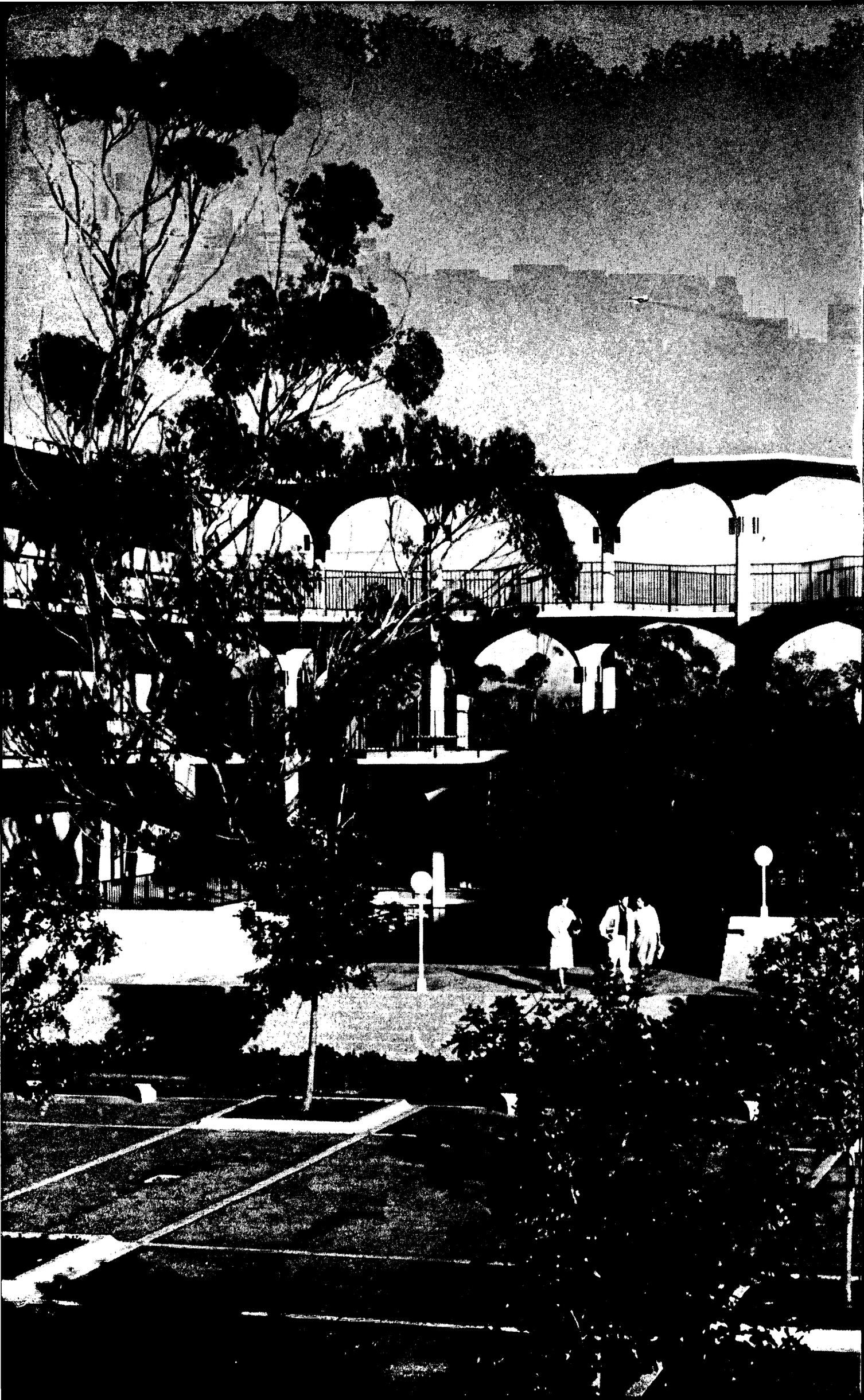
# CATALOG



Price: 50 cents

UNIVERSITY OF CALIFORNIA / SAN DIEGO

# GENERAL CATALOG

REVELLE COLLEGE
MUIR COLLEGE
GRADUATE DIVISION

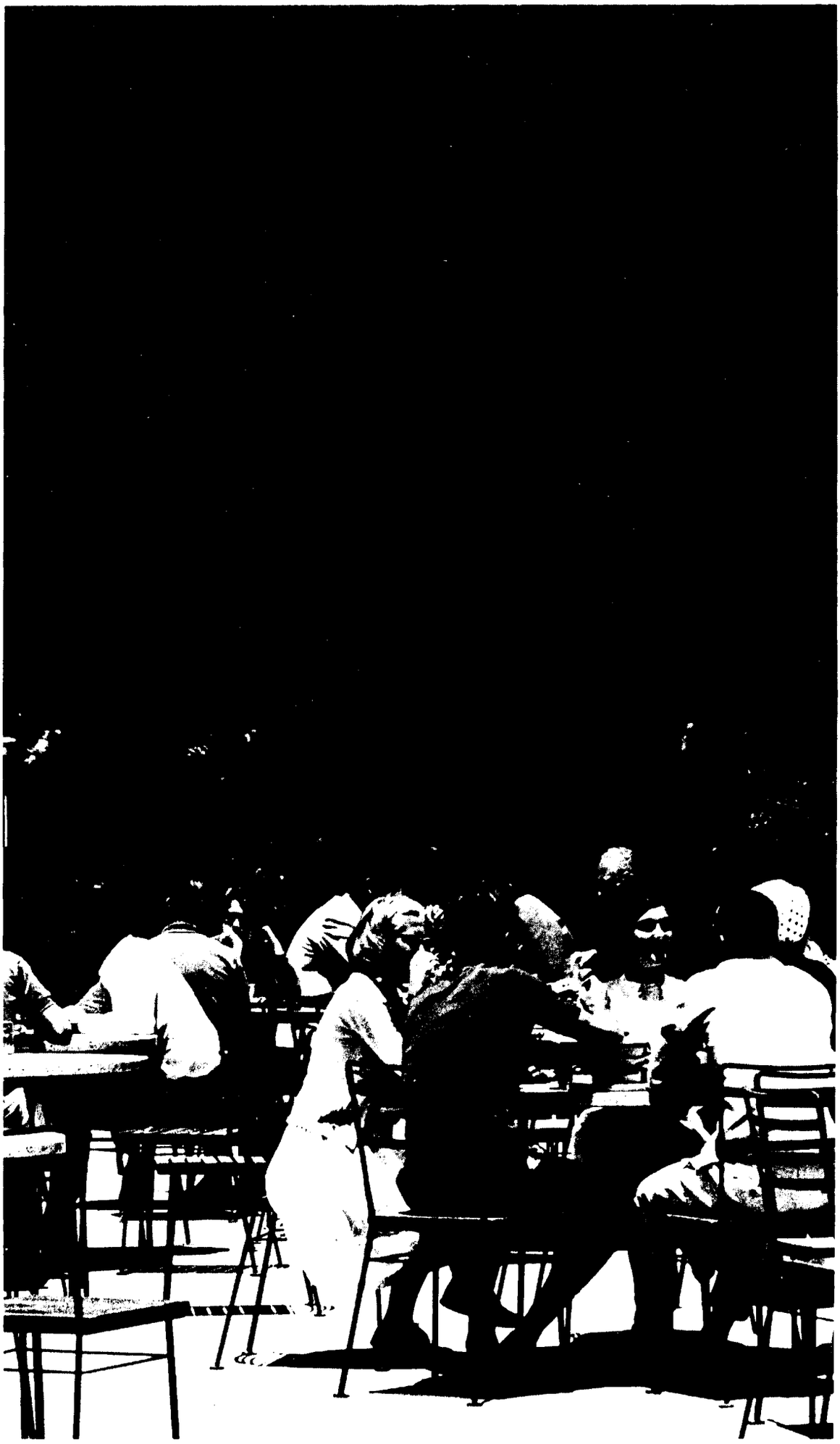
*Fall, Winter, and Spring Quarters, 1966-67*

UNIVERSITY OF CALIFORNIA, SAN DIEGO

POST OFFICE BOX 109

LA JOLLA, CALIFORNIA 92037

*All material herein is subject to change without prior notice.*



The sunlit patio adjacent to the cafeteria and Central Facilities Building

# Academic Calendar 1966-1967

## FALL QUARTER—1966

| | |
|---|---|
| August 15<br>Monday | Last day for filing new applications for admission to graduate status, as well as renewal of applications previously submitted, (fall quarter 1966). |
| August 15<br>Monday | Applications for readmission to graduate status for fall quarter 1966 must be filed with the Registrar on or before this date. |
| August 25<br>Thursday | Applications for readmission to undergraduate status for fall quarter 1966 must be filed with the Registrar on or before this date. |
| September 26<br>Monday | **Fall quarter begins.** |
| September 26<br>Monday | Subject A examination. |
| September 26<br>Monday through<br>September 30<br>Friday | Registration and Orientation week |
| September 28-<br>29-30<br>Wednesday<br>Thursday<br>Friday | Undergraduate enrollment in classes. |
| September 30<br>Friday | Examination in English for new foreign students. |
| September 30<br>Friday | Last day for students to pay fees without penalty. |
| October 3<br>Monday | **Instruction begins.** |
| October 7<br>Friday | Last day to file official Study List Packets without penalty. |
| October 12<br>Wednesday | Last day for students to file official Study List Packets with late fee but without penalty of lapsed status in the University. |
| October 12<br>Wednesday | Last day for late registration. |
| October 14<br>Friday | Last day for adding course(s). Last day for dropping course(s) without fee. |
| October 24<br>Monday | Candidates who expect to complete work for master's degrees to be conferred in December 1966 must file applications for candidacy on or before this date. |

| | |
|---|---|
| October 31<br>Monday | Last day for filing with committee in charge final form of thesis for doctor's degree to be conferred December 1966. |
| November 1<br>Tuesday | Applications for admission to undergraduate standing including applications for intercampus transfer, for the winter quarter 1967 must be filed with complete credentials with the Office of Admissions on or before this date. |
| November 4<br>Friday | Last day to drop course(s) (without penalty of F) with fee. |
| November 15<br>Tuesday | Last day for filing applications for admission to graduate status, as well as renewal of applications previously submitted, (winter quarter 1967). |
| November 24<br>Thursday | **Thanksgiving holiday—academic and administrative holiday.** |
| November 25<br>Friday | |
| November 28<br>Monday | Dissertation for the doctor's degree to be conferred in December 1966 must be filed with the committee in charge on or before this date. |
| December 5<br>Monday | Applications for readmission to graduate status for winter quarter 1967 must be filed with the Registrar on or before this date. |
| December 9<br>Friday | Last day for graduate students to file notice of withdrawal for the fall quarter. |
| December 10<br>Saturday | **Instruction ends.** |
| December 12<br>Monday | Applications for readmission to undergraduate status for winter quarter 1967 must be filed with the Registrar on or before this date. |
| December 12<br>Monday through<br>December 17<br>Saturday | **Final examinations.** |
| December 16<br>Friday | Last day for filing with the Office of the Registrar completed copies of thesis for master's degree and dissertation for the doctor's degree to be conferred December 1966. |
| December 16<br>Friday | Last day for filing degree name card. |
| December 17<br>Saturday | **Fall quarter ends.** |
| December 23<br>Friday | **Christmas holiday—academic and administrative holiday.** |
| December 26<br>Monday | |
| December 30<br>Friday | **New Year's holiday—academic and administrative holiday.** |
| January 2<br>Monday | |

# WINTER QUARTER—1967

| | |
|---|---|
| January 3<br>Tuesday | **Winter quarter begins** |
| January 4<br>Wednesday | Registration. |
| January 4<br>Wednesday | Examination in English for new foreign students. |
| January 4<br>Wednesday | Last day for students to pay fees without penalty. |
| January 5<br>Thursday | **Instruction begins.** |
| January 11<br>Wednesday | Last day to file official Study List Packets without penalty. |
| January 13<br>Friday | Last day for students to file official Study List Packets with late fee but without penalty of lapsed status in the University. |
| January 13<br>Friday | Last day for late registration. |
| January 17<br>Tuesday | Last day for adding course(s). Last day for dropping course(s) without fee. |
| January 30<br>Monday | Candidates who expect to complete work for master's degrees to be conferred in March 1967 must file applications for candidacy on or before this date. |
| February 1<br>Wednesday | Applications for admission to undergraduate standing including applications for intercampus transfer, for the spring quarter 1967 must be filed with complete credentials with the Office of Admissions on or before this date. |
| February 6<br>Monday | Last day for filing with committee in charge, final form of thesis for doctor's degree to be conferred March 1967. |
| February 7<br>Tuesday | Last day for filing applications for admission to graduate status, as well as renewal of applications previously submitted, (spring quarter 1967). |
| February 8<br>Wednesday | Last day to drop course(s) (without penalty of F) with fee. |
| February 13<br>Monday | **Lincoln's Birthday—academic and administrative holiday.** |
| February 15<br>Wednesday | Dissertation for the doctor's degree to be conferred in March 1967 must be filed with the committee in charge on or before this date. |
| February 15<br>Wednesday | Applications for readmission to graduate status for spring quarter 1967 must be filed with the Registrar on or before this date. |

| | |
|---|---|
| March 1<br>Wednesday | Applications for admission to undergraduate standing including applications for intercampus transfer, for the fall quarter of 1967 must be filed with complete credentials with the Office of Admissions on or before this date. |
| March 10<br>Friday | Last day for graduate students to file notice of withdrawal for the winter quarter. |
| March 11<br>Saturday | **Instruction ends.** |
| March 11<br>Saturday | Applications for readmission to undergraduate status for spring quarter 1967 must be filed with the Registrar on or before this date. |
| March 13<br>Monday thru<br>March 18<br>Saturday | **Final examinations.** |
| March 17<br>Friday | Last day for filing with the Office of the Registrar completed copies of thesis for master's degree and dissertation for the doctor's degree to be conferred March 1967. |
| March 17<br>Friday | Last day for filing degree name card. |
| March 18<br>Saturday | **Winter quarter ends.** |

## SPRING QUARTER — 1967

| | |
|---|---|
| March 27<br>Monday | **Spring quarter begins.** |
| March 27<br>Monday and<br>March 28<br>Tuesday | Registration |
| March 28<br>Tuesday | Examination in English for new foreign students. |
| March 28<br>Tuesday | Last day for students to pay fees without penalty. |
| March 29<br>Wednesday | **Instruction begins.** |
| April 4<br>Tuesday | Last day to file official Study List Packets without penalty. |
| April 6<br>Thursday | Last day for students to file official Study List Packets with late fee but without penalty of lapsed status in the University. |
| April 6<br>Thursday | Last day for late registration. |
| April 14<br>Friday | Last day for adding course(s). Last day for dropping course(s) without fee. |

| | |
|---|---|
| May 1<br>Monday | Last day for filing with committee in charge, final form of thesis for doctor's degree to be conferred June 1967. |
| May 5<br>Friday | Last day to drop course(s) (without penalty of F) with fee. |
| May 8<br>Monday | Dissertation for the doctor's degree to be conferred in June 1967 must be filed with the committee in charge on or before this date. |
| May 30<br>Tuesday | **Memorial Day—academic and administrative holiday.** |
| June 6<br>Tuesday | Last day for graduate students to file notice of withdrawal for the spring quarter. |
| June 6<br>Tuesday | Last day for filing with the Office of the Registrar completed copies of thesis for master's degree and dissertation for the doctor's degree to be conferred June 1967. |
| June 6<br>Tuesday. | **Instruction ends.** |
| June 6<br>Tuesday | Last day for filing degree name card. |
| June 7<br>Wednesday through<br>June 13<br>Tuesday | **Final examinations.** |
| June 13<br>Tuesday | **Spring quarter ends.** |

Architects model of Central University Library scheduled for 1969 occupancy

# Contents

Humanities-Library Auditorium lecture by Philosophy Professor H. Marcuse

# The University of California

The University of California was founded nearly a century ago – in 1868 – by act of the State Legislature. It is a unique institution made up of nine campuses strategically located throughout the state. The first of these campuses to be established was that at Berkeley, and during the years the others have followed: at Los Angeles, Davis, San Francisco, Santa Barbara, Riverside and, most recently, San Diego, Irvine and Santa Cruz.

Any qualified student may obtain an education at the University of California. Instruction in the arts and sciences as well as fundamental training for many of the professions is available to him. At present, there is a choice of some two hundred curricula and majors that lead to degrees, certificates or credentials. Each year approximately eight thousand students earn degrees at the bachelor or first professional level and another three thousand earn advanced degrees.

All campuses of the University operate on the quarter system. Through the University Education Abroad program, undergraduates have an opportunity for study in universities overseas. In addition to the regular academic offerings on the various campuses, the University also conducts extensive adult education programs (University Extension) and agricultural services (Agricultural Extension) throughout the state.

## ADMINISTRATION OF THE UNIVERSITY

The organization and government of the University is entrusted, under the State Constitution, to The Regents of the University of California. This Board is composed of twenty-four members, sixteen of whom are appointed by the Governor and eight of whom are *ex officio* by reason of the public offices they hold. The executive head of the University, in all its departments and on all its campuses, is the President. He and his staff direct the development of major policy for the entire institution. The Board of Regents appoints the President and he is directly responsible to them. On each campus the chief administrative officer is the Chancellor, also appointed by The Regents. He and his staff are in charge of all activities on their particular campus.

Subject to the approval of The Board of Regents, the conditions for the admission of students and the granting of degrees and certificates are determined by the Academic Senate. The Senate, which is composed of the faculty and certain administrative officers, also authorizes and supervises all courses of instruction in the academic and professional schools and colleges of the University.

# THE SAN DIEGO CAMPUS

## The Setting

The University of California, San Diego is situated near the northern limits of the city of San Diego. Occupying nearly 1,000 acres, the campus site spreads from the sea front, where the Scripps Institution of Oceanography is located, across a large portion of the adjacent Torrey Pines Mesa high above the Pacific Ocean. Much of the land is wooded; to the east and north lie mountains, to the west the sea.

San Diego is California's oldest and third largest city, with a metropolitan-area population of just over one million. It has much to offer UCSD students in the way of cultural and recreational activities.

Within the city, and easily accessible to the campus, are scores of public beaches, including those of Mission Bay, an area that is being developed into one of the finest aquatic centers in the world. The nearby mountains offer skiing in the winter; hiking and camping the year around. Just beyond the mountains the vast and beautiful desert stretches to the Colorado River.

In downtown San Diego is Balboa Park, one of the largest city parks in the country and home of the world-famous San Diego Zoo. Fine arts, natural history and other museums are located in this park. And here, also, stands the Old Globe Theatre, a replica of an Elizabethan playhouse, where community theater is offered throughout the year and the renowned National Shakespeare Festival is held each summer.

The recently completed Community Concourse, featuring a 3,000 seat civic theater and extensive convention and exhibition facilities, is located in the heart of the city, offering residents and visitors major Broadway productions and providing a beautiful new home for the San Diego Symphony.

A major sports stadium, under construction in nearby Mission Valley, will provide playing fields for San Diego's major league football and Triple-A baseball teams. An indoor sports arena, under construction near Mission Bay, will soon house professional basketball and ice hockey teams.

The city's attractions are many and varied. Theater, museums, music, art, sports – all are available in San Diego.

## Early Days

The San Diego campus of the University of California had its origins in the closing years of the 19th century when Berkeley zoologists selected La Jolla as the site for a marine station on the Pacific. This project, which eventually became the Scripps Institution of Oceanography, was made a part of the University of California in 1912. When, in the late 1950's, it was decided to establish a general campus of the University at San Diego, the Scripps Institution – with its distinguished though small staff of scientists – formed the nucleus for the new enterprise.

At first, only graduate studies and degrees in the physical sciences were offered. In the fall of 1964 the campus opened for undergraduates, offering a basic lower division curriculum preparing students for upper division majors in the humanities, the social sciences, the biological sciences, the physical sciences and mathematics.

The San Diego campus is expected to reach maximum growth by 1995, with a student enrollment of 27,500. By that time twelve interrelated colleges will have been established, each of which will accommodate approximately 2,300 students and provide a wide variety of both undergraduate and graduate programs. The idea behind this plan is to give students and faculty the opportunity of working in desirably small academic units while at the same time enjoying the advantages of a major university.

John Walsh, a nationally known writer of science, wrote recently in *Science:* "The idealism, self-confidence, and academic daring in evidence at San Diego should make the University in the coming years one of the most interesting experiments in American higher education."

Scholars and researchers of international reputation have been attracted to the UCSD faculty, which now includes two Nobel laureates and eighteen members of the National Academy of Sciences. The University's graduate students are drawn from the upper ranks of the nation's finest colleges and universities and from institutions of comparable standing throughout the world. The San Diego campus offers its students an opportunity for intimate association with some of the greatest names in American education today.

## Revelle College

Of the twelve colleges planned for the San Diego campus, only Revelle College is currently in operation. Muir College will admit its initial class in the fall of 1967.

Revelle College was named in honor of Dr. Roger Revelle, former University-wide Dean of Research, and for many years Director of the University's Scripps Institution of Oceanography. Dr. Revelle received his Ph.D. in Oceanography from the University of California in 1936 and joined Scripps as Professor of Oceanography in 1948. He was named Director of Scripps in 1950 and University Dean of Research in 1962. He resigned his post of Director and as Dean in September, 1964. During his long association with Scripps he saw it develop into the largest oceanographic institution in the world and was the first alumnus to become its Director.

Revelle College, formerly called the School of Science and Engineering and later The First College, was established in 1958 on the San Diego campus. After being temporarily housed at the water's edge in buildings on the Scripps campus, the first buildings of Revelle College were completed and occupied during the 1963-64 academic year.

In 1960 Revelle College began a graduate program in the physical sciences. From that beginning, it has rapidly been developing its humanities and social science programs. Today, research ranges from the problems of cosmochemistry to studies in 17th century philosophy. The teaching program reflects a broad spectrum of learning—with offerings in aerospace and mechanical engineering sciences, applied electrophysics, biology, chemistry, earth sciences, economics, fine arts, languages, literature, mathematics, philosophy, physics and psychology. Other programs, including anthropology and history, are in the process of development.

