thought
Political Science 150; Ancient and Classical Political Thought
Political Science 151; Religion and Political Theory
Public Policy 103; (same as VTSS 110); Philosophical and Ethical Issues in Public Policy
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 31/131/231; Founder in Myth and History
Religious Studies 42; Philosophy of Religion
*Religious Studies 116; Japanese Buddhism
Religious Studies 124B; Christianity to the Year 1000
Religious Studies 126; (same as History 110); Age of Reformation
Religious Studies 147; Modern Christian Thought
Religious Studies 178; American Religious Thought
SLE 91, 92, 93; Structured Liberal Education (entire sequence must be completed and thereby also satisfies Areas 1 and 2)
Sociology 170; Classics of Modern Social Theory
VTSS 110; Philosophical and Ethical Issues in Public Policy (same as Public Policy 103)
VTSS 131; (same as Philosophy 60); Philosophy of Scientific Knowledge
VTSS 132; (same as History of Science 145, Philosophy 145); The Scientific Revolution
VTSS 145; Chemistry and the Life Sciences in Historical and Philosophical Perspective

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AREA 4: HUMAN DEVELOPMENT, BEHAVIOR, AND LANGUAGE

*Anthropology 1/101; Social and Cultural Anthropology
Anthropology 4; (same as Linguistics 55); Language and Culture
Anthropology 5; (same as Human Biology 113 & Linguistics 65); Biology and Evolution of Language
*Anthropology 12; Sex and Gender
*Anthropology 165; Psychological Anthropology

Classes, Greek 51, 52; Intensive Beginning Greek (entire sequence must be completed)
Classes, Latin 51, 52; Intensive Latin (entire sequence must be completed)
Communication 170; Communication and Children
Computer Science 75; (same as Linguistics 35); Computers and Language
Education 215; (same as Psychology 145); Psychological Foundations of Education
English 101; (same as Linguistics 71); Linguistics and Literature
English 102; History of the English Language
English 105; (same as Linguistics 72); Linguistic Approaches to Point of View in Fiction
English 163D; (same as History 163); The Female Experience: Victorian Heritage
German 19A/119; (same as Linguistics 75); Introduction to the Germanic Languages
German 118/218; (same as Linguistics 176); 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)
Human Biology 113; (same as Anthropology 5, Linguistics 65); Biology and Evolution of Language
Linguistics 1; Introduction to Linguistics
Linguistics 35; (same as Computer Science 75); Computers and Language
Linguistics 55; (same as Anthropology 4); Language and Culture
Linguistics 65; (same as Anthropology 5, Human Biology 113); Biology and Evolution of Language
Linguistics 70; The Structure of English Words
Linguistics 71; (same as English 101); Linguistics and Literature
Linguistics 72; (same as English 105); Linguistic Approaches to Point of View in Fiction
Linguistics 73; Black English
Linguistics 75; (same as German 19A/119); Introduction to the Germanic Languages
Linguistics 145; (same as Psychology 146); Language and Thought
Linguistics 176; (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 145); Language and Thought
Psychology 159A; Perception, Cognition, and Music
*Religious Studies 1E; Eastern and Western Conceptions of the Self
Religious Studies 49; Approaches to the Study of Religion
Slavic Languages 1, 2, 3; Beginning Russian (entire sequence must be completed)
Sociology 5; Status, Friendship, and Social Pressure
Sociology 120; Interpersonal Relations
Sociology 122; Introduction to Sociophysiology
Sociology 149; Youth in Modern Society
Spanish 11B, 12B, 13B; Second Year Spanish for Bilinguals (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 & the Black Diaspora
*Anthropology 1/101; Introduction to Sociocultural Anthropology
*Anthropology 3; Human Pre-History
*Anthropology 8; Introduction to China
*Anthropology 11; Sex Roles & Society
Anthropology 15/116; Anthropological Perspectives on American Culture
*Anthropology 21; (same as History 21, Political Science 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 22; (same as History 22, Political Science 22); The World Outside the West in the Age of European Imperialism (satisfies Area 5 and Non-Western Culture; when taken in sequence with Anthropology 21, also satisfies Area 3)
*Anthropology 100; (same as History 80, Latin American Studies 80); Culture, Politics and Society in Latin America
*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 in a Changing World
*Anthropology 115; Peoples of Island Southeast Asia
*Anthropology 117; Chinese Culture and Society
*Anthropology 187; (same as Human Biology 183); Hunter Gatherers & Archaeological Perspectives
*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
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 & Society
Communications 1; Communication and Society
Economics 1; Elementary Economics
Economics 51/51Q; Economic Analysis I
Economics 113; (same as VTSS 121); Technology in a History Perspective
Education 231; (same as Sociology 152, VTSS 155); Contrasting Images of the World Political and Economic Order
German Studies 31A/131; Central Europe: Geography, Institutions, and Society
*History 21; (Same as Anthropology 21, Political Science 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)
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VTSS 170; Work, Technology, and Society