## Muir College

Muir College is presently being formed in buildings at Camp Matthews, a former Marine Corps rifle range now part of the UCSD campus. The college was named for John Muir, the famed California geologist, explorer and naturalist.

Muir was born in Dunbar, Scotland, in 1838 and was educated in Scotland and the University of Wisconsin. He pioneered in the exploration of the Sierra Nevada Mountains and also explored in Alaska and the Arctic regions. He labored many years in the cause of forest preservation and toward the establishment of national parks and forests. He was awarded an honorary degree from the University of California in 1913. Muir made his home in Martinez, California, where he died in 1914.

Instruction will begin at Muir College in the fall of 1967 at Camp Matthews. About two years later, students, faculty and administration will move to new permanent buildings located directly north of Revelle College.

The general education requirements will include a three-term sequence of courses on the cultural tradition of a nation. Students will be offered a choice among three western cultures, an oriental culture, and an ancient culture.

Central to the scheme of Muir College will be an emphasis on student responsibility for developing academic patterns relating to the individual's interests. There will be opportunity for self-education, independent study, and direct participation by undergraduates in research and creative work.

## The Scripps Institution of Oceanography

The Scripps Institution was originally an independent biological research laboratory. It became an integral part of the University in 1912 and at that time was given the Scripps name in recognition of the interest and financial support of Miss Ellen Browning Scripps and Mr. E. W. Scripps. The scientific scope of its research has grown to embrace physical, chemical, geological and geophysical studies of the oceans as well as biological studies. Continuing investigations are conducted of the topography and composition of the ocean bottom, of waves and currents, and of the flow and interchange of matter between seawater and the ocean bottom or the atmosphere. Its own research ships have extended the geographic scope from the Institution's beach and the adjacent coastal waters to all of the world's oceans.

The education program has grown hand-in-hand with the research program. Instruction is on the graduate level only and students are not usually admitted except as candidates for the Ph.D. Although there is a rapid rate of increase, there are less than a thousand persons currently active as marine scientists, of whom a significant portion are Scripps graduates. Their studies are marked by a high degree of interdisciplinary and international collaboration. Many nationalities are represented among the staff and student body.

The Institution has eight oceanographic research vessels. Their cruises vary from local, limited-objective trips to far-reaching expeditions designed to gather a variety of data on relatively unexplored tracks. In 1962 and 1963 two Scripps ships circumnavigated the globe in opposite directions and joined en route for seismic refraction studies of the Earth's crust under the Indian Ocean. A third ship made a cruise around the world in 1964.

The academic departments associated with the Institution are the Departments of Oceanography, Marine Biology and Earth Sciences. The 30 professors are complemented by an academic staff of 90 research scientists, many of whom have a regularly scheduled part in the instructional program.

Investigations supported by contracts and grants funded from extra-University sources, primarily Federal, cover a wide latitude of marine research. The general research effort is conducted by three Divisions, designated Oceanic Research, Marine Biology, and Earth Sciences. The diversity of their work is extended by three Federally-sponsored laboratories: the Marine Physical Laboratory, the Physiological Research Laboratory, and the Visibility Laboratory, and by the Marine Life Research Group sponsored by the State of California.

Organizationally separate, but sharing close affiliation and proximity with Scripps, are the University of California's Institute of Geophysics and Planetary Physics and Institute of Marine Resources. The headquarters laboratory of the U.S. Bureau of Commercial Fisheries, Fishery-Oceanography Center and the Inter-American Tropical Tuna Commission both occupy a new laboratory recently built by the Bureau on the San Diego campus.

The combination of a large scientific staff and extensive facilities provides an extraordinary opportunity for the small student body (approximately one hundred) to enjoy close contact with existing oceanographic concepts and active participation in research.

## The School of Medicine

The University of California, San Diego is planning a new school of medicine that will enroll its first class in September, 1968. Plans call for a progressive increase to an entering class size of 96 students.

UCSD School of Medicine will offer a unique, experimental curriculum that will emphasize close affiliation with the general campus and maximum flexibility. The first year will be taught primarily by faculty members from the graduate departments at UCSD with graduate students and medical students taking the same course in cell biology. Formal demonstration laboratories for first-year medical students will be replaced by rotation through various research laboratories similar to that given to first-year graduate students in biology. Opportunities in research will be enhanced by the uniquely integrated relationship with the faculty in the graduate Departments of Biology, Chemistry, Physics, Mathematics and the behavioral and social sciences. At least 20 percent of the student's time will be free to pursue research or other elective activities.

The second-year curriculum will introduce the student to organ structure and function in health and disease and will also include an integrated course in the neurosciences, and courses in pathogenic microbiology and pharmacology. During this year, students will be assigned to 24-man multidiscipline laboratories where they will be supervised by instructors from various departments of the School of Medicine.

During the third year, students will be introduced to the tools of clinical medicine and will pursue a core clinical curriculum at the three hospital facilities which will be operated by, or affiliated with, the School of Medicine. This

will allow a fourth year which will be largely elective and which should allow a student to pursue his individual interests by taking medical or surgical clerkships, clinical or basic science electives, or continued research.

### Selection Factors

Selection will be based on the applicant's scholastic record, letters of recommendation, performance on the Medical College Admission Test and a personal interview.

A catalogue containing complete information on the School of Medicine will be published at a future date.

### Programs for Prospective Medical Students

UCSD offers no special premedical program. An undergraduate student considering medicine as a career may choose any program leading to the Bachelor of Arts degree, provided that he elects those additional courses which the medical schools of his choice require for admission. This is complicated by the fact that different medical schools have somewhat different admission requirements. All medical schools require courses in general physics, inorganic chemistry, mathematics, the humanities, and the social and behavioral sciences with most schools requiring additional work in chemistry and biology. The program of a major in biology at UCSD should satisfy the admission requirements of almost all medical schools.

## The Computer Center

The UCSD Computer Center operates a large computer system which is used by students and staff for instruction and research. Most students and staff do their own programming. Actual operation of the computer system is performed by a staff of professional computer operators. Programming consultants are available to answer questions on programming.

Non-credit programming courses are conducted frequently. Numerical analysis and programming courses are offered by the Mathematics Department.

The Computer Center is engaged in research involving numerical analysis, systems programming and information retrieval. A computation seminar is conducted regularly on computers, numerical analysis, and related subjects.

## The University Library

The Library of the University of California, San Diego consists of the General Collection, the Science and Engineering Library, the Scripps Institution of Oceanography Library, and the Biomedical Library. By the fall of 1966 the Library will contain 350,000 volumes and will receive 9,000 periodicals and other serial publications.

The General Collection consists of a basic library covering all subject fields and specialized graduate collections in most areas of the humanities and social sciences. A major portion of the Library's special collections of rare and valuable books, including collections of D. H. Lawrence, Ernest Hemingway and a rapidly developing Baja California Collection, has been donated by the Friends of the UCSD Library.

The Science and Engineering Library contains strong collections in aeronautics, astrophysics, atomic energy, chemistry, electronics, engineering, instrumentation, mathematics, missiles research, physics and space sciences.

The Biomedical Library has been established to serve the School of Medicine and the health-related sciences. More than 10,000 volumes per year are being added to this Library.

The Scripps Institution of Oceanography Library has outstanding collections in oceanography, marine biology and underseas technology, and also specializes in geology, geophysics and zoology publications.

## The Institute of Geophysics and Planetary Physics

The San Diego branch of the University-wide Institute of Geophysics was established in 1960. Present research activities emphasize the study of microseismic waves on land and on the sea bottom, normal modes of the Earth, turbulence of the oceans and atmosphere, ocean waves and ocean tides and ionospheric disturbances of the electric field gradient.

The Institute does not grant degrees, but makes its facilities available to graduate students from various departments who have chosen to write their dissertations on a problem of the Earth. Members of the Institute staff now hold joint appointments with the Departments of Earth Sciences, Physics, Chemistry and Oceanography.

## The Institute of Marine Resources

This is a University-wide institute, devoted to fostering research and investigations into the resources of the sea. With its headquarters on the San Diego campus and a wide interest in the biological, geological, physical and socioeconomic aspects of marine resources, its activities offer many opportunities to graduate students.

## The Institute for the Study of Matter

The departments of Physics, Chemistry and Earth Sciences participate in the Institute for the Study of Matter. Research activities are concerned with the behavior of extremely pure metals at all temperatures, particularly very low and very high temperatures.

## The Institute for Radiation Physics and Aerodynamics

The departments of Mathematics, Aerospace and Mechanical Engineering Sciences, Physics, Chemistry and Applied Electrophysics participate in the Institute for Radiation Physics and Aerodynamics. The Institute, established by The Regents in 1964, is an interdisciplinary research unit for research and graduate training in aerospace sciences, hydrodynamics, atomic and molecular physics, spectroscopy and radiation transport and numerical methods.

The Institute's research is particularly concerned with phenomena which occur in ionized media at high temperatures and high energy densities.

## Education Abroad Program

The Education Abroad Program offers opportunities to undergraduate students of the University of California to study in universities overseas. It is administered for the entire University by the Santa Barbara campus and serves as a focal point of information on all types of educational exchange experiences. A bulletin entitled *University of California Abroad* is published periodically and is distributed to all of the campuses of the University.

The University operates study centers in France, Germany, Italy, Japan, Spain, Colombia, Hong Kong and the United Kingdom.

Eligibility requirements are: junior standing in the University, two years of university-level work in the language of the country with a B average (or the equivalent thereof), an overall B average, seriousness of purpose, and an indication of ability to adapt to a new environment. Transfer students are eligible if they meet the language requirement and have completed at least one language course in the University of California. (The language requirement is not applicable to the centers in Hong Kong, Japan and the United Kingdom).

The participants will spend from nine to eleven months abroad. This includes a special orientation program, six or seven weeks of intensive language preparation, a full academic year in the university of their choice, and some vacation travel. All students will be concurrently enrolled at the University of California and in the host university and will receive full academic credit for courses satisfactorily completed.

An effort is made by The Regents to bring this year abroad within the reach of all students, regardless of their financial resources. Applications for 1967-68 will be accepted on or after October 7, 1966.

## University Extension

University Extension makes available the resources of the University on a state-wide basis to individuals and organizations. Extension programs are organized around the following educational aims: (1) the intellectual and cultural development of adults; (2) the dissemination of new knowledge resulting from teaching and research activities within the University; (3) the continuing education of scientific, technical, and professional personnel; (4) the development of special educational programs for public and private organizations and agencies; and (5) public affairs education through programs designed to aid adults in meeting their responsibilities as citizens.

A variety of methods are used to implement these aims: classes, discussion groups, correspondence courses, conferences, institutes, short courses, lectures, motion picture production, radio broadcasts, educational television, and vocational counseling and testing (Santa Barbara and Los Angeles only).

Veterans may use the educational benefits available to them under Federal and State laws to enroll in University of California Extension classes, provided the classes are part of their prescribed and recognized objectives approved by the Veterans Administration.

For detailed information on University Extension, local or statewide, write or telephone University Extension, University of California, San Diego, P.O. Box 109, La Jolla, California 92037. Telephone 453-2000, extension 1371.

# Admission to the University of California

## UNDERGRADUATE

The admission requirements of the University are based on two principles:

1. That the best assurance of success in the University is shown by high quality of scholarship in previous work.
2. That the study of certain specified subjects will give the student both good preparation for study in the University and reasonable freedom in choosing his field of specialization.

All communications concerning undergraduate admission should be addressed to the Office of Admissions, Room 2112, Urey Hall, University of California, San Diego, La Jolla, California 92037.

## Application for Admission

An application for admission should be filed with: Office of Admissions, Room 2112, Urey Hall, University of California, San Diego, La Jolla, California 92037.

Application forms may be obtained from the Office of Admissions during the periods listed below. The applicant is urged to apply early in the filing period to avoid unnecessary delays in the processing of his application.

Undergraduate applications, including intercampus transfers, must be filed for the fall quarter between October 1 and March 1, for the winter quarter between May 1 and November 1, and for the spring quarter between August 1 and February 1. A summer quarter is not offered at the present time at San Diego.

Admission requirements are uniform on all campuses of the University. Admission entitles the student to attend the campus of his choice if the required facilities are available. Since applications will be processed and acted upon in only one Office of Admissions, applications should not be directed to more than one campus.

If after an applicant has filed for admission his plans change and he prefers to register on a different campus, he must write to the Director of Admissions, 570 University Hall, University of California, Berkeley, California 94720, indicating the campus where he now wishes to register and the reason for his change. His records will be transferred to the campus he wishes to attend provided facilities are available there. Such requests must be received within the filing periods shown above. These filing periods apply to *all* undergraduate applicants (regular, special, limited, second degree and intercampus transfer).

## Application Fee

A nonrefundable fee of $10.00 is charged for each application for admission filed. Remittance by bank draft or money order, payable to *The Regents of the University of California,* must be attached to the application.

## Transcripts of Record

Each applicant is responsible for requesting the graduating high school and each college attended to send promptly official transcripts of record directly to the Office of Admissions where his application is on file.

Those applying as entering freshmen should ask the high school to submit as soon as possible preliminary transcripts showing the complete record through the sixth semester and listing courses in progress or planned. In every case, a final transcript including a statement of graduation and listing courses and grades for the seventh and eighth semesters will be necessary.

Those applying in advanced standing should arrange for the graduating high school to send immediately to the Office of Admissions a complete and final transcript including a statement of graduation. Transcripts from the last college attended should include a statement of good standing or honorable dismissal. A preliminary transcript should show work in progress.

Any additional schools attended after an application for admission has been filed are considered to be part of the applicant's record and must be reported to the Office of Admissions. Transcripts and other documents submitted become the property of the University and cannot be returned.

## Notification of Admission

Applicants for admission to the fall quarter will be notified regarding admission beginning about January 15, and most will have been notified by April 15. Applicants for the winter and spring quarters will be notified as soon as possible following receipt of all appropriate transcripts. (Delays may occur if required documents or fees have not been received by the Office of Admissions).

Those admitted will be required to return a *statement of intention to register,* together with a nonrefundable fee of $25.00, which will be credited to the incidental fee if the student registers in the quarter for which he applied.

## Failure to Register

An applicant who is not eligible for admission or one who has been admitted but fails to register in the term for which he applied, and who thereafter desires to attend the University, must submit a new application for admission, with a $10.00 fee.

## Subject A: English Composition

Every undergraduate is required to demonstrate an acceptable level of ability in English composition. This requirement (Subject A) may be met by:

1. Passing the Subject A examination given on campus at the opening of each quarter and at testing centers on the last Saturday in April, or

2. Achieving a score of 600 or higher in the College Entrance Examination Board Achievement Test in English composition after completion of the eleventh grade in high school, or

3. Entering the University with credentials showing the completion of an acceptable college-level course in composition with a grade of C or better. Exemption from Subject A requirement is determined by the Admissions Office.

Those students who fail the examination or do not otherwise meet the requirement must enroll in the non-credit course in Subject A during the first quarter in residence. A fee of $45 is charged for the course.

## Preparation for University Work

In addition to the high school subjects required for admission to the University, certain preparatory subjects are recommended for many University curricula to give the student an adequate background for his chosen field of study. Lack of a recommended high school course may delay graduation from the University. Details of these recommendations will be found in the bulletin, *Prerequisites and Recommended Subjects,* which is ordinarily in the hands of high school and junior college counselors and which may be obtained from the campus Office of Admissions or the University Dean of Educational Relations, University Hall, University of California, Berkeley, California 94720.

A student needing additional preparation is advised to attend one of the many excellent California junior colleges. There he can take courses applicable toward the requirements of the college or school of the University in which he wishes to enroll.

## Admission to Freshman Standing

An applicant for admission to freshman standing is one who has not registered in regular session in any college-level institution since graduation from high school.

If, at the time of high school graduation, the applicant does not meet the requirements given below for admission to freshman standing or does not qualify by examination, he must meet the requirements for admission to advanced standing. An exception to this regulation will be made only if the student's deficiency was the result of his not having studied one or more required high school subjects. Such a student can sometimes remove the deficiency during the summer; he should consult the Office of Admissions in advance.

The College Entrance Examination Board Scholastic Aptitude Test and Achievement Tests are not requirements for admission. However, applicants for admission as entering freshmen are urged to offer a full set of aptitude and achievement tests in order (1) to assist in counseling and placement, (2) to fulfill the Subject A requirement, or (3) to meet the requirements for admission by examination.

## Requirements for Admission to Freshman Standing

An applicant for admission to freshman standing must meet the requirements listed below.

### Graduation From High School

An applicant who has been graduated from a California high school with the required scholarship average in the prescribed courses will be admitted to the University. When a resident of California has been graduated from a high school outside California, the acceptability of the record is determined by the Office of Admissions.

## Subject Requirements

### A. HISTORY, 1 UNIT

This must consist of 1 unit of United States History, or one-half unit of United States History and one-half unit of civics or American Government.

### B. ENGLISH, 3 UNITS

These must consist of three units of English composition, literature, and oral expression.

### C. MATHEMATICS, 2 UNITS

These must consist of two units of subjects such as elementary algebra, geometry, trigonometry, calculus, elementary functions, matrix algebra, probability, statistics, or courses combining these topics, but excluding arithmetic and such nonacademic subjects as shop mathematics and business mathematics.

### D. LABORATORY SCIENCE, 1 UNIT

This must consist of an eleventh- or twelfth-grade year course in one laboratory science. Both semesters must be in the same subject field.

### E. FOREIGN LANGUAGE, 2 UNITS

These must be in one language. Any foreign language with a written literature is acceptable.

### F. ADVANCED COURSE, 1 (OR 2) UNITS

This must be chosen from the following:
Mathematics, a total of 1 unit of second-year algebra, solid geometry, trigonometry, or an advanced course for which trigonometry is a prerequisite. Foreign language, either 1 additional unit in the same foreign language offered under *e* or 2 units of another foreign language. Science, 1 unit of either chemistry or physics in addition to the science offered under *d*.

### ELECTIVES

Additional elective units to complete the minimum of 15 standard entrance units are also required.

## Scholarship Requirements

At least a B average is required in courses taken after the ninth year used to meet the subject requirements. Grades received in elective courses or in courses taken in the ninth year or earlier are not used in computing this average. Subject requirements are satisfied by courses in which a grade of C or higher has been assigned. Grades are considered on a semester basis except from schools that give only year grades. Grades are accepted as they appear on the transcript.

In determining the B average, a grade of A in one course will be used to balance a C in another, but an A may not be used to compensate for D, E, or F grades.

Courses taken in the ninth year or earlier in which a grade of D or lower is received may be repeated to establish subject credit.

Courses taken after the ninth year in which a grade of C or lower is received may be repeated to establish subject credit or to improve scholarship. Grades earned in the first repetition may be used to satisfy scholarship; grades of C or higher in additional repetitions will satisfy the subject requirement, but will not be counted higher than a C in scholarship computation.

Courses may be repeated in an amount not to exceed 2 units of the *a* to *f* pattern.

## Admission By Examination

An applicant ineligible for admission to freshman standing on the basis of his high school record, and who has not attempted college work subsequent to high school (except during the summer session immediately following graduation), may qualify for admission by examination.

The University does not offer entrance examinations but accepts the results of examinations given by the Educational Testing Service for the College Entrance Examination Board.

To qualify by examination, the applicant must present scores in the Scholastic Aptitude Test (S.A.T.) and three Achievement Tests, which must include:

1. English Composition
2. Social Studies or Foreign Languages
3. Mathematics or Sciences

The tests must not be taken before completion of the first half of the eleventh grade. The Achievement Test in English composition cannot be used to satisfy the Subject A requirement unless taken after completion of the eleventh grade. The first repetition of a test will be accepted, but the verbal and mathematics scores on the Scholastic Aptitude Test must be from the same sitting. The total score on the Scholastic Aptitude Test must be at least 1000; the scores on the three Achievement Tests must total at least 1650; and the score on any one Achievement Test must not be less than 500.

Arrangements to take the tests should be made with the Educational Testing Service, P.O. Box 1025, Berkeley, California 94701, or P.O. Box 592, Princeton, New Jersey 08540. The fees are to be paid to the Educational Testing Service. Scores will be regarded as official only if they are received by the Office of Admissions directly from the Educational Testing Service.

| Test Dates | Application Deadline |
|---|---|
| Saturday, November 5, 1966 | October 8, 1966 |
| Saturday, December 3, 1966 | November 5, 1966 |
| Saturday, January 14, 1967 | December 10, 1966 |
| Saturday, March 4, 1967 | February 4, 1967 |
| Saturday, May 6, 1967 | April 8, 1967 |
| Saturday, July 8, 1967 | June 10, 1967 |

Applicants should arrange to take the tests as early as possible so that the scores can be reported in time to be considered for admission.

## Admission to Advanced Standing

An applicant who has registered in a junior college, a four-year college, a university, extension classes of college level, or any comparable institution since graduation from high school is subject to regulations governing admission to advanced standing. The applicant may not disregard his college record and apply for admission to freshman standing.

## Requirements for Admission to Advanced Standing

An applicant for admission to advanced standing must meet the requirements listed below:

The requirements for admission to advanced standing vary in accordance with the high school record of the applicant. Each applicant, however, must present from the last accredited college or university attended a statement of good standing and an academic record with a grade point average of C (2.0) or better. If the record established in any one accredited institution is below a C (2.0) average, an additional unit and scholarship requirement may be imposed on subsequent credit completed to offset the deficit incurred. In addition, the applicant must meet one of the following conditions:

1. An applicant who was eligible for admission to the University in freshman standing may be admitted at any time he has established an overall grade point average of C (2.0) or better.
2. An applicant who was ineligible for admission to the University in freshman standing, but whose only deficiency arose from not having studied one or more of the required high school subjects, may be admitted when the following conditions are met:
   a. He has established an overall grade point average of C (2.0) or better.
   b. He has satisfied by appropriate courses with a grade of C or better, the subject requirements for admission to freshman standing.

**Exception:** Deficiencies in subject requirements will be waived in an amount not exceeding 2 high school units if the applicant has established a minimum of 84 acceptable quarter units or 56 acceptable semester units passed with a grade point average of 2.4 or better. Subject deficiencies in excess of 2 units must be satisfied.

3. An applicant who was ineligible for admission to the University in freshman standing because of low scholarship or a combination of low scholarship and incomplete subject preparation (omission, or by grades of D or lower) may be admitted when the following conditions are met:
   a. He has established a minimum of 84 acceptable quarter units or 56 acceptable semester units passed with a grade point average of 2.4 or better.
   b. He has satisfied, by appropriate courses, subject requirements for admission to freshman standing except that subject deficiencies will be waived in an amount not exceeding 2 high school units.

## Credit for Work Taken in Other Colleges

The University grants unit credit for courses consistent with its curriculum that have been completed in colleges and universities accredited by appropriate accrediting agencies.

As an integral part of the system of public education of California, the University accepts, at full unit value, approved transfer courses completed with satisfactory grades in the public junior colleges of the state. Frequently, students who intend to complete their advanced studies at the University will find it to their advantage to complete the first two years of their college course in one of the many excellent California public junior colleges. After a student

has earned 105 quarter units or 70 semester units acceptable toward a degree, no further credit will be granted for courses completed at a junior college.

The decision regarding the acceptability of extension courses taken at an institution other than the University rests with the Office of Admissions. The decision regarding the applicability of such course work in satisfaction of degree requirements rests with the faculty of the particular school or college in which the student plans to enroll.

## Requirements for Nonresident Applicants

It has been necessary to place some limitation on enrollment of applicants who are not residents of California, and, therefore, only those of exceptional promise will be eligible for admission. The requirements below are designed to admit nonresident applicants whose standing, as measured by scholastic records, is in the upper half of those who would be eligible under the rules for California residents.

### Admission By High School Record

#### Graduation from High School

The acceptability of records from high schools outside California will be determined by the Office of Admissions.

#### Subject Requirements

The same subject pattern as for a California resident is required.

#### Scholarship Requirements

The scholarship requirements for a resident applicant apply to a nonresident applicant except that the scholarship average must be 3.4 or higher on the required high school subjects.

### Admission By Examination

A nonresident applicant who is ineligible for admission to freshman standing and who has not attempted college work subsequent to high school (except during the summer session immediately following high school graduation) may qualify for admission by examination. The requirements for a resident applicant apply to a nonresident applicant except that the total score on the Scholastic Aptitude Test must be at least 1100 and the scores on the three Achievement Tests must total at least 1725.

### Admission To Advanced Standing

In addition to the regular admission requirements, a nonresident applicant for admission to advanced standing must have maintained a grade-point average of 2.8 or higher in college subjects attempted and acceptable for transfer credit. If the applicant did not have at the time of high school graduation an average of 3.4 or higher in courses satisfying the required subject pattern, he must present a minimum of 84 acceptable quarter units or 56 acceptable semester units passed with a grade-point average of 2.8 or higher.

## Admission of Applicants From Other Countries

The credentials of an applicant for admission from another country in either undergraduate or graduate standing are evaluated in accordance with the general regulations governing admission. An application, official certificates, and detailed transcripts of record should be submitted to the Office of Admissions early in the appropriate application filing period. Doing so will allow time for exchange of necessary correspondence and, if the applicant is admitted, will help him in obtaining the necessary passport visa.

An applicant from another country whose native language is not English may be admitted only after demonstrating that his command of English is sufficient to permit him to profit by instruction in the University. The applicant may arrange to take the *Test of English as a Foreign Language* in his own country by writing directly to the Educational Testing Service, P.O. Box 592, Princeton, New Jersey 08540, or P.O. Box 1025, Berkeley, California 94701. The fee for these examinations should be sent to the Educational Testing Service, and not to the University. The applicant should request that his scores in the tests be forwarded to the Office of Admissions on the campus where he plans to enroll. Or, the applicant's knowledge of English may be tested by an examination given by the University. However, admission of an applicant who fails to pass this examination will be deferred until he has acquired the necessary proficiency in the use of English.

A student from a country where the language is not English is given college credit in his own language and literature only for courses satisfactorily completed in his country at institutions of college level, or for upper division or graduate courses taken in the University of California or in another English-speaking institution of approved standing.

# GRADUATE

## The Nature of Graduate Instruction

A graduate course is a highly advanced course in a field of study already intensively presented in the upper division. It normally carries a number in the 200 series. Graduate courses demand—on the part both of instructors and of students—either a critical analysis or a specialization of research not normally appropriate to an undergraduate major. Graduate courses may be conducted in several ways:

1. As advanced lecture courses.
2. As seminars in which the faculty and students present critical studies of organized fields of knowledge.
3. As independent study or reading courses.
4. As research projects carried on under faculty supervision.

The main purpose of graduate study is to inspire independence of mind and originality in the search for knowledge and truth. The candidate must attain a mastery of his chosen field. He must also conduct a successful program of independent research for the Ph.D. Consequently, graduate students are accorded considerable liberty insofar as enrollment in courses is concerned, provided they meet the minimum enrollment necessary to establish residence.

## Standards of Admission

Students seeking admission to graduate status at the University of California must hold a bachelor's degree or its equivalent from an institution of acceptable standing. The program of preparation should be substantially equivalent in both the distribution of academic subject matter and in scholarship achievement to the requirements for a comparable degree at the University of California. Applications for admission are evaluated in terms of scholastic qualifications and formal preparation for the graduate field of study.

The Vice Chancellor – Graduate Studies or the department in which the applicant wishes to pursue an advanced degree may deny him admission if his scholastic record or his undergraduate program of study is judged not adequate as a foundation for advanced academic or professional study. This procedure applies to all applicants, whether they come from schools or colleges within the University of California or elsewhere. Individual departments may have special requirements for admission to graduate status, and certain departments and schools require an *additional* and special application for admission to their advanced-degree program.

## Admission without an Advanced-Degree Objective

Students who do not desire to become candidates for higher degrees must meet the same admission requirements as those who are prospective candidates for degrees. They must be admitted to a specified field of study and they must satisfy the Vice Chancellor-Graduate Studies that their program of study has a definite scholarly or professional purpose. Such students are not eligible for exemption from the nonresident tuition fee.

## Admission Procedures

Each student seeking admission to the Graduate Division on the San Diego campus must file a formal application and an official transcript of his record *in duplicate* from each college and university he has attended, not later than August 15 for the fall quarter, not later than November 15 for the winter quarter and not later than February 15 for the spring quarter. One set of the official records is retained permanently in the Office of Admissions. These records may not be withdrawn. The duplicate set of records will be sent to the student's major department. The application must be accompanied by a check, money order or bank draft for $10 in payment of the application fee. Any payment must be drawn for the exact amount of the fees, and should be made payable to The Regents of the University of California. Because of the time required to process an application and to prepare the registration forms, applications and/or transcripts received after the deadline date will be considered only as time permits and in the order received. The blank for application may be obtained from the Office of Admissions, University of California, San Diego, P.O. Box 109, La Jolla, California 92037.

An applicant who has taken the Graduate Record Examination should submit with his application a copy of the results of the examination; this will be especially helpful for a student whose grade-point average is near the minimum requirement for admission in regular graduate status.

## Admission of Foreign Students

Foreign students are held to the same regulations affecting admission and candidacy as are students from the United States. Every foreign student whose training has been in a language other than English must appear for the University Examination in English for Foreign Students to determine whether he has sufficient command of English to enable him to pursue his graduate studies effectually. If it proves to be insufficient he may be required to take a noncredit English course and a slightly reduced graduate program. To reduce the possibility of this, students are requested to take the Test of English as a Foreign Language (TOEFL Test) prior to coming to the United States. Information concerning the test may be obtained from the nearest U.S. embassy or by writing to Educational Testing Service, P.O. Box 1025, Berkeley, California; or P.O. Box 592, Princeton, New Jersey.

For information concerning health insurance requirements for foreign students, see section on Student Health Service.

## Renewal of Application for Admission

Students who do not register in the quarter for which they were accepted for admission in graduate status must file a *renewal of application* form, with supplementary official transcripts, at the office in which their original application for a graduate admission was filed. The deadlines for filing are the same as those required for original applications. Additional fee is not charged for a renewal of application, but approval for admission to any given quarter does not imply approval for admission at some later date.

## Duplication of Higher Degrees

The duplication of higher degrees is discouraged. The holder of a master's degree in a given field received at another institution may not become a candidate for a degree in the same field in this University. However, petitions for a master's degree in a different field will be considered on their individual merits.

## Higher Degrees for Members of the Academic Senate

Voting members of the Academic Senate are not eligible for advanced degrees at the University of California.

## Enrollment of Postdoctoral Scholars

The University provides opportunities and facilities for postdoctoral scholars to carry out individual programs of study and research. Postdoctoral scholars are defined as persons holding any doctoral degree (M.D., D.D.S., D.V.M., D.P.H. or Ph.D.) who wish to pursue, either under the direction of or in consultation with members of the faculty, special studies or training to further their preparation in a given field. Not included in this classification are visiting scholars with permanent positions in other institutions.

All postdoctoral scholars should make arrangements to enroll for such studies and training through the department or research unit with which they may be associated.

## Accommodation of Visiting Scholars

The University of California has always been hospitable to faculty members and research scholars from other institutions who wish to visit the University. Facilities for study and research are made available whenever possible.

# ACADEMIC RULES AND REGULATIONS

## Definition of Terms:

**New Student:** An undergraduate student who has never been enrolled at UCSD or a student entering graduate status at UCSD for the first time.

**Continuing Student:** A student who was enrolled in the same (graduate or undergraduate) status at UCSD during the previous quarter.

**Returning Student:** A former UCSD student who was not enrolled at UCSD during the previous quarter or who withdrew during the previous quarter.

**Graduate Student:** A student who was enrolled in graduate status during the previous quarter, or who is returning from a leave of absence granted after he obtained graduate status.

## Registration

Registration is the means by which one becomes a student at the University. It includes the payment of fees and the completion and filing of informational forms for various purposes. A student must be officially admitted to UCSD before he may register for classes. He is not officially enrolled in classes until he has completed the registration procedure.

A student registers for new classes each quarter. While specific directions are published for each registration period, the basic steps are:

1. Pay fees at the Cashier's Office.
2. Consult academic adviser.
3. Enroll in classes and file completed cards (Official Study List Packet) with the Registrar's Office.

## Preenrollment for Undergraduates

A continuing undergraduate student in good standing may preenroll in classes according to the instructions published toward the end of each quarter. Preenrollment in classes is for the convenience of the student who wishes to reserve places in desired classes, and is not final until the student becomes officially registered by paying the required fees. After the student becomes officially registered, preenrollment is final unless cancelled prior to the first day of the quarter.

Continuing undergraduate students who do not wish to take advantage of preenrollment will register and enroll at the same time as new and re-entering undergraduate students.

Students will be assessed a late registration fee of $10 if they have not registered (paid fees) before the first day of classes. A student who has an outstanding debt from a previous quarter must pay his account in full prior to enrolling for a subsequent quarter.

## Graduate Students

All students entering graduate status for the first time are considered to be "new students," and must file an application for admission to graduate status and be accepted for admission by the Graduate Division.

Every candidate for a higher degree is required to register each quarter until all degree requirements are fulfilled (including the thesis or dissertation and final examination). The candidate must continue to register until either the degree is awarded or he is granted a formal leave of absence or withdrawal.

If a graduate student fails to register or is absent without a leave of absence, the University will presume that he has withdrawn from the Graduate Division. He may apply for readmission at a later date, but cannot be assured of acceptance.

Instructions for the registration procedure for graduate students are available toward the end of each quarter.

## Registration Card

At the time of registration each student will receive a registration card which is evidence that he is a regularly enrolled student at UCSD, and which entitles him to library privileges, student health care, and other University privileges. In addition, for the undergraduate, the registration card provides identification for associated student functions.

If the card is lost, a duplicate may be obtained from the Registrar's Office for $3.00.

## Application for Readmission

The deadline for all returning students to file an application for readmission is four weeks prior to the first scheduled day of registration. Transcripts for work taken at other institutions must be submitted as part of the application.

## Official Study List

In order to receive credit for courses undertaken the student must list them on his Official Study List Card, secure a class card for each course so listed and file them with the Registrar's Office.

Unapproved withdrawal from, or neglect of, a course listed on the Official Study List Card will result in a failing grade. Any change in program after filing the list – whether to add, replace, or drop a course – must be by formal petition approved by the instructor. The approved petition must be filed at the Registrar's Office.

## Study List Limits

The normal undergraduate program consists of an average of four courses each quarter for four years. However, a student may enroll for three courses without approval by the Provost of his college, as long as he maintains an aver-

age of four courses for the four years. If a student wishes to enroll in less than three courses in any quarter, he must secure the permission of the Provost of his college. For purposes of the Registrar's Office and the Selective Service Office, three courses are considered the minimum for a full-time student.

While four courses are suggested as the maximum number to be taken during any one quarter, a superior student may take more with the permission of the Provost of his college. However, students are cautioned not to overload their programs – a heavy course load is no excuse for poor scholarship.

A graduate student in a regular quarter is limited to 16 credits when he takes only undergraduate courses, to 12 credits when he takes only graduate courses, and to a total made up in the proper proportion of 12 to 16 – as, for example, 6 graduate and 8 undergraduate – when he takes both undergraduate and graduate courses.

Research assistants and others employed approximately on half-time are limited to three-fourths of these totals. Students engaged full time in other occupations are limited to 6 credits of graduate and/or upper division courses.

Study lists exceeding these limits may be acceptable only with the approval of the Vice Chancellor-Graduate Studies.

Each graduate student must register for, attend, and complete upper division courses (courses in the 100 series), or graduate courses (200 series), amounting to at least 6 credits for each quarter so as to satisfy the minimum residence requirement in candidacy for most of the higher degrees or certificates issued by the University.

## Change of Program

A student may add or drop courses, or change sections within a course, after the Official Study List has been filed, according to the following schedule:

| | | |
|---|---|---|
| during 1st and 2nd week of classes | ADD or DROP | No Fee |
| during 3rd through 5th week of classes | DROP ONLY | $3 Fee |
| during 5th week through end of quarter | DROP ONLY by special permission of the Provost. | $3 Fee |

Permission to add or drop a course requires approval of instructor and Provost. Permission to change sections within a course requires approval of instructors only.

A petition for a change in the Official Study List is available in the Registrar's Office, and must be filed with that office to relieve the student of responsibility for dropped courses and to credit the student for courses added.

## Credit by Examination

With the instructor's approval, students in good standing may petition to obtain credit for some courses by examination. For further information, consult the Office of the Provost.

## Intercampus Transfer (Undergraduates)

An undergraduate who is registered on any campus of the University of California, or who was previously registered in a regular session at another UC campus and has not since been registered in another institution, may apply for

transfer in the same status to another campus of the University.

Intercampus Transfer Application Forms are available from the Registrar and must be filed with that office by March 1 for the fall quarter, by November 1 for the winter quarter and by February 1 for the spring quarter.

Completed forms will be forwarded to the campus to which the student wishes to transfer, together with a complete copy of the student's record (including high school and all advanced standing.) No charge is made for this service.

## Intercampus Exchange Program (Graduate)

A graduate student registered on any UC campus who wishes to take courses on another campus may become an Intercampus Exchange Graduate Student with the approval of his adviser and the Dean of the Graduate Division on the campus to be visited. He continues to be considered a graduate student in residence on his home campus and is not admitted to the graduate division at the host campus, for he has not transferred his enrollment.

Application forms for the Intercampus Exchange Program for graduate students may be obtained from the Registrar's Office.

## Concurrent Enrollment in Other Institutions

Concurrent enrollment in regular sessions at another institution or in University Extension while enrolled on the San Diego campus is permitted only when approved in advance by the Provost of the student's college.

# ACADEMIC REGULATIONS

### GRADES

Grades in courses (graduate or undergraduate) are defined as follows: "A", excellent; "B", good; "C", fair; "D", barely passing; "F", failure; and "I", undetermined (work of passing quality but incomplete). The designations, "P", passed, and "N", not passed, are used in reporting grades on some graduate courses. The designations "S", and "U", are used in reporting satisfactory and unsatisfactory work in certain graduate courses of individual programs of research and study. "NR" indicates that the instructor has not reported a grade.

All grades, except "I" are final when filed by an instructor in his end-of-term course report. An exception is the correction of a clerical error. No term grade except "I" may be revised by reexamination. Only courses for which grades "D", or "F" were received may be repeated for credit and not more than once, unless authorized by the Provost of the student's college. A student is entitled to replace the grade "I" with a passing grade and to receive credit provided he completes the work of the courses in a way approved by the instructor. The student is required to complete the necessary work by the end of the next quarter he is in attendance, or the grade will be changed to a "F". To remove an "I" grade, the student must complete a petition at the Registrar's Office, secure the instructor's approval and pay a $5.00 fee at the Cashier's Office.

## Special Grade Options for Graduate Students

### Satisfactory—Unsatisfactory

With the consent of the department, students pursuing individual programs of

research and study or engaged in other appropriate graduate activities of an individual nature may receive unit credit for such work. In calculating grade point standing, units gained in this way shall not be counted. Such work shall be graded "S", satisfactory, or "U", unsatisfactory. No credit will be allowed for work marked unsatisfactory.

### Passed—Not Passed

Graduate students taking courses outside their own department have the option, with permission of their department chairmen and of the course instructor, of enrolling in a special category where they may be graded by a "P", passed, or "N", not passed. Students must register at the beginning of each course as either regular or special class members. The grades a student receives as a special class member shall be ignored in determining his grade point average. A grade of "P" will carry the same unit credit as an ordinary passing grade in the course, and a grade of "N" will carry no unit credit.

### GRADE POINTS

Grade points are assigned as follows: "A", 4 points per unit; "B", 3 points per unit; "C", 2 points per unit; "D", 1 point per unit; "F" and "I", no points. To determine grade point average, an undergraduate should divide the total number of grade points earned by the total unit value of courses attempted. Graduate students can determine their grade point averages by the same procedure, but should exclude courses with grades of P, N, S, U, and I. (Each undergraduate course counts 4 units, and each graduate course ranges from 1 to 12 units, as indicated in the course descriptions.)

### FINAL GRADES

As soon as possible after the end of each quarter, final grades will be mailed to students by the Registrar's Office. It should be emphasized that course reports filed by instructors at the end of each quarter are final.

## Scholastic Requirements

### Undergraduate Students:

For good academic standing and for graduation, an undergraduate must earn at least twice as many grade points as the value of course work attempted, *i.e.* a C average.

The scholastic status of all UCSD undergraduates is governed by the following provisions:

1. **Probation:** A student will be placed on probation if, at the end of any quarter, his grade point average falls below 2.0 (C), computed on the total of all courses undertaken in the University, including courses graded Incomplete. The basis for removal from probation is a 2.0 (C) grade point average based on all work taken in the University.
2. **Dismissal:** A student will be subject to dismissal from the University if his grade point average falls below 1.5 for any quarter, or if, after one quarter on probation, he has not achieved a 2.0 average, computed on the total of all courses undertaken in the University including those graded Incom-

plete. He will also be subject to dismissal if he fails to make satisfactory progress toward a degree at UCSD.

If a student becomes subject to dismissal, his grades and records will be carefully reviewed by the Provost of his college who will consider the student's total performance, and will take appropriate action. If the Provost feels the student will be able to overcome his academic deficiency, the Provost will suspend dismissal and allow the student to continue on probation. If the Provost feels the student cannot overcome his deficiency, the student will dismissed from the University.

The Provost also will have the power to suspend dismissals, continue probation or authorize the return of a dismissed student to probationary status. Students on probation or subject to dismissal will be under the supervision of the Provost of the college.

In order to transfer from one campus of the University to another, a student who has been dismissed or who is on probation must obtain the approval of the Dean or Provost into whose jurisdiction he seeks to transfer. After completing a transfer the student is subject to the supervision of the Dean or Provost on the new campus.

### Graduate Students:

For good standing and award of an advanced degree a graduate student is required to maintain a grade point average of 3.0 (B), computed on the total of all courses undertaken in graduate status at the University.

A graduate student is subject to dismissal if his overall grade point average falls below 3.0 (B) at any time, or his work in any two consecutive terms falls below a 3.0 average.

## Removal of Deficient Grades

A grade of D or F may be raised by repeating the course, but cannot be raised by reexamination. If a course is repeated, it will count as a single course in computing the total courses passed, but both courses will be considered in determining the grade point average.

## Notice of Candidacy

At the beginning of his senior year and the quarter before he expects to receive his degree, every undergraduate is required to complete the "A" card in his study list packet, indicating his candidacy for the Bachelor's degree. The Registrar will then consult with the Provost of his college and a degree check will be prepared. The student will be notified whether or not the program he is undertaking will satisfy degree requirements.

A graduate student must indicate his candidacy for a Master's or a Doctorate degree the third and the final quarter before he expects his degree, by filling out the "A" card in his study list packet. In addition, the final quarter before a graduate student expects his degree, he must file in the Registrar's Office a petition for the *Advancement to Candidacy* for preparation of his final degree checks.

# THE MASTER'S DEGREE/GENERAL REQUIREMENTS

## Preparation

The preliminary training of the candidate for the degree of Master of Arts or Master of Science should be substantially the equivalent of that represented by the corresponding bachelor's degree of the University of California. If the candidate's undergraduate course is found to be in any serious respect deficient in its breadth of fundamental training or fails to provide a proper foundation for advanced work in the department or departments of the candidate's choice, he may be required to devote some time to specified undergraduate courses, involving a longer period of residence than would otherwise be required.

A graduate of an institution of acceptable standing is normally admitted to candidacy for a master's degree at the University of California on an equality with a graduate of the University of California if his college course has been of such character as to furnish a satisfactory basis for advanced academic work.

In the departments at San Diego the degree of Master of Science is offered in the fields of aerospace and mechanical engineering sciences, applied electrophysics, chemistry, earth sciences, marine biology, oceanography, and physics. The degree of Master of Arts is offered in the fields of mathematics, philosophy, and psychology.

## Amount and Distribution of Work

At the option of the department of his major field, a student must pursue one of the two following plans for fulfillment of the requirements for the master's degree. Under either plan all the requirements for the degree must be satisfied within a calendar year from the time of completion of the course requirement.

## Plan I: Thesis Plan

Credit must be obtained for 30 quarter units, of which at least 12 must be in graduate courses in the major field, 6 additional units in graduate courses, and 12 units in graduate or upper division courses. A master's thesis must be approved by a committee of three faculty members appointed by the Vice Chancellor-Graduate Studies.