AREA 6: MATHEMATICAL SCIENCES
Classics 138A; (same as History of Science 138A, Philosophy 138A); Introduction to the Exact Sciences: Cosmology (Classics 138A and Classics 138B must be completed and thereby also satisfies Area 3)
Classics 138B; (same as History of Science 138B, Philosophy 138B); Introduction to the Exact Sciences: Cosmology (Classics 138A and Classics 138B must be completed and thereby also satisfies Area 3)
Computer Science 108A; Fundamentals of Computer Science
History of Science 138A; (same as Philosophy 138A, Classics 138A); Introduction to the Exact Sciences: Cosmology (History of Science 138A and History of Science 138B must be completed and thereby also satisfies Area 3)
History of Science 138B; (same as Philosophy 138B/Classics 138B); Introduction to the Exact Sciences: Cosmology (History of Science 138A and History of Science 138B must be completed and thereby also satisfies Area 3)
Linguistics 25; Mathematics for the Study of Language
Mathematics 15; Introduction to Mathematics
Mathematics 19; Calculus and Analytical Geometry
Mathematics 20; Calculus and Analytical Geometry
Mathematics 21; Calculus and Analytical Geometry
Mathematics 22; Calculus and Analytical Geometry
Mathematics 23; Calculus and Analytical Geometry
Mathematics 41; Calculus and Analytical Geometry
Mathematics 42; Calculus and Analytical Geometry
Mathematics 43; Calculus and Analytical Geometry
Mathematics 113, or 113S; Linear Algebra
Operations Research 50; Models and Applications of Operations Research in Society
Philosophy 17; From Philosophy to Mathematics
Philosophy 57; Introduction to Logic

Philosophy 138A; (same as History of Science 138A, Classics 138A); Introduction to the Exact Sciences: Cosmology (Philosophy 138A and Philosophy 138B must be completed and thereby also satisfies Area 3)
Philosophy 138B; (same as History of Science 138B, Classics 138B); Introduction to the Exact Sciences: Cosmology (Philosophy 138A and Philosophy 138B must be completed and thereby also satisfies Area 3)

AREA 7: NATURAL SCIENCES
Anthropology 80; Human Origins
Applied Physics 10; The Nature of Physics and Technology
Applied Physics 15; The Nature of the Universe
Applied Physics 50; Astronomy Laboratory and Observational Astronomy
Applied Physics 100; Introduction to Observational Astronomy and Astronomy Laboratory
Biology 40; Evolutionary Biology
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 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 & 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
Area 8: Technology and Applied Science

Civil Engineering 170; Environmental Science & Technology
Civil Engineering 176; Small Scale Energy Systems
Computer Science 75/Linguistics 35; Computers & 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 - Statistics (Formerly Eng. 3)
Engineering 12, Intermediate Dynamics
Engineering 30; Engineering Thermodynamics
Engineering 35; Automotive Technology
Engineering 40; Basic Electronics
Engineering 50 (Mat Sci 50); Introductory Science of Materials
Linguistics 35; (same as Computer Science 75);
Computers and Language
Operations Research 50; Models and Applications of Operations Research in Society
Operations Research 152; Introduction to Operations Research
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 taken 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 Academic Council members:
Area 8:
ME 180; Energy and Society

B) Courses taught by non-Academic Council members:
Area 2:
OS G 101B; German Theater (also listed as Drama 101B)
OS G 120; New Ways of Seeing (also listed as Art 120)
OS G 122; German Art: Romanticism to New Sobriety (also listed as Art 122)
OS G 123; German Art in the Weimar Republic and Nazi Period (also listed as Art 123)