## Plan II: Comprehensive Examination Plan

Credit must be obtained for 36 quarter units of which at least 14 must be in graduate courses in the major field, 10 additional units in graduate courses, and 12 units in graduate or upper division courses. A comprehensive final examination, designated as a master's examination, must be passed.

## Foreign Language Requirement

Language requirements, if any, adopted by individual departments shall be administered as the Graduate Council shall direct.

## Foreign Language Examinations

Most departments will require students to demonstrate appropriate proficiency

in one or more foreign languages. Students are strongly urged to acquire the best possible language preparation before entering graduate school, since, otherwise, their programs may be seriously delayed. There will be instruction offered in the summer or early fall preceding registration for new students and students in residence. Examinations recognized by the Graduate Council may be taken before, but not more than three years before, admission to graduate status. The student must have satisfied all necessary language requirements before taking the qualifying examination for advancement to candidacy for the Ph.D. degree.

The examinations in foreign languages required by all departments are conducted by the Department of Linguistics under the supervision of the Graduate Council. Information concerning the language examinations is available from the Department of Linguistics.

## Application for Advancement to Candidacy

Application for advancement to candidacy must be made through the Office of the Graduate Division. Application must be made with the recommendation of the department concerned and must contain a general statement of the studies upon which the application is based. Advancement to candidacy shall take place not later than one quarter prior to the date of completion of requirements for the degree. Admission to candidacy is not automatic; it requires a formal application distinct from registration.

## Residence Requirement

The minimum residence requirement is three quarters, at least one of which must occur after the student has been admitted to candidacy for the master's degree. It is not always possible, however, to complete subject requirements within the minimum period of residence. Residence is established by satisfactory completion of 6 units per quarter, some of which must be on the graduate level.

## Standard of Scholarship

Only courses in which the student is assigned grades "A", "B", "C", "P" or "satisfactory" are counted in satisfaction of the requirements for the master's degree. In addition, a student must maintain a minimum grade-point average of 3.0 in all courses taken after admission to graduate status. This requirement may be waived in special cases by the Graduate Council, acting through the Vice Chancellor-Graduate Studies.

# THE DOCTOR OF PHILOSOPHY DEGREE/GENERAL REQUIREMENTS

Students who desire to become candidates for the doctor's degree should bear in mind that the degree of Doctor of Philosophy is granted by the University of California not for the fulfillment of technical requirements alone, such as residence and the completion of fundamental courses within a chosen field, but more for the student's general grasp of the subject matter of a large field of study and his distinguished attainments within it, for his critical ability, his power to analyze problems and to coordinate and correlate the data from allied

fields to serve the progress of ideas. In addition, he must demonstrate, through his dissertation, the ability to make an original contribution to the knowledge of his chosen field, and throughout his career as a graduate student must prove himself capable of working independently.

The degree of Doctor of Philosophy is now offered on the San Diego campus as a result of work in the fields of aerospace and mechanical engineering sciences, applied electrophysics, cellular biology, chemistry, earth sciences, English and American literature, Spanish literature, marine biology, mathematics, oceanography, philosophy, physics and psychology.

## Preparation

A prospective candidate for this degree must hold a bachelor's degree from one of the colleges of this University, based on a curriculum that includes the requirements for graduate status in the department of his major subject, or must have pursued successfully elsewhere an equivalent course of study.

## Residence Requirement

The minimum residence requirement for the Ph.D. degree is six quarters, three of which must be spent in continuous residence at the San Diego campus, except in the case of a joint Ph.D. program, in which the residence requirements will be defined by the Graduate Council. Residence is established by the satisfactory completion of 6 units per quarter, some of which must be at the graduate level.

## Foreign Language Requirement

Before taking the qualifying examination for advancement to candidacy for the Ph.D. degree, the student will be required by the department to satisfy the foreign language requirements as established by the department and approved by the Graduate Council. In each case requirements will be satisfied by passing examinations as the Graduate Council shall direct. Language requirements vary in the individual departments.

## Program of Study

The student's program of study must be approved by the Vice Chancellor-Graduate Studies, must embrace a field of investigation previously approved by his department, and must extend over the full period of study. However, recommendation for the degree is based on the attainments of the candidate rather than duration of his study. Departmental requirements for the degree will be found under Courses of Instruction.

## Notice of Intended Candidacy

Notice of intention to proceed to candidacy for the Ph.D. degree should be given to the Office of the Registrar as early as possible during a graduate student's career, preferably at the end of the first quarter of graduate study.

## Qualifying Examinations

Before admission to candidacy for the Ph.D. degree, a student must have satisfied all preliminary requirements set by his major department and by the Graduate Council and must have passed the qualifying examination conducted by the Doctoral Committee.

## Doctoral Committees

Upon nomination of the department or interdepartment group of the student's field of study, a Doctoral Committee will be appointed by the Vice Chancellor-Graduate Studies. This Committee conducts the qualifying examination, supervises and passes upon the student's dissertation, and conducts the final oral examination. The Committee shall consist of five or more members, of which at least two shall be from departments other than that of the student's major.

## Advancement to Candidacy

The candidate must file his application, properly approved by the Doctoral Committee, and must report in person to the Office of the Registrar, who determines if all formal requirements have been met. A minimum period of resident study equivalent to three quarters must intervene between the date of formal advancement to candidacy and the date of the final examination. Each applicant must submit a formal application and pay a fee of $25.00.

## Dissertations

A dissertation on a subject chosen by the candidate, bearing on his principal study and showing his ability to make independent investigation, is required of every candidate for the degree. In its preparation the candidate is guided by his Doctoral Committee, which also passes on the merits of the completed dissertation. The approval of this Committee, as well as that of the Vice Chancellor-Graduate Studies, is required before he is recommended for the degree.

An appropriate draft of the dissertation must be submitted to each member of the Doctoral Committee no later than four weeks before the final examination. Copies of the approved dissertation must be deposited in the University Library. Instructions for the preparation and submission of theses may be obtained from the Office of Registrar and Admissions.

## Final Examination

The candidate's final examination is conducted by his Doctoral Committee. The examination is oral and deals primarily with the relationships of the dissertation to the general field in which the subject lies.

## Leave of Absence

Graduate students who are severing their connection with the University for a specific period of time, after which they intend to resume their studies, must secure a formal leave of absence. Petitions are available at the Registrar's Office. Leave of absence is a privilege requiring the endorsement of the depart-

ment in which the student is studying and approval of the Vice Chancellor-Graduate Studies. The privilege of readmission may be denied, however, if in the opinion of the Vice Chancellor-Graduate Studies denial is required by special circumstances. Leaves of absence should be for a stated period, normally not to exceed one year, with continuation of the leave at the discretion of the Vice Chancellor-Graduate Studies and of the student's major department. Graduate students on leave-of-absence status are *not* expected to make use of any University facilities or to place demands upon faculty time during the period of their leave.

Graduate students who are granted formal leave of absence are exempt from all fees during the period of their leave.

## Withdrawal From The University

A student withdrawing from the University during a quarter must file a *Notice of Withdrawal* with the Registrar's Office before leaving the campus. In cases of illness or emergency, notice of withdrawal should be made as soon as the student decides not to continue.

**The importance of giving proper notice before discontinuing attendance cannot be overemphasized.** If proper notice is not filed, the student will receive failing grades in all courses and jeopardize his eligibility to reenter the University of California and his admission by transfer into another institution.

## Lapse Of Status

Lapse of status means the enforced withdrawal of a student from the University and may be caused by:

1. Failure to respond to official notices.
2. Failure to settle financial obligations when due, or to make satisfactory arrangements with the cashier if payment cannot be made.
3. Failure to complete the physical examination.
4. Failure to file an Official Study List when required.

Each student who becomes subject to lapse of status action is given advance notice and ample time to deal with the situation. However, if the student fails to respond, action will be taken without further notice and he is entitled to no further services from the University except assistance toward reinstatement.

A student wishing to have his status restored must secure a petition from the Registrar. If the petition is approved, a fee of $10 must be paid in addition to any other charges that may be outstanding. Reinstatement is not final until the petition has been accepted by the Registrar.

## Change Of Name Or Address

Students must notify the Registrar's office promptly of any change of name or address. Forms are available from the Registrar's office.

## Transcript Of Records

A $1.00 fee is charged for each transcript of a student's record. Applications for a transcript of record should be made to the Registrar several days in ad-

vance of the time needed. **An application for a transcript must bear the student's signature.**

Transcripts will be released only upon signed request of the student. Transcripts will not be issued for a student whose status has lapsed or who has not made satisfactory arrangements regarding bills due or other indebtedness to the University.

## Preservation Of Receipts

Carefully preserve all receipts of payments made to the Cashier, whatever their nature. Not only do they constitute evidence that your financial obligations have been discharged, but may support a claim that you have filed certain documents or petitions pertaining to your academic record.

## Fee Refunds

Students who withdraw from the University during the first five weeks of instruction will receive refunds of incidental fees, student activity fees, and nonresident tuition fees (if such have been paid) on the following basis:

| | |
|---|---|
| First two weeks of instruction | 80% of total paid |
| Third week of instruction | 60% of total paid |
| Fourth week of instruction | 40% of total paid |
| Fifth week of instruction | 20% of total paid |
| After fifth week of instruction | no refund |

A preregistered student may cancel his registration and request full refund of fees before the first day of the quarter. Thereafter, a withdrawal form is necessary. The effective date for calculating a fee refund is the last day the student attended any University class.

Claims for refund of fees must be presented during the fiscal year (July 1 to June 30) in which the claim is applicable. To obtain a refund, the student must surrender his registration card and present his fee receipt to the Registrar.

Fees will not be refunded except in the cases mentioned above or in case of error or negligence on the part of the University.

## Rules Governing Residence

The residence classification of each student is determined in accordance with Section 244 of the California Government Code, Sections 23054, 23055 and 23057 of the California Education Code and the Standing Orders of the Regents. It is therein provided that a resident student is any person who has been a legal resident of the State of California for more than one year immediately preceding the opening day of the quarter during which he proposes to enroll.

The attention of the alien prospective student is directed to the fact that he is a nonresident unless, in additon to the general residence requirements for tuition purposes, he has been admitted to the United States for permanent residence in accordance with all applicable laws of the United States. The attention of the prospective student who has not attained the age of 22 and whose parents are not California residents, and the attention of the veteran who was not a resident of California at the time of his entrance into the Armed Forces, is directed to the fact that presence in California for more than one year does not, of itself, entitle the student to classification as a resident.

Every student who is classified as a resident but who becomes a non-resident of California is obliged to notify the Attorney in Residence Matters at once. Application for a change in classification with respect to a previous quarter will not be received under any circumstances.

A person incorrectly classified as a resident student is subject to reclassification as a nonresident. If the incorrect classification resulted from concealed facts or untruthful statements made by him, the student then shall be required to pay all tuition fees which would have been charged to him as a nonresident student. He shall be subject also to such discipline as the President of the University may approve. Petitions for reclassification of residence are available in the Registrar's Office.

## Residence Status

Every new or returning student is required to fill out a Statement of Legal Residence in order to determine his residence classification for fee purposes. If a student's family moves into or out of California, or if he maintains an independent household in any state other than that from which he was admitted, he should apply for reclassification to the Attorney for the Regents in Residence Matters, 590 University Hall, University of California, Berkeley 94720.

Applications for residence reclassification should be submitted well in advance of the next registration. Any student in doubt about his residence status may communicate with the Attorney, who makes all decisions in these matters.

# GRADUATE DEGREES AWARDED

The fields of study and the specific degrees awarded and the campuses on which they are offered are listed below: (In this listing the campuses are indicated by the following abbreviations: Berkeley, B; Davis, D; Irvine, I; Los Angeles, LA; Riverside, R; San Diego, SD; San Francisco Medical Center, SF; Santa Barbara, SB; Santa Cruz, SC.)

Aerospace and Mechanical Engineering Sciences – M.S. (SD); Ph.D. (SD)
African Area Studies – M.A. (LA)
Agricultural Chemistry – Ph.D. (B,D)
Agricultural Economics – M.S. (B,D); Ph.D. (B, D)
Agricultural Education – M.Ed. (D)
Agricultural Science – M.S. (LA); Ph.D. (LA)
Agricultural Science and Management – M.S. (D)
Agronomy – M.S. (D)
Anatomy – M.A. (B, SF); M.S. (D, LA); Ph.D. (B, D, LA, SF)
Animal Husbandry – M.S. (D)
Animal Physiology – M.S. (D, SF); Ph.D. (B, D, SF)
Anthropology – M.A. (B, D, R, LA, SB); Ph.D. (B, D, LA, R, SB)
Anthropology Sociology – M.A. (LA); Ph.D. (LA)
Applied Electrophysics – M.S. (SD); Ph.D. (SD)
Applied Mathematics – M.A. (SB); Ph.D. (B)
Architecture – M. Arch. (B)
Architecture (Urban Design) – M. Arch. (LA)
Art – M.A. (B, D, LA); M.F.A. (LA, SB)
Art History – Ph.D. (LA)
Asian Studies – M.A. (B); Ph.D. (B)
Astronomy – M.A. (B, LA); Ph.D. (B, LA, SC)
Atmospheric and Space Science – M.A. (B); Ph.D. (B)
Bacteriology – M.A. (B); Ph.D. (B)
Biochemistry – M.A. (B, R); M.S. (LA, SF); Ph.D. (B, LA, R, SF)
Biological Chemistry – M.S. (LA); Ph.D. (LA)
Biological Sciences – M.A. (I); Ph.D. (I)
Biology – M.A. (R, SB, SC); Ph.D. (R, SB, SC)
Biophysics – Ph.D. (B, D, SF)
Biophysics and Nuclear Medicine – M.S. (LA); Ph.D. (LA)
Bioradiology – M.Biorad. (B)
Biostatistics – M.A. (B); M.S. (LA); Ph.D. (B, LA)
Botany – M.A. (B, D, LA, SB); M.S. (D); Ph.D. (B, D, LA)
Business Administration – M.B.A. (B, LA); M.S. (LA); Ph.D. (B, LA)
Cellular Biology – Ph.D. (SD)
Chemical Engineering – M.S., (B); Ph.D. (B)
Chemistry – M.A. (I, R, SB); M.S. (B, D, LA, SD); Ph.D. (B, D, I, LA, R, SD, SB)
Chemistry – Ph.D. (SD-San Diego State College)
City and Regional Planning – M.C.P. (B); Ph.D. (B)
Classical Archaeology – M.A., (B); Ph.D. (B)
Classics – M.A. (B, LA); Ph.D. (B, LA)
Comparative Biochemistry – M.A. (B, D, SF); Ph.D. (B, D, SF)
Comparative Law – M.C.L. (LA)
Comparative Literature – M.A. (B, I, R); Ph.D. (B, R)
Comparative Pathology – M.S. (B, D, SF); Ph.D. (B, D, SF)
Comparative Pharmacology and Toxicology – M.S. (D, SF); Ph.D. (D, SF)
Creative Writing (in the English Department) – M.F.A. (I)
Criminology – M. Crim. (B); D. Crim. (B)
Dance – M.A. (LA)

Demography – M.A. (B); Ph.D. (B)
Dental Surgery – M.D.S. (LA, SF)
Dentistry – D.D.S. (LA, SF)
Design – M.A. (B)
Dramatic Art – M.A. (B, D, SB); Ph.D. (B)
Earth Sciences – M.S. (SD); Ph.D. (SD)
Economics – M.A. (B, D, LA, R, SB); Ph.D. (B, D, LA, R, SB)
Education – M.A. (B, D, LA, SB); M.Ed. (LA); Ed.D. (B, LA); Ph.D. (B, LA)
Endocrinology – M.A. (B, D, SF); Ph.D. (B, D, SF)
Engineering – M.S. (B, D, I, LA, SB); M.E. (LA); M.Eng. (B, D); D. Eng. (B, D); Ph.D. (B, D, I, LA, SB)
English – M.A. (B, D, I, LA, R, SB); Ph.D. (B, D, I, LA, R, SB)
Entomology – M.S. (B, D, R); Ph.D. (B, D, R)
Environmental Health Sciences – M.S. (B); Ph.D. (B)
Epidemiology – Ph.D. (B)
Folklore – M.A. (B)
Folklore and Mythology – M.A. (LA)
Food Science – M.S. (B, D)
Forestry – M.S. (B); M.F. (B); Ph.D. (B)
French – M.A. (B, D, I, LA, R, SB); Ph.D. (B, D, LA, R, SB)
Genetics – M.S. (B, D); Ph.D. (B, D)
Geochemistry – M.A. (LA); Ph.D. (LA)
Geography – M.A. (B, D, LA, R); Ph.D. (B, D, LA)
Geological Sciences – M.A. (R); Ph.D. (R)
Geology – M.A. (B, LA, SB); M.S. (D); Ph.D. (B, D, LA, SB)
Geophysics – M.A. (B, LA); Ph.D. (B, LA)
German – M.A. (B, D, I, LA, R, SB); Ph.D. (B, D)
Germanic Languages – Ph.D. (LA)
Greek – M.A. (B, LA)
Health Education – M.S. (LA)
Hispanic Languages and Literatures – Ph.D. (LA)
History – M.A. (B, D, I, LA, R, SB); Ph.D. (B, D, LA, R, SB)
History of Art – M.A. (B, I, SB); Ph.D. (B)
History of Consciousness – Ph.D. (SC)
History of Health Sciences – M.A. (SF); Ph.D. (SF)
Home Economics – M.S. (D)
Horticulture – M.S. (D)
Immunology – Ph.D. (B)
Indo European Studies – Ph.D. (LA)
Information Science (Documentation) – M.S. (LA)
International Agricultural Development – M.S. (D)
Irrigation – M.S. (D)
Islamic Studies – M.A. (LA); Ph.D. (LA)
Italian – M.A. (B, LA); Ph.D. (LA)
Journalism – M.A. (LA); M.S. (LA); M.Journ. (B)
Landscape Architecture – M.L.A. (B)
Latin – M.A. (B, LA)
Latin-American Studies – M.A. (LA); Ph.D. (B)
Law – LL.B. (B, D, LA); LL.M. (B); J.Sc.D. (B)
Librarianship – M.L.S. (B); Ph.D. (B); D.L.S. (B)
Library Science – M.L.S. (LA)
Linguistics – M.A. (B, D, LA); Ph.D. (B, LA)
Literature, English and American – Ph.D. (SD)
Literature, Spanish – Ph.D. (SD)
Logic and the Methodology of Science – Ph.D. (B)
Marine Biology – M.S. (SD); Ph.D. (SD)
Mathematics – M.A. (B, D, I, LA, R, SB,SD); Ph.D. (B, D, I, LA, R, SB, SD)
Medical History – M.A. (LA); Ph.D. (LA)
Medical Microbiology and Immunology – M.S. (LA); Ph.D. (LA)

Medical Physics – M.A. (SF); Ph.D. (B, LA, SF)
Medical Physics (Radiology) – M.S. (LA); Ph.D. (LA)
Medicine – M.D. (LA, SF)
Meteorology – M.A. (LA); Ph.D. (LA)
Microbiology – M.A. (B, D, LA, SF) Ph.D. (B, D, LA, SF)
Molecular Biology – M.A. (B, LA); Ph.D. (B, LA)
Music – M.A. (B, D, LA, R, SB); Ph.D. (B, LA, SB)
Near Eastern Languages – M.A. (B); Ph.D. (B)
Near Eastern Languages and Literature – M.A. (LA); Ph.D. (LA)
Nursing – M.S. (LA, SF)
Nursing Science – D.N.S. (SF)
Nutrition – M.S. (B, D, SF); Ph.D. (B, D, SF)
Nutritional Sciences – M.S. (LA)
Oceanography – M.S. (SD); Ph.D. (SD)
Optometry – M. Opt. (B)
Oral Biology – M.S. (SF)
Oriental Languages – M.A. (B, LA); Ph.D. (B, LA)
Paleontology – M.A. (B); Ph.D. (B)
Parasitology – M.S. (B); Ph.D. (B)
Pathology – M.S. (SF); Ph.D. (SF)
Pharmaceutical Chemistry – M.S. (SF); Ph.D. (SF)
Pharmacology – M.S. (LA, SF); Ph.D. (LA, SF)
Pharmacy – Pharm.D. (SF)
Philosophy – M.A. (B, D, I, LA, R, SB, SD); Ph.D. (B, D, I, LA, SD, SB)
Physical Education – M.A. (B, D, SB); M.S. (LA)
Physical and Health Education – M.A. (SB)
Physics – M.A. (B, D, I, R, SB); M.S. (LA, SD); Ph.D. (B, D, I, LA, R, SD, SB)
Physiological Optics – M.S. (B); Ph.D. (B)
Physiology – M.A. (B); M.S. (LA, SF); Ph.D. (B, LA, SF)
Planetary and Space Physics – M.S. (LA); Ph.D. (LA)
Plant Pathology – M.S. (B, D, R); Ph.D. (B, D, R)
Plant Physiology – M.S. (B, D, LA); Ph.D. (B, D)
Plant Science – M.S. (LA, R); Ph.D. (LA, R)
Political Science – M.A. (B, D, LA, R, SB); Ph.D. (B, D, LA, R, SB)
Poultry Science – M.S. (D)
Preventive Medicine and Public Health – M.S. (LA)
Psychology – M.A. (B, D, LA, R, SD, SB); Ph.D. (B, LA, R, SD, SF, SB)
Public Administration – M.A. (B); M.P.A. (LA)
Public Health – M.S. (LA); M.P.H. (B, LA, SF); Dr. P.H. (B, LA, SF)
Range Management – M.S. (B, D)
Romance Languages and Literatures – Ph.D. (B, LA)
Romance Philology – Ph.D. (B)
Sanskirt – Ph.D. (B)
Scandinavian Languages and Literatures – M.A. (B); Ph.D. (B)
Slavic Languages and Literatures – M.A. (B, LA); Ph.D. (B, LA)
Social Science – Ph.D. (I)
Social Welfare – M.S.W. (B, LA); D.S.W. (B)
Sociology – M.A. (B, D, LA, R, SB); Ph.D. (B, D, LA, SB)
Soil Science – M.S. (B, D, R); Ph.D. (B, D, R)
Spanish – M.A. (B, D, I, LA, R, SB); Ph.D. (R)
Speech – M.A. (B, LA, SB); Ph.D. (B, LA)
Statistics – M.A. (B); Ph.D. (B)
Theater Arts – M.A. (LA); M.F.A. (LA)
Theater History – Ph.D. (LA)
Vegetable Crops – M.S. (D)
Veterinary Medicine – D.V.M. (D)
Virology – M.A. (B); Ph.D. (B)
Wood Science and Technology – M.S. (B); Ph.D. (B)
Zoology – M.A. (B, D, LA, SB); Ph.D. (B, D, LA)

A class in karate, part of the growing physical education program at UCSD

The language laboratory, a basic part of the language proficiency program

# Revelle College

## THE UNDERGRADUATE EDUCATIONAL PROGRAM OF REVELLE COLLEGE

### Educational Philosophy

The faculty of UCSD has been given a rare opportunity to shape an undergraduate curriculum that will, insofar as any educational program can, prepare its students for the modern world. From the outset of planning the curriculum, the faculty has asked: What sort of knowledge must students have if they are to be liberally educated? In what areas? To what depth? How specialized must that education be in the undergraduate years? The educational philosophy of Revelle College has been developed in response to such fundamental questions. Its undergraduate program is based on the axiom that, before being granted a Bachelor of Arts degree, every student must have attained:

1. An acceptable level of general education in mathematics, foreign language, the physical, biological, and social sciences, the fine arts and the humanities.
2. Preprofessional competence in one academic discipline.
3. An understanding of an academic area outside his major field.

To that end, uniform lower division curriculum has been established so that the student can acquire an understanding of the fundamental problems, methods, and powers of the humanities and the arts, the social and behavioral sciences, and the physical and biological sciences.

The lower division curriculum assumes that an undergraduate should not specialize heavily in his major field until he has had a chance to learn something about all of the fields that are open to him. His general education must, then, be thorough enough for him to see the possibilities of those fields. Early in his career, he should know, as it were, three languages: his own, a foreign language and the universal language of mathematics. He will learn more about his own culture in a two-year humanities sequence, an introduction to major literary, philosophical, and historical documents which requires the regular writing of essays, each to be gone over tutorially with his instructor. He will study a foreign language as a spoken, vital means of communication to be used day-to-day; studying that language, he will come to know something of the general nature of language itself. And he will study mathematics as part of general education and as an introduction to a required sequence of courses in the physical and biological sciences. Finally, he will, as a sophomore, study the social and behavioral sciences. He will also have some elective time in which he can take courses in disciplines that he would like to explore further. Once he has completed this program, he will be ready for the relatively more specialized work of the upper division.

During the student's upper division years his main effort will be devoted to intensive work in his major field at a level of competence that is sufficient for continuing study in the graduate school.

The student's general education will not, however, stop at the end of the sophomore year; in addition to his major every upper division student will do a substantial portion of his course work in an area of learning outside that of his major. ("Areas of learning" are Physical Sciences, Social Sciences, and

Humanities). The courses he elects for this "noncontiguous minor" must compose an integrally related complex which will enable him to continue informal study in adult life. General education is effective only if it encourages continuation after the student's college years.

## Curriculum

UCSD students are required to demonstrate an acceptable level of basic knowledge in the humanities, fine arts, social sciences, language, mathematics, and the physical and biological sciences before entering a major academic field for specialization during the junior and senior years. They will reach the required level through a set of courses that comprise approximately 80 percent of the total course hours during the first two years.

Students are encouraged to meet the requirements of the lower division and the major requirements of the upper division as rapidly as possible. The program is designed to be completed in four years. However, students are not bound to fixed amounts of time or numbers of hours, and they are encouraged to make the fullest use of prior training and individual study. Those who demonstrate superior achievement and competence in an academic area may take advanced courses and individual-study programs that give them an opportunity to complete degree requirements in fewer than four years. Lower division mathematics and physics can be taken at various levels by students with differing preparation or ability. A student may enter a major program only after completion of the lower division general education requirements.

The major program will require up to fifteen upper division courses (the actual number depends on the major). In addition to the major program and related elective choices, which will total up to eighteen courses in the upper division, each student will be required to complete a noncontiguous minor. The student will be required to demonstrate in the upper division a general reading and speaking proficiency in a foreign language.

## Lower Division Requirements

In order to fulfill the minimum lower division requirements in the principal fields of knowledge the student takes a recommended set of courses, the prerequisites for which have been met by the general admission standards of the University.

The lower division general education requirements are:

1. Seven courses in humanities and fine arts.
2. Three courses in mathematics.
3. Five courses in the physical and biological sciences.
4. Three courses in the social sciences.
5. Verbal and reading proficiency in a modern foreign language.

The recommended courses are concerned with the following areas.

## Humanities

The humanities sequence introduces the student to his cultural heritage. It rests on the axiom that this heritage is best found in the great documents of Western Civilization in which it has assumed concrete form. The student is

invited to confront these literary, philosophical and historical documents directly: through lectures, group discussions, themes, and conferences he will learn to interpret them, to discover their interrelations, and to perceive their continuity.

The sequence opens with the study of contemporary works, then goes back to the Judaeo-Grecian beginnings and traces the development of Western Civilization forward again to the present. Essential to the course are the student's themes; in these he will be asked to come to direct and personal terms with what he has read, and to acquire the skills of clear and cogent expository writing. Every theme will be discussed intensively in individual conferences between student and instructor.

## Social Sciences

The social sciences requirement, a one-year sequence of three courses in the sophomore year, offers students intensive instruction in selected aspects of the social and behavioral sciences. The courses may be integrated into a single sequence, or may be divided into such fields as modern economics, experimental psychology and specially designated courses in philosophy and history.

## Physical and Biological Sciences

The science sequence presents the fundamental concepts of modern physical science and biology. It provides a background to further study in these disciplines and, for the non-scientist, an understanding and appreciation of current developments in these fields. In both breadth and emphasis, the program constitutes an appropriate terminal course for those students who will continue their studies outside the sciences.

The common requirement is met by a five-course sequence beginning in the winter quarter of the first year. Laboratory instruction is offered during the last three courses of the sequence. The first quarter concentrates on the scale and scope of natural phenomena and on mechanics; the second, on electricity and magnetism; the third quarter, on thermodynamics, radiation and matter, atomic and molecular structure; the fourth quarter, on the elements of chemical bonding. The fifth quarter covers the nature of biology and of the principles that govern the biological world. Emphasis is placed on the characteristics common to all living organisms and on the cell in relation to heredity and metabolism.

## Language

Revelle College, unlike most colleges in the United States, has set its language requirements in terms of levels of proficiency that must be attained by the student, rather than in terms of a certain course or number of courses that must be passed. Three language requirements in Revelle College should be carefully distinguished:

1. Oral proficiency as a lower division requirement.

By the end of his sophomore year the student is expected to have demonstrated his ability to carry on ordinary conversation comfortably in a modern

foreign language. The skill aimed at is what would be adequate for the student to continue his education by participating in substantive courses conducted in the foreign language—*e.g.*, the courses offered by the Department of Literature on this campus or courses offered to native speakers of the language in their own country.

2. Reading proficiency as a lower division requirement.

By the end of his sophomore year the student is expected to have demonstrated his ability to read ordinary material—*e.g.*, newspapers and popular literature—in a foreign language. The level aimed at is that which college students in this country normally attain by the end of their second year of training in the language.

3. General oral and reading proficiency as a requirement for graduation.

This is discussed in the catalog section on graduation requirements. The normal preparation for lower division language proficiency will be language courses in the student's freshman year. With normal high school preparation in language most students will require about a year of course work to prepare for the examination, but some students will take less time and some more, because of differences in ability, industry, and previous language work in high school, on other campuses, or in informal extracurricular activities (*e.g.*, foreign movies, language clubs, language tables) involving the language.

To assist the student in attaining the required language proficiencies, Revelle College offers three special kinds of aid in its courses:

1. The most advanced self-instructional materials and equipment available in this country, which the student can use to advance his proficiency at his own optimum speed.

2. A program of small tutorial classes, conducted by native-speaking tutors. A student's assignment to a new tutorial class will be a measure of his increased proficiency; the classes will be recomposed weekly to maintain homogeneity of class membership, permitting each class to be conducted at the highest level possible for each of its members.

3. Instruction by linguistic scientists about language and the learning of languages. This instruction is intended to broaden the scope of the student's education as well as to assist him in his own language study.

## Freshman Year

| Fall | Winter | Spring |
|---|---|---|
| Humanities | Humanities | Humanities |
| Language | Language | Language |
| Mathematics | Mathematics | Mathematics |
| Fine Arts | Physical Science | Physical Science |

### Sophomore Year

| Fall | Winter | Spring |
|---|---|---|
| Humanities | Humanities | Humanities |
| Physical Science | Physical Science | Biology |
| Social Science | Social Science | Social Science |
| Elective/Language | Elective/Language | Elective/Language |

## Graduation Requirements

In order to graduate from Revelle College, a student must:

1. Complete the lower division general education requirements.
2. Complete a major.
3. Complete a noncontiguous minor.
4. Demonstrate proficiency in a modern foreign language (upper division).
5. Satisfy the Subject A requirement.
6. Satisfy the American History and Institutions requirement.
7. Take at least 48 courses, with at least the minimum scholarship standing. (see Academic Regulations)
8. Nine courses (36 units) out of the final eleven (44 units) courses completed by each candidate for the bachelor's degree must be completed on the San Diego campus.

Upon satisfaction of the graduation requirements, Revelle College will recommend the award of the degree of Bachelor of Arts, with a diploma specifying the major field.

## REVELLE COLLEGE MAJORS

The following majors will be offered during the academic year 1966-1967:

Aerospace and Mechanical Engineering Sciences
Applied Electrophysics
Biology
Chemistry
Earth Sciences
Economics
History
Literature (English, German, Spanish)
Mathematics
Philosophy
Physics
Psychology

## THE NONCONTIGUOUS MINOR

Six (6) courses will be in a minor field not closely related to the major, to be selected in consultation with the college department and subject to the approval of the Provost of Revelle College. With the approval of the adviser, not

more than three lower division courses may be accepted on the noncontiguous minor. The noncontiguous minor may be met in one of the following ways:

1. The noncontiguous minor may center on a problem, area, or period of the student's choice which is selected in consultation with the faculty adviser in any of the three major areas of study (Natural Sciences, Social Sciences, Humanities) except that of his major. The program will consist of six courses articulated around the problem. Thus, for example, a major in one of the Natural Sciences could do a noncontiguous minor in "The French Revolution" for which he might conceivably take courses in Political Science, Sociology, Literature, History and Economics; a student majoring in the Humanities could take a noncontiguous minor in a Social Science area or a Natural Science area (in the Natural Sciences the "problem" might conceivably be selected from among several such "problems" devised and structured as units by agreement of the science faculty).

2. If the adviser finds that the offerings in Revelle College are not sufficient to prepare a program as described above, the student may take any six courses in one department or field not related to his major.

## FOREIGN LANGUAGE PROFICIENCY IN UPPER DIVISION

In order to graduate from Revelle College, the student must have demonstrated an overall ability to perform in a foreign language. For oral proficiency, previous passing of the lower division language requirement will be taken as satisfactory demonstration. To demonstrate reading proficiency, the student will take an appropriate examination. The student will normally take this examination at the end of his junior year; if he does not pass it then, he will have his senior year in which to gain the required proficiency.

### Subject A: English Composition

Satisfaction of Subject A is a prerequisite to taking any regular course in English composition, or any Humanities sequence course beyond Humanities I. It is also a prerequisite to the receipt of a bachelor's degree.

### American History and Institutions

Candidates for a bachelor's degree must satisfy the "Requirement in American History and Institutions" by demonstrating a knowledge of American history and of American political institutions and ideals. This requirement may be satisfied:

1. By passing a one quarter History course (30 or 33A or 33B), at UCSD or
2. By passing an examination which the Committee on American History and Institutions offers for the purpose of satisfying the requirement (no unit credit is given for the examination), or
3. By presenting a statement of satisfaction of the present State requirement as administered in another collegiate institution within the State.

Further information regarding the requirement and examinations may be obtained from the Chairman of the Committee on American History and Institutions, located within the History Department.

### Transfer Students

In general, a student wishing to transfer as a junior to Revelle College will be held to the lower division general education requirements and to the lower

division prerequisites for his proposed major. The general education requirements, however, will be interpreted rigorously only for those subjects that are directly related to his proposed major. The Provost, in consultation with appropriate departments, will evaluate the credentials of each transfer student on an individual basis. Transfer without penalty will be authorized upon approval of the Provost and the responsible department. A transfer student at the junior or senior level may be admitted to a major even though he has not completed the lower division general education requirements. In such cases, the general requirements must be completed before graduation.

## MAJOR PROGRAMS AND COURSES OF INSTRUCTION

Courses are numbered as follows:

| | |
|---|---|
| **1-99** | **Lower division courses** |
| **100-199** | **Upper division courses** |
| **200-299** | **Graduate division courses** |

The quarter in which the course is given is indicated by capital letters: **F** for the fall quarter, **W** for the winter quarter, **S** for the spring quarter, and **Su** for the summer quarter. The credit value of each graduate course in quarter units is indicated by the numbers in parentheses.

Some of the courses listed will not be offered during the 1966-67 academic year, or will be offered every other year, etc. Such courses are indicated as follows:

*** Not offered 1966-67**
**† Offered in 1966-67 and every second year**
**** Offered in 1967-68 and every second year**
**†† Course given in alternate years only**

## AEROSPACE AND MECHANICAL ENGINEERING SCIENCES (INCLUDING BIOENGINEERING)

Departmental Office, 5202 Urey Hall

### Instructional Staff

H. Bradner, Ph.D., D.Sc., *Professor of Engineering Physics and Geophysics*
Y. C. Fung, Ph.D., *Professor of Bioengineering and Applied Mechanics*
P. A. Libby, Ph.D., *Professor of Aerospace Engineering*
S. C. Lin, Ph.D., *Professor of Engineering Physics*
J. W. Miles, Ph.D., *Professor of Applied Mechanics and Geophysics*
W. Nachbar, Ph.D., *Professor of Applied Mechanics*
S. S. Penner, Ph.D., *Professor of Aerospace and Mechanical Engineering Sciences (Chairman of the Department)*
W. Prager, Eng.D., Sc.D., *Professor of Applied Mechanics*
B. W. Zweifach, Ph.D., *Professor of Bioengineering*
D. B. Olfe, Ph.D., *Associate Professor of Aerospace Engineering*
S. Rand, Ph.D., *Associate Professor of Engineering Physics*
A. M. Schneider, Ph.D., *Associate Professor of Aerospace Engineering*
F. A. Williams, Ph.D., *Associate Professor of Aerospace Engineering*
R. L. Burton, Ph.D., *Assistant Professor of Engineering Physics*
C. H. Gibson, Ph.D., *Assistant Professor of Aerospace Engineering*

G. A. Hegemier, Ph.D., *Assistant Professor of Applied Mechanics*
N. C. Huang, Ph.D., *Assistant Professor of Applied Mechanics*
M. Intaglietta, Ph.D., *Assistant Professor of Bioengineering*
D. R. Miller, Ph.D., *Assistant Professor of Engineering Physics*
S. Nemat-Nasser, Ph.D., *Assistant Professor of Applied Mechanics*
R. F. Pawula, Ph.D., *Assistant Professor of Aerospace Engineering*
C. W. Van Atta, Ph.D., *Assistant Professor of Aerospace Engineering*

* * *

E. Reissner, Ph.D., *Visiting Professor of Applied Mechanics (Winter quarter only)*
K. G. P. Sulzmann, *Research Engineer*
H. L. Karatas, Ph.D., *Research Associate in Applied Mechanics (winter and spring quarters)*

* * *

The current instructional and research programs emphasize high-temperature gas dynamics, fluid mechanics, bioengineering, solid mechanics and structures, and vehicle guidance and control. The graduate program is characterized by strong interdisciplinary relationships with the Departments of Physics, Mathematics, and Chemistry, with the Medical School, and with associated university institutes such as the Institute for Geophysics and Planetary Physics, the Institute for Radiation Physics and Aerodynamics, and the Space Sciences Laboratory.

## UNDERGRADUATE PROGRAM

The Department of Aerospace and Mechanical Engineering Sciences offers two programs of study at the undergraduate level, each leading to the degree of Bachelor of Arts (Applied Science). Both programs have common required courses in the junior year so that a student may delay final choice of program to the end of the junior year. The *applied mechanics* program prepares the student for pre-professional graduate studies in aerospace and mechanical engineering whereas the *electromechanics program* does the same in those areas of aeronautical and electrical engineering related to guidance, control and systems analysis. Students considering a major in applied mechanics are advised to take Mathematics 100, AMES 1 and Physical Science 1E in their sophomore year and those considering a major in electromechanics are advised to take Mathematics 100, 101 and 102 in their sophomore year. The courses required by the department are to be supplemented by electives in contiguous and noncontiguous areas chosen in consultation with departmental representatives. Students with superior records are expected to take more than the minimum number of courses with special emphasis on AMES, mathematics, physical chemistry, physics, and applied electrophysics.

All students in AMES are required to take, in their junior year, courses in continuum and fluid mechanics, thermodynamics and dynamics as contained in AMES 100, 101A, 101B, 111, Physics 140 and AMES 120A. Those students who have completed Mathematics 100 in their sophomore year are required to complete Mathematics 120, 121 and 122 in their junior year; those who have not done so are also required to complete Mathematics 100 in the first quarter of the junior year.

### Senior Year—Applied Mechanics Program

A student electing to follow the applied mechanics program is required during his senior year to complete his studies of fluid mechanics with AMES 101C and of dynamics with AMES 120B, 120C and 120D. In addition he is required to study solid mechanics as contained in AMES 130A and 130B.

It is recommended that seniors complete their noncontiguous minor during their senior year. Electives generally chosen in physics and necessary to fulfill minimum graduation requirements are to be selected in consultation with the departmental advisers. Superior students are encouraged to supplement a minimum program with courses in AMES, mathematics, physical chemistry, and physics.

### Senior Year—Electromechanics Program

A student electing to follow the electromechanics program is required during his senior year to complete his studies of dynamics with AMES 120B, 120C and 120D and to complete a sequence of courses devoted to systems theory and identified as AMES 140A, 140B and 140C. It is recommended that seniors complete their noncontiguous minor during their senior year. Electives generally chosen in either mathematics, physics or applied electrophysics necessary to fulfill minimum graduation requirements are to be selected in consultation with the departmental advisers.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## AMES DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE
## (APPLIED MECHANICS)

| | Fall | Winter | Spring |
|---|---|---|---|
| Freshman Year | Humanities 1 | Humanities 2 | Humanities 3 |
| | Language 1A or 2A | Language 1B or 2B | Language 1C or 2C |
| | Math 1A or 2A | Math 1B or 2B | Math 1C or 2C |
| | Fine Arts 1 | Physical Science 1A | Physical Science 1B |

| | | | |
|---|---|---|---|
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math 2C/Math 100 | Humanities 5<br>Social Science<br>Physical Science 1D<br>Math 100/*AMES 1 | Humanities 6<br>Social Science<br>Biology 1<br>*Physical Science 1E |
| **Junior Year** | AMES 100<br>Physics 140<br>Math 120 | AMES 101A<br>AMES 111<br>Math 121 | AMES 101B<br>AMES 120A<br>Math 122 |
| **Senior Year** | AMES 120B<br>AMES 101C | AMES 120C<br>AMES 130A | AMES 120D<br>AMES 130B |

*Recommended but not required.

## AMES DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE
## (ELECTROMECHANICS)

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math 2C/Math 100 | Humanities 5<br>Social Science<br>Physical Science 1D<br>Math 100/*AMES 1 | Humanities 6<br>Social Science<br>Biology 1<br>*Physical Science 1E |
| **Junior Year** | AMES 100<br>Physics 140<br>Math 120 | AMES 101A<br>AMES 111<br>Math 121 | AMES 101B<br>AMES 120A<br>Math 122 |
| **Senior Year** | AMES 120B<br>AMES 140A | AMES 120C<br>AMES 140B | AMES 120D<br>AMES 140C |

*Recommended but not required

## GRADUATE PROGRAM

Admission will be in accordance with the general requirements of the Graduate Division. Candidates with bachelor's or master's degrees in mathe-

matics, the physical sciences, or any branch of engineering are invited to apply.

The Department of the Aerospace and Mechanical Engineering Sciences offers graduate instruction leading to the master and Ph.D. degrees in engineering science, with specialization in aerospace engineering, propulsion, gas dynamics and fluid mechanics, solid mechanics, structures, and vehicle guidance and control.

The instructional and research programs are characterized by strong interdisciplinary relationships with the Departments of Mathematics, Physics, and Chemistry and with associated campus institutes such as the Institute for Radiation Physics and Aerodynamics and the Institute for Geophysics and Planetary Physics.

## MASTER'S DEGREE PROGRAM

Both Plan I and Plan II are offered in the Department. Specific requirements by the Department are as follows:

1. The course of study must be approved by the student's adviser. The courses should generally include six (for Plan I) or nine (for Plan II) quarter courses offered by the AMES faculty. In special situations, where the departmental adviser is satisfied that the candidate has adequate proficiency in areas to be covered by these courses, other graduate courses may be elected as substitutes.
2. Students must have an average grade of B or higher in the courses taken in fulfillment of requirements for the master's degree. The Department will award master's degrees in engineering science only.
3. The thesis under Plan I is reviewed by a thesis adviser and one other faculty member appointed by the department chairman on the recommendation of the thesis adviser.
4. Under Plan II, the Department will allow a maximum of 6 units of research.

## DOCTOR'S DEGREE PROGRAM

A departmental examination will be given to all Ph.D. candidates prior to the regular Ph.D. qualifying examination. This departmental examination must be taken by all students during the sixth quarter of graduate work at UCSD. Under exceptional circumstances, particularly for graduate students who hold master's degrees from other institutions, the departmental examination may be taken at an earlier date on the recommendation of the adviser.