Area 5:
OS G 127; Social and Cultural Life in Germany (also listed as History 127)
OS G 131; The Two Germanies (also listed as History 131)
OS G 140; The German Federal Republic in the International System (also listed as Political Science 140)
OS G 230A; Berlin: History & Culture (also listed as History 230A)
OS G 230B; Berlin: History & Culture (also listed as History 230B)

Florence

A) Courses taught by Academic Council members:
Area 2:
Art 154; The Art of Sculpture Since 1900
English 182; Images of Italy
English 183; Modern Italian Poetry
Area 5:
History 134A; Europe from World War II to the Present
History 135A/Political Science 121X; U.S. and Western Europe After World War II
OS F 101A; Technology & Modern Society (also listed as VTSS 101A)
OS F 107A; Work and Society in Italy

B) Courses taught by non-Academic Council members:
Area 2:
OS F 111A; Tuscan Art from Giotto to Leonardo
OS F 111B; High Mannerism in Florence, Rome, and Venice
OS F 125A; Masterpieces of Italian Literature through Dante (also listed as Italian 125A)
OS F 125B; Masterpieces of Italian Literature 1300-1500 (also listed as Italian 125B)
OS F 125C; Masterpieces of Italian Literature 1800-1900 (also listed as Italian 125C)
Area 3
OS F 115; Renaissance Florence (also listed as History 115)

Area 5:
OS F 110X; Problems and Issues of Contemporary Italian Politics (also listed as Political Science 110X)
OS F 180; Mediterranean Problems

OXFORD
A) Courses taught by Academic Council members:
Area 2:
English 180; English Literature, English Places
Area 3:
Sociology 151W; Class in British Social Thought
Area 5:
OS O 140V; 19th and 20th Century Perspectives on Gender Difference
Political Science 182X; Reputation in Anglo-American Law
Sociology 131W; English Society in Film and Literature

B) Courses taught by non-Academic Council members:
Area 2:
OS O 140V; History of English Architecture (also listed as Art 176X)
English 254; Contemporary British Theatre
Area 5:
OS O 143A; British History 1780-1870 (also listed as History 143A)
OS O 143B; British History 1870-1970's (also listed as History 143B)
OS O 162; Comparative Approaches to Race and Sex Discrimination
Economics 114; British Economy Since World War II
Economics 115X; Aspects of International Economic Policy
History 142V; Archaeology and the Making of the British Landscape
International Relations 132; Imperialism and Decolonization: The British Commonwealth 1870-1980

TOURS
A) Courses taught by Academic Council members:
Area 2:
French 114T; The Modern French Novel
French 173T; Symbolism

B) Courses taught by non-Academic Council members:
Area 2:
OS T 115T; Literary Existentialism (also listed as French 115T)
OS T 120; History of Arts: The Renaissance in Italy and France
OS T 120B; History of Art: Baroque in France and Europe
OS T 131T; French Literature Survey: 17th and 18th Centuries (also listed as French 131T)
OS T 132T; French Literature Survey 19th Century (also listed as French 132T)
OS T 133T; French Literature Survey: 20th Century (also listed as French 133T)

Area 5:
Political Science 140; France and the Third World
OS T 111X; La politique francaise contemporaine (also listed as Political Science 111X)
OS T 120X; La Politique exterieure de la France (also listed as Political Science 120X)
OS T 130A; Survey of French History to 1789 (also listed as History 130A)
OS T 130B; Survey of French History: 1789-Present (also listed as History 130B)

VIENNA
A) Courses taught by Academic Council members:
Area 2:
OS V 163B; History of Austrian Theater (also listed as Drama 163B)

B) Courses taught by non-Academic Council members:
Area 2:
OS V 50; The Choral Music of Central Europe
OS V 101C. Drama in Vienna Theaters (also listed as Drama 101C)
OS V 167. Contemporary Austrian Literature
OS V 243. Intellectual Scene since 1900

Area 5:
OS V 113X. Poland and Eastern Europe (also listed as Political Science 113X)
OS V 123. Austria and South East Europe from 1526 to the present
OS V 130X. Eastern Europe Since 1945 (also listed as Political Science 130X)
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