Students transferring to AMES from other departments, who have successfully passed a departmental examination administered by another department, will not be required to pass a departmental examination administered by AMES. However, these transfer students must obtain certification from their advisers that they possess professional knowledge of fluid mechanics, solid mechanics, bioengineering, or vehicle guidance and control before taking the Ph.D. qualifying examination.

After satisfactory completion of the departmental examination, graduate students in AMES must pass the usual Ph.D. qualifying examination administered by a Senate Committee, which will consist of five or more members, of whom at least two are members of other departments. The Committee for the qualifying examination is nominated by the department chairman on the basis

of recommendations made by the thesis adviser, and is appointed by the Graduate Council.

Doctoral candidates in AMES are generally expected to show proficiency in Russian as part of the foreign language requirements.

Successful candidates will be awarded the Ph.D. degree in engineering science with or without one of the following subsidiary labels: aerospace engineering, applied mechanics, or engineering physics.

## COURSES

### LOWER DIVISION

**1. Introduction to Aerospace Sciences** **W**

Space vehicle propulsion systems; structural problems; hypersonic reentry into planetary atmospheres.

### UPPER DIVISION

**100. Continuum Mechanics** **F**

Discussion of common foundations of fluid and solid mechanics; stress; instantaneous motion (rates of rotation and deformation); stress rate; constitutive equations (Newtonian fluid, elastic solid); conservation of mass; momentum and energy theorems. Coordinated laboratory experiments. Four hours lecture, two hours laboratory. Prerequisites or co-registration: Physics 140, Mathematics 100.

**101A. Fluid Mechanics** **W**

Potential flow theory with application to airfoils and wings; compressible flow theory including generalized one-dimensional flow. Coordinated laboratory experiments. Four hours lecture, two hours laboratory. Prerequisites: AMES 100, Mathematics 120; also prerequisite or co-registration: AMES 111.

**101B. Fluid Mechanics** **S**

Continuation of compressible flow theory including wave phenomena; viscous flow theory including boundary layer theory. Coordinated laboratory experiments. Four hours lecture, two hours laboratory. Prerequisites: AMES 101A, AMES 111, Mathematics 121.

**101C. Fluid Mechanics** **F**

Continuation of AMES 101B concerned with reacting flows; transport phenomena; combustion theory and with the applications to propulsion theory. Coordinated laboratory work. Four hours lecture, two hours laboratory. Prerequisites: AMES 101B, Mathematics 122.

**111. Thermodynamics** **W**

Extension and applications of Physics 140. Thermodynamic cycles including idealized propulsion systems; electromechanical processes including fuel cells and secondary power units; calculation of thermodynamic functions for ideal gases from spectroscopic data. Three hours lecture. Prerequisite: Physics 140; also prerequisite or co-registration: AMES 101A.

**120A. Dynamics of Electromechanical Systems** S

Representation of physical systems by linear ordinary and partial differential equations, illustrated by applications selected from rigid body mechanics, lumped-parameter and distributed-parameter electrical systems and heat conduction; Kirchhoff's laws; harmonic oscillators – pendulum, RLC tuned circuit, vibrating string; coupled systems; solutions of differential equations in the domain of the independent variable; free (transiedt) response and forced (steady-state) response to sinusoidal driving forces; superposition. Four hours lecture. Prerequisite: Mathematics 121.

**120B. Dynamics of Electromechanical Systems** F

Continuation of AMES 120A. Circuit analysis; application of the Laplace transform to solution of linear differential equations arising in electrical and mechanical systems; the transient and/or steady-state response to sinusoidal, impulse, exponential, step, etc., driving functions; transfer functions; impedance; characteristic equation; natural modes; stability Routh-Hurwitz criterion; pole-zero analysis. 1 Partial fraction-expansions; networks synthesis; linearization of a nonlinear system about an operating point. Four hours lecture. Prerequisites: AMES 120A, Mathematics 122.

**120C. Dynamics of Electromechanical Systems** W

The analysis of motion in three dimensions; vector analysis; vector derivatives in rotating coordinate systems; euler angles; matrix algebra; eigenvectors and eigenvalues; diagonalization of a matrix; coordinate transformations using vectors, matrices, and resolver chains. Infinitesimal rotations (small angles) as vectors. Rigid body dynamics for translation and rotation; angular velocity; angular momentum; moments and products of inertia; principle axes; gyroscopes. Four hours lecture. Prerequisite: AMES 120B.

**120D. Dynamics of Electromechanical Systems** S

Continuation of AMES 120C. Method of adjoints; the fundamental matrix; Lagrange's and Hamilton's equations; variational methods; orbital mechanics; two-body orbit problem; survey of problems and methods in guidance and control. Four hours lecture. Prerequisite: AMES 120C.

**130A. Solid Mechanics** W

Discussion of elastic, plastic, viscoelastic and viscoplastic solids in connection with simple static and dynamic problems concerning structural elements and structures (rods, beams, rings, and frames). Coordinated laboratory experiments. Four hours lecture, two hours laboratory. Prerequisite: AMES 101C.

**130B. Solid Mechanics** S

Discussion of simple problems in two and three-dimensional elasticity (torsion, flexure, stress concentration at circular holes; plane waves, Rayleigh waves, thermoelasticity). Simple illustrative problems in viscoelasticity and plasticity. Coordinated laboratory experiments. Four hours lecture, two hours laboratory. Prerequisite: AMES 130A.

**140A. Automatic Control Systems** F

The classical procedures for feedback control systems; formulation of differential equations and system model from physical description. Use of Laplace

transforms; transfer functions; compensation; Bode, Nichols, and root locus plots. Prerequisite or co-registration: AMES 120B.

**140B. Automatic Control Systems** **W**

Continuation of AMES 140A. Generalized concepts of system performance analysis based on frequency, transient, and error coefficient methods; compensation with lead or lag networks; gain-phase and pole-zero plots; linear sampled-data systems; Z-transforms; control systems incorporating digital computers. Associated laboratory involving analog and/or hybrid computer and automatic control devices. Prerequisite: AMES 140A.

**140C. Automatic Control Systems** **S**

Introduction to nonlinear systems; quasilinearization; describing functions; phase plane analysis. Introduction to random processes for time-invariant linear systems. Introduction to state-space characterization of dynamic systems. Laboratory. Prerequisite: AMES 140B.

**199. Independent Study for Undergraduates** **F,W,S**

Independent reading or research on a problem by special arrangement with a faculty member. Prerequisite: consent of instructor.

## GRADUATE

**205. GRADUATE SEMINAR (1,1,1)** **F,W,S**

The Staff

All graduate students in AMES are expected to attend the biweekly departmental research conference. On alternate weeks, all graduate students should attend a departmental seminar of their choice dealing with topics in fluid mechanics, solid mechanics, bioengineering, or guidance and control.

**210A-210B-210C. Introductory Fluid Mechanics (3,3,3)** **F,W,S**

Mr. Gibson, Mr. Miller, Mr. Van Atta

Kinematics; potential flow; wing theory; surface waves; gas dynamics; Navier-Stokes equations; boundary layers; turbulence. Prerequisites: undergraduate fluid mechanics and thermodynamics, or consent of instructor.

**211A. Propulsion (Air Breathing Engines) (3)** **F**

Mr. Williams

Propulsion of aircraft, missiles and boosters by air-breathing engines, including cycle analysis; characteristics of engine components, and matching of engine components to produce an efficient engine. Prerequisites: undergraduate fluid mechanics and thermodynamics, or consent of instructor.

**211B. Propulsion (Chemical Rockets and Mission Analysis) (3)** **W**

Mr. Penner

Solid and liquid-propellant rocket engines, combustion processes, motor design and performance; rocket configurations; mission analyses; optimization calculations. Prerequisites: AMES 211A, undergraduate fluid mechanics and thermodynamics, or consent of instructor.

**211C. Propulsion (Electrical and Nuclear Propulsion) (3)** S

Mr. Burton

Fundamentals of magnetohydrodynamics, plasma and ion propulsion; propulsion by solid-core nuclear rockets; advanced propulsion system concepts. Space missions using electrical and nuclear propulsion systems. Prerequisites: AMES 211A-211B, undergraduate fluid mechanics, electricity and magnetism, and thermodynamics, or consent of instructor.

**220A. Physical Gas Dynamics (3)** F

Mr. Rand

Kinetic theory of neutral and ionized gases; transport properties; radiation transfer; Planck's radiation law; classical treatment of continuum radiation; fundamental principles and applications of statistical mechanics; thermodynamic properties of high-temperature gases. Prerequisites: limited to second year graduate students. AMES 210A-210B-210C, Mathematics 120-121-122, Physics 100A-100B-100C, 140, or consent of instructor.

**220B. Physical Gas Dynamics (3)** W

Mr. Lin

Principles of electrodynamics and quantum mechanics; theories of atomic and molecular structure; perturbation method in quantum mechanics; semiclassical treatment of radiation; scattering phenomena; transition probabilities; vibrational relaxation; dissociation, ionization, and recombination. Prerequisites: AMES 210A-210B-210C, 220A, Physics 130A-130B, Mathematics 120-121-122, or consent of instructor.

**220C. Physical Gas Dynamics (3)** S

Mr. Lin

Shock waves and detonation waves; explosions and hypersonic flow; experimental methods in high-temperature gases; shock tubes; atomic and molecular beams; selected topics such as chemical reactions and relaxation processes in turbulent flow interaction of radiation with ionized gases, and gas lasers. Prerequisites: AMES 210A-210B-210C, 220A-220B, Physics 130A-130B, Mathematics 120-121-122, or consent of instructor.

**221A. Opacity Calculations (3)** F

Mr. Penner

Basic laws for radiant-energy emission from gases, liquids and solids; spectral absorption coefficients, line shapes, curves of growth; theoretical and experimental methods for estimating opacities of uniform and non-uniform gases. Prerequisite: consent of instructor. Not offered every year.

**221B. Radiative Transfer Theory (3)** W

Mr. Olfe, Mr. Penner, Mr. Rand

Fundamental quantities and the equation of transfer; methods of solving radiative transfer problems for gray and non-gray gases; nonstationary problems. Prerequisite: AMES 211A, or consent of instructor. Not offered every year.

**221C. Radiation Gas Dynamics (3)** S

Mr. Olfe

Conservation equations of gas dynamics including a radiation field; the effect of radiative transfer on acoustic waves, shock-wave structure, and boundary layers; radiative cooling in the shock layers of high-velocity reentry vehicles; radiative transfer effects on convection and turbulence. Prerequisites: AMES 211A-211B or consent of instructor. Not offered every year.

**222A-222B-222C. Advanced Fluid Mechanics (3,3,3)** F,W,S

Mr. Libby, Mr. Lin, Mr. Miles

Contemporary problems in broad areas of fluid mechanics, *e.g.*, surface waves, hydrodynamic stability, boundary layers with mass and heat transfer, turbulent flow theory, multiphase systems, hypersonic flow theory, shock wave structure, theory of reacting flows, etc. Prerequisites: AMES 210A-210B-210C, 211A-211B-211C, Mathematics 120-121-122, or consent of instructor.

**231A. Foundations of Solid Mechanics (3)** F

Mr. Huang

Cartesian tensors; specification of stress, instantaneous motion, and infinitesimal strain; conservation principles; typical constitutive equations; specification of finite strain. Prerequisite: AMES 130A, or consent of instructor.

**231B. Elasticity (3)** W

Mr. Fung

Basic equations; general boundary value problem and uniqueness of its solution; torsion and flexure; variational principles; numerical methods. Prerequisite: AMES 231A, or consent of instructor.

**231C. Elasticity (3)** S

Two-dimensional problems and complex variable methods; fundamentals of plate theory; selected three-dimensional problems. Prerequisite: AMES 231B, or consent of instructor.

**232. Matrix Methods in Analysis of Structures and Continua (3)** F

Mr. Nachbar

Elements of matrix algebra; application of transfer matrix and force and displacement methods to linear and nonlinear problems. Prerequisite: AMES 130B, or consent of instructor.

**233. Plasticity (3)** W

Mr. Prager

Classification of plastic solids; behavior of plastic structures; limit analysis; plastic design; finite plastic deformation, application to technological forming processes. Prerequisite: AMES 231A, or consent of instructor.

**234. Viscoelasticity (3)** S

Mr. Huang

Equivalent mathematical representations of stress-strain relations of linear viscoelastic solids. Quasi-static and dynamic stress analysis problems; thermal effects; nonlinear viscoelasticity. Prerequisite: AMES 231B, or consent of instructor.

***235A. Theory of Shells (3)** F

Mr. Nachbar

Fundamentals of shell theory; linear membrane and bending theories of shells of revolution; pressure vessels; shallow shells. Prerequisite: AMES 130A or consent of instructor.

**235B. Theory of Shells (3)** W

Mr. Reissner

Nonlinear membrane and bending theory of finite deflection and small strain of shells of revolution and shallow shells. Prerequisite: AMES 235A, or consent of instructor.

**236. Structural Stability (3)** S

Mr. Nachbar

Instabilities of structural elements under steady, oscillatory, and impulsive loading. Elastic buckling of compressed plates and shells. Prerequisites: AMES 235A, or consent of instructor.

**237. Vibrations of Structures (3)** F

Mr. Prager

Free and forced vibrations of structural elements; approximate methods of determining natural frequencies and modes, and dynamic response of structures. Prerequisite: AMES 232, or consent of instructor. Not offered every year.

**250A. Astrodynamics and Rocket Navigation (3)** F

Mr. Schneider

Practical application of celestial mechanics to vehicle analysis; elements of a two-body orbit; elliptical, parabolic, hyperbolic orbits. Coordinate systems; orbit transfer in single-force field and two-force field systems; optimal plane change; lunar flights; interplanetary flight; low-thrust vehicles. Prerequisites: basic mechanics, vector and matrix methods, or consent of instructor.

**251A. Guidance of Aerospace Vehicles (3)** W

Mr. Schneider

Survey of guidance problems; definitions, mission phases, guidance requirements, intercept (proportional navigation and homing), explicit and implicit guidance, rendezvous, methods of steering, steering control and stability, introduction to optimal steering laws. Prerequisites: AMES 250A, and basic feedback control theory, or consent of instructor.

**251B. Gyrodynamics and Inertial Navigation Systems (3)** S

Mr. Schneider

Behavior of gyros and accelerometers; inertial navigation system equations for cruise and orbiting vehicles; Schuler tuning, error analysis. Alignment; gyrocompassing on fixed and moving vehicles; four-gimbal, three-gimbal, and strapdown systems. Prerequisite: AMES 251A, or consent of instructor. Not offered every year.

**253A. State-Space and Time-Domain Approach to Control Theory (3)** S

Mr. Schneider

Time domain methods; their utility in the analysis and design of control systems. The fundamental matrix; vector and matrix differential equations and

difference equations, canonical representations of dynamic systems; controllability and observability of linear systems. State-variable equations for discrete-time systems and analysis by means of time-domain matrices; stability analysis and design of control systems using state-space techniques; the use of computer programs as examples. Prerequisites: basic feedback control systems, matrix methods, or consent of instructor.

**264. Filtering and Random Processes in Automatic Control (3)** W

Mr. Pawula

Statistical problems of importance to control engineers; review of probability theory with application to such problems as evaluation of probability of kill; introduction to sampling theory; error analysis; estimation of correlation functions and spectra. Extensive treatment of random processes in linear feedback systems including optimum design of such systems; Wiener filters, Kalman filters. Brief treatment of non-linear systems in presence of random noise. Prerequisites: basic feedback control theory and AMES 294A, or consent of instructor.

**271. Structure and Function of Tissues (3)** F

Mr. Zweifach

General discussion of the structure and function of major tissues of the animal body. Detailed discussions of smooth muscle, blood vessels, general matrix of ground substances. Emphasis will be placed on the vascular system and related tissues, such as the endothelial cells, erythrocytes, gels, mucopolysaccharides, basement membranes, etc. Prerequisite: consent of instructor.

**272. Microcirculation Mechanics (3)** S

Mr. Fung

Application of continuum mechanics to problems in microcirculation. The pressure-flow relationships; geometry of the microcirculatory system and its influence on physiological behavior. Auto-regulation; elasticity and strength of erythrocytes and blood vessels; adhesion of cells; rouleaux formation; hemolysis; the mechanics of capillary blood vessels; the gel, sol states and their transformation; the dynamics of erythrocytes in circulation; the minimization of excorporeal blood handling damage; the abnormal conditions of microcirculation. Prerequisite: consent of instructor.

**273. Rheology of the Blood and Blood Vessels (3)** W

Mr. Intaglietta

Non-Newtonian fluids; the nonlinear viscous characteristics of blood in viscometers; the elastic limit of the whole blood and the matrix formation at low strain rate. Constitutive laws of blood vessels and other tissues; interaction of blood cells and blood vessel walls; the differences in the flow characteristics of blood in vivo and in vitro. Prerequisite: consent of instructor.

**274. Hemodynamics (3)**

Mr. Fung, Mr. Zweifach

The dynamics of blood in circulation; propagation of waves in blood vessels; Korotkoff sound; stability and flutter; physical features of blood flow through the tissues; mass transport across vascular membrane; diffusion kinetics; emigration of leucocytes; clot formation. Prerequisite: consent of instructor. Not offered every year.

**275. Advanced Cell Physiology for Bioengineering (3)**
Mr. Zweifach
Discussion of several special types of cells: endothelium, smooth muscle, mast cells, lymphocytes, neutrophiles, platelets, macrophages, etc. The ultrastructure and biochemical characteristics of these cell types will be considered. Emphasis will be placed on quantitative measurements and analyses based on mathematical and physical principles. Prerequisite: consent of instructor. Not offered every year.

**276. Selected Topics in Bioengineering (3)** **W**
The Staff
Discussion of research areas under current investigation in the bioengineering group. In addition, visiting scientists will be invited to cover topics of current interest. Prerequisite: consent of instructor.

**277. Laboratory Projects in Bioengineering (3)** **S**
Mr. Intaglietta
Theory of statistical inference, analysis, and design of experiments; data handling by digital computers, video tape recording, etc. Theory and application of optical and electronic instrumentation. The course will consist of lectures, conferences, demonstrations, as well as student's own selected laboratory project for study in depth. Prerequisite: consent of instructor.

**294A. Methods in Applied Mechanics (3)** **F**
Mr. Pawula
Probability distribution functions; statistical independence; functions of random variables; characteristic functions; correlation functions; time averages; sampling; the central limit theorem; spectral analysis; the Gaussian random process; narrow band processes, linear systems; random walks; the Fokker-Planck-Kolmogorov equations and Brownian motion. Prerequisites: Mathematics 120-121-122, or consent of instructor. Not offered every year.

**294B. Methods in Applied Mechanics (3)** **W**
Mr. Rand
Motion of discrete and continuous conservative systems; boundary-value problems of dynamics; eigenfunctions and eigenvalues; applications of integral transform methods, Green's functions, and calculus of variations. Stability of continuous systems. Prerequisites: Mathematics 120-121-122, or consent of instructor. Not offered every year.

**294C. Methods in Applied Mechanics (3)** **S**
Mr. Williams
Continuation of 294B to include diffusion processes and transport phenomena (elliptic and parabolic equations, integral equations). Application of asymptotic expansions and singular perturbation techniques. Prerequisite: AMES 294B, or consent of instructor. Not offered every year.

**296. Independent Study (3,3,3)** **F,W,S**
The Staff

**299. Graduate Research (1-6, 1-6, 1-6)** **F,W,S**
The Staff

# APPLIED ELECTROPHYSICS

Departmental Office, 7108 Urey Hall

### Instructional Staff

Henry G. Booker, Ph.D., *Professor of Applied Electrophysics (Chairman of the Department)*
Kenneth L. Bowles, Ph.D., *Professor of Applied Electrophysics*
Marshall H. Cohen, Ph.D., *Professor of Applied Electrophysics*
Jules A. Fejer, Ph.D., *Professor of Applied Electrophysics*
Carl W. Helstrom, Ph.D., *Professor of Applied Electrophysics*
Irwin M. Jacobs, Ph.D., *Associate Professor of Applied Electrophysics*
Peter M. Banks, Ph.D., *Assistant Professor of Applied Electrophysics*
George J. Lewak, Ph.D., *Assistant Professor of Applied Electrophysics*
Robert D. Moore, Ph.D., *Assistant Professor of Applied Electrophysics*

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Seibert Q. Duntley, Ph.D., *Research Physicist, Scripps Institution of Oceanography*
Henry D. Block, Ph.D., *Visiting Professor of Applied Electrophysics 1966-67*
Victor H. Rumsey, D. Eng., *Professor of Electrical Engineering, Visiting from Berkeley 1966-67*

### Undergraduate Program

Students desiring a major in applied electrophysics should take the same junior courses during the fall quarter, 1966, as physics majors. Details of the senior year curriculum are not yet available. For further information on an applied electrophysics major, contact the departmental office, 7108 Urey Hall.

### Graduate Program

The objective of the graduate degree program in the Department of Applied Electrophysics is to exploit electrical and electronic applications of physics and mathematics for the purpose of developing the minds of students to the point where they can face novel situations with confidence throughout their lives. Applications will be considered from students who have taken undergraduate majors in one of the following fields: physics, applied physics, applied electrophysics, mathematics, applied mathematics, engineering physics, engineering science, electrical engineering, computer science. In special circumstances alternative undergraduate preparation will be considered (*e.g.*), a biology major for a student interested in the application of information and computer science to biological problems). In appropriate cases provision will be made for graduate students to take, without graduate credit, undergraduate courses required to make up deficiencies.

For the purpose of developing the Department of Applied Electrophysics and its graduate program three areas of activity have been selected. These are: (1) Applied Solid State Physics and Quantum Electronics, (2) Radio Astronomy and Solar System Physics, (3) Information and Computer Sciences. The first of these fields includes the study of superconductors, ferroelectric materials and ferromagnetic materials as possibly related to useful devices. The field includes the study of transistors, masers and lasers, and the propagation of coherent light through solids, liquids and gases.

Radio astronomy and solar system physics involves the study of planetary surfaces, atmospheres, ionospheres and magnetospheres by radio techniques. It includes the study of the solar wind, corona, chromosphere and photosphere. Galactic and extragalactic radio astronomy will also be studied, but the initial emphasis will be on the solar system. The department hopes to have available for use, by arrangement, the facilities of several radio astronomical observatories in California and elsewhere.

The information and computer sciences are concerned with the processing of data regardless of the discipline from which the data arise. More particularly, the information and computer sciences involve the study of the symbols that constitute the carriers of information and of the relations between them, the study of large switching systems, the study of electronic computers and communication systems, and the study of electromagnetic and quantum signal detection. The program will be concerned with the fundamentals of new aspects of these studies.

### Master's Degree Program

Requirements for the degree of Master of Science may be met in accordance with Plan II (comprehensive examination). For the degree of Master of Science the foreign language requirement is a reading knowledge of Russian, German, or French.

### Doctor's Degree Program

Upon a student's admission, the chairman of the department will appoint an adviser to assist the student in planning his program and in preparing for the comprehensive and qualifying examinations. During the first two years the student will take a number of courses and spend some hours each week in association with a research activity. This program must be approved by his adviser. The written comprehensive examination will normally be taken after two years of graduate work, and may be supplemented by an oral examination. There are no special unit requirements. However, a student will normally require not less than 48 quarter units of graduate course-work to pass the comprehensive examination for the degree of Doctor of Philosophy. A student who has taken a Master's Degree can proceed to a Doctor's Degree; at least twelve additional quarter units of graduate course work will be required before the student can take the comprehensive examination for the Degree of Doctor of Philosophy. There are no required courses. However advisers will have available a list of recommended courses for each of the three fields of emphasis described in the previous paragraph.

For the degree of Doctor of Philosophy, the foreign language requirement is as follows:

Either (a) the student must demonstrate a satisfactory reading knowledge of two foreign languages chosen from Russian, German and French;

Or (b) the student must demonstrate a comprehensive speaking and reading knowledge of one of the following languages: (1) Russian, (2) German, (3) French, or (4) a language specifically involved in a student's work as a graduate student or his anticipated work after graduation; this could be the language of a country where he will be engaged in observatory field work.

The oral qualifying examination for the degree of Doctor of Philosophy will be given by a doctoral committee appointed by the Graduate Council. In order

to be admitted to the oral qualifying examination a student must (a) pass the comprehensive examination, (b) satisfy all foreign language requirements, and (c) be accepted by a faculty member as a thesis student. At a qualifying examination the student will be expected to describe his thesis topic and present preliminary results. A candidate for the degree of Doctor of Philosophy will write a dissertation which is expected to demonstrate his ability to face and master novel situations. The candidate will defend his thesis in an oral examination conducted by the doctoral committee.

## COURSES

### GRADUATE

**201. Electromagnetic Theory (3)** **F**
Mr. Lewak
Maxwell's equations; boundary value problems; reflection and transmission of plane waves at a plane interface; cylindrical and spherical waves; electromagnetic waves in waveguides and cavities; excitation of waveguides and cavities; propagation of radio waves over the surface of the earth. Prerequisite: an upper division course in electricity and magnetism.

**202. Physical Optics and Microwaves (3)** **W**
Mr. Fejer
Propagation at optical and microwave frequencies; Huygens' and Fermat's principles; geometrical optics; wave properties; interference phenomena; Fraunhofer and Fresnel diffraction; optical and microwave lenses; polarization, Stoke's parameters; Babinet's principle at optical and microwave frequencies. Prerequisite: Physics 203A or Applied Electrophysics 201.

**203. Optical Systems (3)** **S**
Mr. Duntley
Geometrical, physical and physiological optics; ultraviolet, visible-light, and infrared optical systems; images; coherence, spatial frequency analysis, modulation transfer functions, spatial filtering, apodization, holography, image reconstruction, resolution, information extraction; lasers; detectors; radiometry, photometry, colorimetry, photographic sensitometry; atmospheric and hydrologic optics; visibility. Prerequisite: Applied Electrophysics 202.

**204. Antennas (3)** **W**
Mr. Rumsey
Fundamentals of antenna theory based on Maxwell's equations; low frequency and high frequency approximations; multimode analysis, periodic structures and arrays; frequency independent spiral and log-periodic structures; radio astronomy antennas for measurement of brightness and polarization. Prerequisite: Physics 203A or Applied Electrophysics 201.

**211. Elementary Plasma Waves (3)** **W**

Mr. Booker

Linear theory of waves in magnetoplasmas, especially cold magnetoplasmas; propagation at any angle to magnetic field; quasi-longitudinal and quasi-transverse approximations; hydromagnetic, whistler and radio waves; dispersion and group phenomena; applications to the ionosphere and magnetosphere. Prerequisite: Physics 203A or Applied Electrophysics 201.

**212. Advanced Plasma Waves (3)** **S**

Mr. Fejer

Vlasov-Landau approach to plasma phenomena; point source in a magnetoplasma; satellite ionospheric phenomena at gyro and hybrid resonant frequencies; scattering of radio waves by thermal plasma fluctuations; growing plasma waves, instabilities; field aligned ionospheric irregularities; nonlinear ionospheric wave phenomena. Prerequisite: Applied Electrophysics 211.

**213. Plasma Turbulence (3)** **W**

Mr. Lewak

Statistical mechanics of the plasma; the closure problem and closure approximation; collective coordinates; exactly solvable models, analog models; magnetohydrodynamic weak and strong turbulence; special techniques, generating and probability functionals; turbulent plasmas under natural and experimental conditions. Prerequisite: consent of instructor.

**221. Solar Atmosphere and Solar Wind (3)** **F**

Mr. Banks

The physical structure of the photosphere, chromosphere and corona; solar optical, radio and particle emissions; the problems of radiative transfer, thermodynamic equilibrium, coronal heating, and the solar wind with emphasis upon aspects of importance to solar-terrestrial relations. Prerequisites: Physics 130, 141 **(To be taught for the first time in the fall, 1967).**

**222. The Magnetosphere (3)** **W**

Mr. Banks

A review of current theories and experimental results on the formation of the magnetosphere. Related phenomena concerning plasma shockwaves and instabilities, formation and structure of the trapped particle belts, and charged particle concentrations and temperature in the exosphere. Prerequisites: Physics 130, 141.

**223. The Upper Atmosphere and Ionosphere (3)** **S**

Mr. Banks

An introduction to the physical processes which determine the structures of the neutral and ionized components of the Earth's upper atmosphere. Particle diffusion, heat conduction, chemical aeronomy, charged particle reactions. Effect of solar radiations upon atmospheric composition and temperature. Prerequisites: Physics 130, 141.

**224. Radar and Radio Astronomy of the Solar System (3)** **F**

Mr. Bowles, Mr. Cohen

Radio noise from the sun, moon and planets; echoes from lunar and planetary

surfaces, the solar corona and plasma density fluctuations in the ionosphere, magnetosphere and solar wind; measurement of integrated ionization density; bistatic radar techniques. Prerequisite: consent of instructor.

**225. Signal Processing in Radar and Radio Astronomy (3)** **W**

Mr. Bowles

The measurement of spectrum and correlation functions of observed waveforms; angular spectra; scattering by weak plasma fluctuations; radar signal design; analog and digital processing methods; synthetic antenna apertures and numerical filtering. Prerequisites: Applied Electrophysics 224, 261A.

**226. Galactic and Extragalactic Radio Astronomy (3)** **S**

Mr. Cohen, Mr. Rumsey

A discussion of galactic and extragalactic problems to which radio techniques are applied. Observational characteristics and current theories for the explanation of radio emission from the galaxy, discrete sources and external galaxies; the hydrogen and OH lines. Prerequisite: consent of instructor.

**261A-261B. Introduction to Signal Processing (3,3)** **F,W**

Mr. Helstrom, Mr. Jacobs

Elements of linear systems; sampling; probability, random processes; elementary theory of detection of signals in random noise; matched filtering, least-mean-square filtering and prediction. Prerequisites: an undergraduate course in electric network theory and an undergraduate course in probability.

**262. Communication Theory (3)** **S**

Mr. Jacobs

The coding theorem of information theory. Interplay between digital modulation and coding; some practical coding and decoding systems; source coding; analog modulation systems and pulse code modulation. Prerequisite: Applied Electrophysics 261B.

**263. Signal Detection Theory (3)** **S**

Mr. Helstrom

Karhunen-Loève expansion. Detection of signals in non-white noise. Estimation of signal parameters. Resolution of signals. Detection and estimation of random signals. Prerequisite: Applied Electrophysics 261B.

**271. Introduction to Instrument Design (3)** **W**

Mr. Moore

Physical limitations to measurement; need for amplification, limitations of amplifiers, definition of noise figure, generalized amplifier noise models. Transducers: evaluation in terms of noise performance, stability, linearity. Absolute versus relative measurements, null methods, frequency and time measurements. Introduction to coherent detection (lock-in amplifiers). Prerequisite: consent of instructor.

**272. Techniques of Instrument Design (3)** **S**

Mr. Moore

The designer's dilemma; importance of system approach; the input interface: importance of the physics of the situation, low-noise preamplifier design, tubes

versus semiconductors, special methods, use of inverse feed-back control. The output interface: digital versus analog, real-time problems. Examples. Prerequisite: Applied Electrophysics 271.

**281. Introduction to Automata (3)** **W**

Mr. Block

Applications of biological strategies to design of automata. Engineering approach: learning machines, adaptive systems, pattern recognition, self reproducing and repairing systems, brain models, automatic language translation. Mathematical approach: neural nets, finite state machines, Kleene's theorem, Turing machines, computability, Gödel's theorem. Prerequisite: consent of instructor.

**282. Special Problems in Automata (3)** **S**

Mr. Block

Seminar type course reporting on current problems and new results in the areas introduced in Applied Electrophysics 281. Prerequisite: Applied Electrophysics 281.

**290. Observatory Field Course (1-12, 1-12, 1-12, 1-12)** **F,W,S,Su**

The Staff

Methods of measurement, observation and sampling used at radio, radar and optical observatories in astronomy and solar system physics; establishment and use of equipment for a current research investigation at an observatory; analysis and interpretation of results with a report. Prerequisite: consent of instructor.

**292. Graduate Seminar in Radio Astronomy and Solar System Physics (1,1,1)** **F,W,S**

Mr. Cohen, Mr, Booker, Mr. Bowles, Mr. Fejer, Mr. Banks, Mr. Lewak

Research topics in radio astronomy and solar system physics.

**293. Graduate Seminar in Signal Processing (1,1,1)** **F,W,S**

Mr. Helstrom, Mr. Bowles, Mr. Jacobs, Mr. Moore

Research topics in signal processing.

**296. Independent Study (1-6, 1-6, 1-6)** **F,W,S**

The Staff

Open to properly qualified graduate students who wish to pursue a problem through advanced study under the direction of a member of the staff. Prerequisite: consent of instructor.

**299. Research (1-6, 1-6, 1-6)** **F,W,S**

The Staff

Additional graduate courses will be offered in 1967-68 on topics in computer science, applied solid state physics and quantum electronics.

# BIOLOGY

Departmental Office, 2150 Bonner Hall

**Instructional Staff**

Warren L. Butler, Ph.D., *Professor of Biology*
Clifford Grobstein, Ph.D., *Professor of Biology (Chairman of the Department)*
S. Jonathan Singer, Ph.D., *Professor of Biology*
Herbert Stern, Ph.D., *Professor of Biology*
John A. DeMoss, Ph.D., *Associate Professor of Biology*
Donald R. Helinski, Ph.D., *Associate Professor of Biology*
Stanley E. Mills, Ph.D., *Associate Professor of Biology*
Yasuo Hotta, Ph.D., *Associate Research Biologist*
Melvin H. Green, Ph.D., *Assistant Professor of Biology*
Masaki Hayashi, Ph.D., *Assistant Professor of Biology*
Tom Humphreys, Ph.D., *Assistant Professor of Biology*
Thomas F. Roth, Ph.D., *Assistant Research Biologist*
Herbert M. Schulman, Ph.D., *Assistant Professor of Biology*
Melvin I. Simon, Ph.D., *Assistant Professor of Biology*

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T. H. Bullock, Ph.D., *Professor of Neurosciences*
Melvin Cohn, Ph.D., *Professor in Residence in Biology*
Frank J. Dixon, M.D., *Professor in Residence in Biology*
Frank M. Huennekens, M.D., *Professor in Residence in Biology*
Edwin Lennox, Ph.D., *Professor in Residence in Biology*
John Spizizen, Ph.D., *Professor in Residence in Biology*
William O. Weigle, Ph.D., *Research Associate*

**Research Interests of Instructional Staff**

Bullock: Structure and function of the nervous system.
Butler: Photobiology of plant tissues; photosynthesis and effects on plant growth and development.
Cohn: Induced enzyme and antibody synthesis.
DeMoss: Microbial metabolism and physiology; biosynthetic and regulatory mechanisms.
Dixon: Experimental pathology; immunology.
Green: Virology; regulation of gene expression; chemical nature of lysogeny; RNA synthesis.
Grobstein: Developmental tissue interaction; cytodifferentiation; organ culture.
Hayashi: Transcription and translation of genetic information.
Helinski: Biochemical genetics; nonchromosomal genes; DNA and protein structure.
Hotta: Cell biology and plant biochemistry.
Huennekens: Enzyme chemistry.
Humphreys: Developmental biology, cell aggregation and protein synthesis in differentiating cells.
Lennox: Genetics and regulation of antibody formation-biosynthesis of immunoglobulins.
Mills: Tissue culture; somatic genetics and differentiation in animal and plant cell strains.

Schulman: Differentiation of specialized tissues; regulatory mechanisms; nucleic acid metabolism.
Simon: Chemistry of nucleic acids; immunochemistry.
Singer: Immunochemistry and immunology; physical chemistry of macromolecules; cellular ultrastructure and electron microscopy.
Spizizen: Microbiology, sporulation and DNA transfer in bacteria.
Stern: Plant biochemistry; developmental plant biology; physiology of cell division.
Weigle: Immunochemistry; immunological tolerance; histo-compatibility.

### UNDERGRADUATE PROGRAM

The undergraduate program leading to a Bachelor of Arts in biology reflects the need to integrate the whole of the biological world, and to understand it in terms of the common principles which control living things. The program reflects the striking advances made in biology in recent years and the prospects of revolutionary developments in the future. It emphasizes the basic mechanisms which help to correlate into an integrated whole the enormous diversity of living things.

To aid the student to understand contemporary biology as a whole, regardless of his chosen field of specialization, a core program is offered. All majors in biology, whether they go on to graduate study,* medicine, teaching or agriculture, take the same basic sequence of courses. The sequence begins in the sophomore year – after an introduction to physics, chemistry, and mathematics – with a general consideration of the nature of the living world and its special characteristics and problems as viewed particularly from the cellular level. There follows a two-year program in which living phenomena are examined at their various levels of complexity, molecular, cellular, organismal, and populational. Beyond this, advanced and graduate courses in biology and such allied fields as physics and organic chemistry are available for election by the qualified student in his senior year.

#### Noncontiguous Minor in Biology for Majors outside the Natural Sciences

A noncontiguous minor may be completed in biology by taking some such combination as: Biology 101A-101B-101C and 113, plus Chemistry 100A-100B. Also additional upper division biology courses will be available, and any six biology courses will complete the minor.

*Note: "graduate study" implies all fields of biology and fields of specialization

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## BIOLOGY DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math 2C/Math 100* | Humanities 5<br>Social Science<br>Physical Science 1D<br>Math 100*/Non-contiguous Minor | Humanities 6<br>Social Science<br>Biology 1<br>Physical Science 1EL |
| **Junior Year** | Biology 101A<br>Chemistry 100A<br>Chemistry 140A | Biology 101B<br>Chemistry 100B<br>Chemistry 140B | Biology 101C |
| **Senior Year** | Biology 111A | Biology 111B | Biology 111C<br>Biology 113 |

*Recommended but not required

### Graduate Program
### Doctor's Degree Program

Graduate studies for the Ph.D. degree in the Department of Biology are oriented mainly to the development of the capacity for independent, imaginative and self-critical research.

There are no inflexible entrance requirements to graduate study in the Department of Biology, but it is recommended that the student's undergraduate preparation include at least a year of calculus, elementary organic chemistry, and elementary physical chemistry.

In his first year, the student will probably take one or more of the courses listed below, or those offered in the Chemistry Department or other departments in the University. However, no formal course requirements exist. Much reliance is placed on informal instruction through early and close association of the student with the faculty and research staff, and through regular seminars. After becoming familiar with the research activities of the faculty, through a system of laboratory rotation, the student will begin work on a thesis research problem of his choice, no later than the end of the first year. At the end of the second year, the student will be required to take a two-part

oral examination in order to be admitted to candidacy for the Ph.D. degree. The purpose of these examinations is to have the student demonstrate his competence in the field of his major interest and in related fields of biology. The major remaining requirement for the Ph.D. degree will be the satisfactory completion of a dissertation consisting of original research carried out under the guidance of a faculty member.

Close collaboration with several members of the Departments of Chemistry and Physics is a vital and stimulating aspect of the biology program. Russell F. Doolittle, Martin D. Kamen, Stanley L. Miller, T. G. Traylor and Bruno H. Zimm share many interests with the staff of the Department of Biology, and their physical proximity is a unique feature of this graduate school. Additional strength and breadth in biology is gained by collaboration with the Department of Marine Biology of the Scripps Institution of Oceanography, with the Scripps Clinic and Research Foundation, and with the Salk Institute for Biological Studies. Students may carry out their dissertation research in collaboration with members of these groups.

## COURSES

## LOWER DIVISION

### 1. Nature of Biology

An introductory study of the principles which govern the biological world. Emphasis is given to the cell, heredity, and the chemical and physical bases of living processes. Four hours lecture, one hour recitation. Prerequisite: Physical Science Sequence or equivalent.

## UPPER DIVISION

### 101A-101B-101C. Biology of Organisms F,W,S

Organisms of functioning systems at various levels of complexity, in relation to each other and to their environment. Three hours lecture, four hours laboratory. (Previously numbered 101, 102, 103).

### 111A-111B-111C. Molecular and Cell Biology F,W,S

Course description available at a later date. Three hours lecture, four hours laboratory. Prerequisites: Chemistry 100A-100B and Chemistry 140A-140B. (Previously numbered 111, 112).

### 113. Population Biology and Evolution S

The behavior and flux within groups of organisms, particulary in relation to ecology and evolution. Three hours lecture, four hours laboratory.

### 199. Independent Study for Undergraduates F,W,S

Independent reading or research on a problem by special arrangement with a faculty member. Prerequisite: consent of instructor.

## GRADUATE

### 201A-201B-201C. Cell Biology (4,4,4) F,W,S

The Staff

A general discussion of the structure, metabolism, physiology and genetics of living cells.

**203A-203B-203C. Laboratory Projects in Biology (2,2,2)** **F,W,S**

The Staff

An introduction to contemporary laboratory techniques and research interests through independent, original projects under the direction of individual faculty members. Prerequisites: concurrent enrollment in Biology 201A-201B-201C and/or consent of instructor.

**†210. Immunology (2)** **W**

Mr. Mills, Mr. Weigle

A description of the immune mechanism in terms of antibodies, antigens and complement.

**†220A-220B. Intermediary Metabolism (2,2)** **F,W**

Mr. DeMoss

Advanced readings and discussion of metabolic and biosynthetic pathways, and physiological control mechanisms. Prerequisites: Biology 201A-201B-201C and consent of instructor.

**†222. Macromolecular Biology (2)** **S**

Mr. Singer, Mr. Zimm

A quantitative discussion of biologically important macromolecules, of their structure, and techniques used to study them. Prerequisite: elementary physical chemistry.

**223A-223B. Molecular Genetics** **F,W**

The Staff

Advanced readings and discussion of microbial genetics and the molecular aspects of gene action and gene duplication. Prerequisites: Biology 201A-201B-201C.

****224. Analysis of Development (2)** **S**

Mr. Grobstein, Mr. Stern

Readings and discussion of fundamental problems in developmental biology. Prerequisites: advanced standing and consent of instructor.

****225. Enzyme Chemistry (2)** **F**

Mr. Huennekens

A discussion of the preparation, assay and kinetics of enzymes and the mechanism of action of various classes of enzymes. Prerequisites: Biology 201A-201B-201C.

****226. Regulatory Mechanisms in Higher Organisms (2)** **W**

Mr. Schulman

A discussion of the molecular basis of specialized tissue function in higher organisms. Prerequisites: Biology 201A-201B-201C.

**227. Introduction to the Nervous System (3)** **F**

Mr. Bullock

Survey of anatomy and physiology of invertebrate and vertebrate nervous integration; methods of study and modern developments in the system aspects of neural function. Prerequisite: General Biology, or General Psychology.

**228. Virology (2) S
Mr. Green
A comparative survey of biochemical properties of bacterial, plant and animal viruses. Prerequisites: Biology 201A-201B-201C.

**230. Special Topics in Biology (1,3)**
The Staff
This course to be given by visiting scientists. Topics will depend on the interests of the lecturer, but it is intended that these include at various times developmental biology, virology, plant physiology and related subjects.

**229. Research in Biology (1-6, 1-6, 1-6)** F,W,S
The Staff

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## CHEMISTRY

Departmental Office 4430 Physics-Chemistry Building

**Instructional Staff**
James R. Arnold, *Ph.D., Professor of Chemistry*
Margaret Burbidge, *Ph.D., Professor of Astronomy*
Martin D. Kamen, *Ph.D., Professor of Biochemistry*
Joseph Kraut, *Ph.D., Professor of Chemistry*
Joseph E. Mayer, *Ph.D., Professor of Chemistry*
G. N. Schrauzer, *Ph.D., Professor of Chemistry*
Hans E. Suess, *Ph.D., Professor of Geochemistry*
Harold C. Urey, *Ph.D., Sc.D., Professor-at-Large, Department of Chemistry*
Frederick T. Wall, *Ph.D., Professor of Chemistry*
Bruno H. Zimm. *Ph.D., Professor of Chemistry (Chairman of the Department)*
Stanley L. Miller, *Ph.D., Associate Professor of Chemistry*
Teddy G. Traylor, *Ph.D., Associate Professor of Chemistry*
Alan J. Bearden, *Ph.D., Assistant Professor of Chemistry*
Leigh B. Clark, *Ph.D., Assistant Professor of Chemistry*
Russell F. Doolittle, *Ph.D., Assistant Professor of Biochemistry*
Robert C. Fahey, *Ph.D., Assistant Professor of Chemistry*
Gordon G. Goles, *Ph.D., Assistant Professor of Chemistry*
Robert G. Linck, *Ph.D., Assistant Professor of Chemistry*
Charles L. Perrin, *Ph.D., Assistant Professor of Chemistry*
Joseph W. Watson, *Ph.D., Assistant Professor of Chemistry*
Kent Wilson, *Ph.D., Assistant Professor of Chemistry*

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Irwin Oppenheim, *Ph.D., Visiting Professor of Chemistry*
Leslie Orgel, *Ph.D., Professor in Residence, Department of Chemistry*
Kurt E. Shuler, *Ph.D., Visiting Professor of Chemistry*

### Research Interests of Instructional Staff

Arnold: Cosmic-ray produced radioactivity, meteorites, geochronology, valence theory.

Bearden: Molecular biophysics and solid-state chemistry; Mössbauer spectroscopy of iron-containing proteins.

Burbidge: Observational and theoretical astronomy.

Clark: Electronic states of large and small molecules; molecular crystals; vacuum ultraviolet spectroscopy.

Doolittle: Comparative biochemistry and protein structure.

Fahey: Mechanisms of the addition reactions of olefins and acetylenes; nuclear magnetic resonance spectroscopy.

Goles: Applications of activation analysis and electron micro-probe techniques to problems of the origin of meteorites and of the solar system and to terrestrial geochemistry; microscopic studies of meteorites.

Kamen: Biophysics and biophysical chemistry; heme proteins and metalloproteins in energy-storage processes; photosynthesis and coupled biological oxidations.

Kraut: X-ray diffraction crystallography, three-dimensional structure of proteins and other biologically significant molecules.

Linck: Electron exchange reactions of ligated metal ions; ligand exchange reactions.

Mayer: Statistical mechanics, quantum statistics and quantum mechanics of molecules and fluids.

Miller: Synthesis of organic compounds under geologically primitive conditions; gas hydrates anesthesia; active transport in biological systems.

Orgel: Abiological reactions relevant to the origins of life.

Perrin: Molecular orbital theory, organic polarography, nature of hyperacid solutions, reaction and mechanisms, nitrogen fixation.

Schrauzer: Inorganic chemistry, organo-metallic compounds, organo-metallic analogues and models of bioactive vitamins.

Suess: Abundance of the elements, geochemical studies using natural and man-made radioactivity; activation analysis, $C^{14}$ dating.

Traylor: Electrophilic substitution and addition reactions, free radical reactions, chemistry of porphyrins; molecular structure.

Urey; Origin of the elements and of the solar system; meteorites; stable isotopes in nature.

Watson: Acid catalysis, mechanism of displacement reactions at carbon, phosphorus and sulfur; enzyme models.

Wilson: Experimental physical chemistry; particularly detailed mechanisms of simple gaseous reactions by molecular beam methods.

Zimm: Experimental and theoretical physical chemistry of biological macromolecules and high polymers; statistical mechanics.

### Undergraduate Program

The undergraduate major in chemistry is intended to enable a student to pursue further studies in chemistry or in related fields of science, engineering, or medicine. The program combines a thorough preparation in the fundamentals of chemistry and related fields with an opportunity for more advanced work in particular areas of chemistry.

The student who is considering a major in chemistry is strongly advised to take Physical Science 1DL and 1EL in the sophomore year. Transfer students should have had an equivalent laboratory course, usually approximated by quantitative analysis. Facilities will be made available during the fall quarter for the completion of the additional laboratory work of Physical Science 1DL and 1EL for those students who took Physical Science 1D and 1E. It is desirable also that the student complete Mathematics 100 or its equivalent before the junior year, but the student may take this course in the first or second quarter of that year. Transfer students should note that in the first two years of the Revelle College curriculum, students take calculus and physics, and that the sophomore chemistry course is concerned with thermodynamics and quantum theory – organic chemistry is deferred until the junior year.

Before graduation the student must take as electives at least three upper division courses in related sciences or mathematics. This requirement is intended to give breadth as well as depth to the student's scientific training. To take into account the needs of the individual student, he may, with the permission of the department, substitute courses in related departments for "other chemistry." Opportunities for independent work and for research are available for well-qualified students. A senior student in good standing may be permitted to elect one or more graduate courses (200 series), with the consent of the instructor and the Vice Chancellor-Graduate Studies.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## CHEMISTRY DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| | Humanities 1 | Humanities 2 | Humanities 3 |
| Freshman | Language 1A or 2A | Language 1B or 2B | Language 1C or 2C |
| Year | Math 1A or 2A | Math 1B or 2B | Math 1C or 2C |
| | Fine Arts 1 | Physical Science 1A | Physical Science 1B |

| | | | |
|---|---|---|---|
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math2C/Math 100 | Humanities 5<br>Social Science<br>Physical Science 1DL<br>Math 100/Non-Contiguous Minor | Humanities 6<br>Social Science<br>Biology 1<br>Physical Science 1EL |
| **Junior Year** | Chemistry 100A<br>Chemistry 140A | Chemistry 100B<br>Chemistry 140 B | Chemistry 100C<br>Chemistry 120A<br>Chemistry 140C |
| **Senior Year** | Chemistry | Other Chemistry<br>Other Chemistry | Other Chemistry<br>Other Chemistry |

## Graduate Program

### Master's and Doctor's Degree Program

The Department accepts students who wish to seek the M.S. or the Ph.D. The Department usually recommends financial support only for students who are seeking the Ph.D. The doctoral program is designed to encourage initiative on the part of the student and to develop habits of independent study. Advanced courses in the Department are handled in part by the tutorial system. Students with normal preparation start research early. The qualifying examination for admission to candidacy will require the student to present and discuss propositions that he has prepared independently.

In order that he may participate effectively in this program, the entering graduate student will be required to have a mastery of the subjects usually presented in an undergraduate chemistry curriculum: physical, organic, and inorganic (descriptive) chemistry. So that the student may be properly advised, his mastery of these undergraduate subjects will be tested by examination on his arrival. Physical chemists will be expected to present the equivalent of two years of physics and mathematics at least through integral calculus. The appropriate background courses in biology or geology are highly desirable for students interested in biochemistry and geochemistry, respectively, but will sometimes be taken after arrival. A reading knowledge of two foreign languages is required for the Ph.D.

In the first year the student will usually take several of the courses listed below. Depending on his special interests, he may also take one or more courses in other departments. In the second year he will usually carry a very light load of formal courses, but will continue to participate in seminars and informal study groups.

The qualifying examination, so far as departmental requirements are concerned, will be conducted as follows:

The candidate will present a major and minor proposition.

1. The major proposition should consist of a statement of an original research problem or scientific idea not closely connected with his doctoral thesis. He should be prepared, in the examination, to discuss the theory and the experimental techniques that may be involved, the significance of the proposition, and its relation to previous knowledge.
2. The minor proposition may be similar to the major one, or it may consist of a critical survey of literature in some field of chemistry outside the field of his main interest. The purpose of this prescription is to reveal the ability of the candidate to make a critical survey and an effective, orderly presentation and also to provide him with a further incentive to broaden his understanding of chemistry.

In special circumstances the Doctoral Committee may modify the examination at its discretion.

The interdisciplinary tradition is strong on the San Diego campus. The biochemistry faculty and student body have close ties with the Department of Biology, with many research facilities in common.

Several members of the chemistry faculty are interested in the earth sciences. The ties with oceanography, through marine chemistry and tracer studies of ocean circulation and sedimentation, are also strong. The facilities of the Scripps Institution for marine research are available to all qualified persons at UCSD. A high-speed computer is available for use by graduate students.

### Joint Doctoral Program with San Diego State College

The Department of Chemistry of Revelle College cooperates with the Department of Chemistry in the Division of the Physical Sciences, San Diego State College, in offering a joint program of graduate study leading to the Doctor of Philosophy degree in chemistry.

An applicant for admission to the joint doctoral program must first be admitted to regular graduate standing in the Graduate Division of the University of California, San Diego, and to classified graduate standing in the Graduate Division of San Diego State College. In seeking admission to the two Graduate Divisions, the applicant must pay all fees required by each institution and comply with the admission procedures stated in this catalog and in the current edition of the Bulletin of the Graduate Division of San Diego State College, where the program is more fully described.

## COURSES

### Lower Division

The courses Physical Science 1A thru 1E are given jointly by the Departments of Physics and Chemistry. These courses form an integrated sequence, designed to eliminate unnecessary overlap of content, and contain material equivalent to traditional lower division chemistry and physics courses. Course descriptions are given under the Physical Science section.

### UPPER DIVISION

**100A. Physical Chemistry** **F**

Thermodynamics; gas laws; structure of molecules and solids; properties of

liquids; chemical kinetics. Three lectures, one hour discussion. Prerequisites: Physical Science 1D, Mathematics 2C, or permission of instructor. (Previously numbered 100).

**100B. Physical Chemistry (Lecture and Laboratory)** **W**

Lecture: continuation of 100A. Laboratory: two sessions per week doing experiments to become familiar with advanced laboratory equipment and procedures. Written and oral reports will be required. Laboratory experiments include: spectroscopy, gas laws, electrochemistry, chemical kinetics and many others. Three lectures, six hours laboratory. Prerequisites: Physical Science 1EL, Chemistry 100A. (Previously numbered 101).

**100C. Physical Chemistry (Lecture and Laboratory)** **S**

Continuation of 100B. The structure of atoms and molecules; elementary quantum and statistical mechanics. The treatment is at a more advanced level than in Chemistry 100A or 100B. Prerequisites: Chemistry 100B, Mathematics 100. (Previously numbered 102).

**120A-120B. Inorganic Chemistry** **S,F**

This course treats descriptive inorganic chemistry from a modern standpoint, in the framework of the periodic table. Metals and non-metals; ions in solution; complex ions; inorganic reactions. Four lectures. (Previously numbered 120 and 121). **(120B not offered 1966-67).**

**140A-140B-140C. Organic Chemistry** **F,W,S**

Lecture and laboratory work for students majoring in chemistry and related fields such as biology. These three courses are to be taken in sequence. The lectures will be concerned with (1) structure and properties of covalent molecules, (2) classification of reactions of first-row elements, and (3) reactions of organic compounds, with an introduction to biochemistry. The laboratory will involve (1) separation and purification methods and measurements of physical properties, (2) organic syntheses and product analyses, and (3) advanced synthetic methods and kinetic studies. Three lectures, two three-hour recitation laboratories. Prerequisite: Physical Science 1EL.

**150. Qualitative Organic Analysis** **W**

The analytical methods and laboratory procedures used in the identification of organic compounds will be discussed and illustrated in laboratory experiments. Techniques to be covered include: application of class reactions, derivative preparation, vapor phase chromatography, infra-red and ultraviolet spectroscopy, and nuclear magnetic resonance spectroscopy. The student will apply these techniques to the identification of unknown samples and mixtures. One lecture, two three-hour laboratories. Prerequisite: Chemistry 140C.

**190. Mathematical Methods of Chemistry** **F**

Calculus, special functions, differential equations; probability and statistics; vectors, matrices and determinants; applications of computers; linear algebra. Three lectures. Prerequisites: Chemistry 100C, Mathematics 100.

**199. Senior Reading and Research** **F,W,S**

## GRADUATE

Graduate students may take upper division courses and be assigned 4 units of credit. In Chemistry 100B and 100C the credit will be reduced to 3 units if the student does not participate in the laboratory.

**200A-200B. Molecular Quantum Mechanics (4,4)** **W,S**

Mr. Clark

The fundamental concepts and techniques of quantum mechanics which are necessary for the treatment of problems of chemical interest are developed in Part A. The general sequence of topics is as follows: the foundations of wave mechanics and the development of the Schrödinger equation; the exact solutions of the harmonic oscillator and the hydrogen atom; introduction to matrix mechanics, representations and transformation theory; time-dependent perturbations, the interaction of radiation with matter; many-electron atoms; scattering.

The concepts and techniques developed in part A are applied to molecules and molecular aggregates in part B. Discussion will include the following topics: elements of group theory; molecular rotations and vibrations; electronic states; rotational-vibrational-electronic interactions; intermolecular interactions, energy transfer, exciton theory; optical rotation; scattering phenomenon in regard to chemical dynamics. Prerequisite: Chemistry 190 or equivalent.

**204. Statistical Mechanics of Chemical Systems (4)** **F**

Mr. Oppenheim

Fundamental derivation of equilibrium statistical mechanics and its use in chemical problems.

**211A-211B. Chemical Thermodynamics (3,3)** **F,W**

Mr. Urey, Mr. Wilson

Thermodynamics of chemical systems; first, second and third laws, chemical equilibria, solutions, non-ideal gases, statistical theory. Working of problems is emphasized.

**241. Advanced Topics in Organic Chemistry (1-3)** **S**

The Staff

Topics of special interest will be presented by visiting or regular staff members.

**245. Structure and Properties of Organic Molecules (3)** **F**

Mr. Fahey

Introduction to the measurement and theoretical correlation of the physical properties of organic molecules. Topics to be covered include simple molecular orbital theory, bond lengths, bond energies, dipole moments, ionization potentials, infrared and ultraviolet spectra, nuclear magnetic resonance and electron spin resonance.

**246. Kinetics and Mechanism of Organic Reactions (3)** **W**

Mr. Perrin

Methodology of mechanistic organic chemistry integration of rate expressions, determination of rate constants, transition state theory; catalysis, kinetic orders; isotope effects, substituent effects, solvent effects; linear free energy relationships; product studies, stereochemistry; reactive intermediates; rapid reactions.

**247. Mechanisms of Organic Reactions (3)** S

Mr. Watson

A detailed study of the mechanisms of various organic reactions; carbonium ion reactions (substitutions, displacements, eliminations, additions, hydrolysis); carbanion reactions (eliminations, substitutions, hydrolyses, condensations); carbene reactions; rearrangements; multicenter reactions; free radical processes. The topics emphasized will vary from year to year.

**250. Seminar in Chemistry** F,W,S

The Staff

Regularly scheduled seminars by graduate students provide opportunities for practice in seminar delivery and for the exploration of topics of general interest. These seminars are also used to acquaint students with subjects too specialized for general courses.

**260. Special Topics in Chemistry (3,3)** W, S

The Staff

This course will be given from time to time by visiting or regular members of the staff on topics of special interest. In the winter quarter of 1966/1967, Visiting Professors Oppenheim and Shuler will give a seminar course in stochastic processes and chemical kinetics. In the spring quarter Mr. Wilson will give a course on chemical dynamics and kinetics in the gas phase.

**299. Research in Chemistry (1-6, 1-6, 1-6)** F,W,S

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## EARTH SCIENCES

Departmental Office, 2114 Ritter Hall

### Instructional Staff

Gustaf O. S. Arrhenius, *D.Sc., Professor of Marine Geology*
George E. Backus, *Ph.D., Professor of Geophysics*
*Edward C. Bullard, *Sc.D., F.R.S., Professor of Geophysics*
Harmon Craig, *Ph.D., Professor of Geochemistry (Chairman of the Department)*
Albert E. J. Engel, *Ph.D., Professor of Geology*
Freeman Gilbert, *Ph.D., Professor of Geophysics*
Edward D. Goldberg, *Ph.D., Professor of Chemistry*
Henry W. Menard, *Ph.D., Professor of Geology*
Walter H. Munk, *Ph.D., Professor of Geophysics*
Russell W. Raitt, *Ph.D., Professor of Geophysics*
Victor Vacquier, *M.A., Professor of Earth Sciences*
Richard A. Haubrich, *Ph.D., Associate Professor of Geophysics*
Manuel Bass, *Ph.D., Assistant Professor of Geology*
Gordon Goles, *Ph.D., Assistant Professor of Chemistry*

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Stanley R. Hart, *Ph.D., Visiting Associate Professor of Geology*
James W. Hawkins, *Ph.D., Visiting Assistant Professor of Geology*
Lars-Gunnar Sillen, *D.Sc., Visiting Professor of Geochemistry*

* * *

James R. Arnold, *Ph.D., Professor of Chemistry*
Hans E. Suess, *Ph.D., Professor of Geochemistry*
Harold C. Urey, *Ph.D., D.Sc., Professor of Chemistry-at-Large*

*In residence summer quarters.

## Undergraduate Program

The undergraduate curriculum in earth sciences is principally designed to prepare students for advanced study and research by providing: 1) a strong background in mathematics, physics, and chemistry; 2) a basic knowledge of earth sciences; and 3) an introduction to important areas of present research in the earth and planetary sciences. Prospective majors must have fulfilled the general lower division requirements or their equivalent, and, in addition, are advised to take Physical Science 1DL and 1EL or equivalent in the sophomore year. Students are also advised to take Mathematics 100 or the equivalent during the sophomore year, otherwise this course must be taken in the first quarter of the junior year.

Majors are required to take a total of at least fifteen upper division courses in the physical and earth sciences and mathematics in addition to Mathematics 100. These courses must include: 1) Chemistry 100A-100B-100C (physical chemistry); 2) at least three additional upper division elective courses in mathematics, physics or chemistry; 3) Earth Sciences 101, 102, 103. (Students who wish to concentrate in geophysics may petition the chairman for substitution of physics or mathematics courses for the physical chemistry sequence.)

In addition all majors are required to take the summer field course Earth Sciences 150, and to participate in the spring field program during their junior and senior years. Classical geologic areas such as the Colorado plateau and the volcanoes of the Cascade Range are studied briefly during the recess between the winter and spring quarters each year.

Outside of these requirements, every effort is made to adjust the curriculum to the student's individual interests, insofar as they are consistent with broad preparation for advanced study. Thus one student may wish to concentrate his studies in mathematics, another in chemistry. Mathematics-science electives, other than those required in mathematics, physics and chemistry, may be additional courses from these departments, or from other departments such as oceanography or engineering. Seniors may also elect 200 level courses from the graduate curricula, with approval of their adviser, the course instructors, and the Vice Chancellor–Graduate Studies.

Occasionally opportunities arise for students to participate in long-range marine expeditions with members of the Department who are associated with Scripps Institution of Oceanography or Institute of Geophysics and Planetary Physics. Students actively assist in collecting and analyzing data related to research interests of the staff. Majors may petition the Department to participate in such expeditions; permission is granted on the basis of academic standing and interest.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## EARTH SCIENCES DEPARTMENTAL REQUIREMENTS RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math 2C/Math 100 | Humanities 5<br>Social Science<br>Physical Science 1DL<br>Math 100/Non-contiguous Minor | Humanities 6<br>Social Science<br>Biology 1<br>Physical Science 1EL |
| **Junior Year** | Earth Sciences 101<br>Chemistry 100A<br>Elective (Science or Math)<br>*Earth Sciences 150 | Earth Sciences 102<br>Earth Sciences 120<br>Chemistry 100B | Earth Sciences 103<br>Earth Sciences 121<br>Chemistry 100C |
| **Senior Year** | Earth Sciences 122<br>Elective (Science or Math) | Earth Sciences 115<br>Elective (Science or Math) | Elective (Science or Math) |

*All majors are required to take the summer field course for one month during the summer after the junior year.

### Graduate Program

The Department of Earth Sciences offers a graduate curriculum leading to the M.S. and the Ph.D. in earth sciences. Two general curricula are offered: geology-geochemistry and geophysics. The programs of study emphasize the appli-

cation of the analytical, experimental, and theoretical methods of physics and chemistry to fundamental problems in the terrestrial, marine, atmospheric and planetary sciences.

*Geology-Geochemistry Curriculum*—A baccalaureate major in one of the physical or earth sciences, or mathematics, or engineering. The student's preparation should include:

1. Two years of college physics. Physics courses designed specifically for medical, biological, or agricultural students will normally not be acceptable for this requirement.
2. Two years of chemistry, including physical chemistry (advanced physics may be substituted for one year of chemistry).
3. Mathematics courses in integral calculus and differential equations.

*Geophysics Curriculum*—Normally, a bachelor's degree in physics or mathematics will be necessary. The student's preparation should also include introductory courses in geology.

*Deficiencies*

Provisions will be made to allow graduate students to make up deficiencies by taking undergraduate courses. The Department attempts to keep the program flexible and recognizes that many students have such deficiencies.

### Master's Degree Program

The Master of Science degree will be offered under Plan II (comprehensive examination) according to the general rules of the Graduate Division. All programs must include the basic curriculum of courses described under the doctoral program, and a reading knowledge of either French, German, or Russian is required.

### Doctor's Degree Program

Students will normally concentrate their work in one of two basic curricula:

*Geology-Geochemistry*—Geology and geochemistry students will be responsible for the material included in the following courses: Earth Sciences 122, 150, 200, 201, 219, 224, 246A-246B, 250, Oceanography 110, and either Physics 140 or Chemistry 210A-210B. (Students found to be deficient in physical chemistry will be required to take Chemistry 100A-100B-100C as a prerequisite.) These courses constitute the basic curriculum in preparation for the qualifying examination.

*Geophysics*—Geophysics students will be responsible for the material included in the following courses: Earth Sciences 150, 240 through 247, 250, and any two of Earth Sciences 200, 201, 212, 219, 224, 226.

Near the end of the second year in residence the student in either the geophysics or the geology-geochemistry curriculum will normally have completed his basic course work and preparation for the qualifying examination. Before taking the qualifying examination he must pass reading examinations in two foreign languages (normally German, French or Russian), or a reading and speaking examination in one of these languages.

The qualifying examination for the Ph.D. will emphasize the student's ability to integrate the material covered in his course work with his knowledge of the basic physical sciences for the analysis of general problems in the earth sciences. A written examination may be administered by the Department in

some instances; in all cases an oral examination will be conducted by the student's Doctoral Committee. The oral examination will be based on the presentation and defense of propositions prepared independently and submitted by the student.

When the student is ready for the qualifying examination he will submit to his adviser two or three propositions, at least one of which must be outside of his major field. The propositions will be statements or conjectures concerning research problems in the earth sciences or allied problems in other fields. Upon acceptance of the propositions by the Department, the Doctoral Committee will conduct the examination, in which the student will be expected to discuss the significance of the propositions and the experimental and theoretical problems involved in studies designed to prove or disprove the propositions.

*Advanced Work for the Doctor's Degree*

Advanced study and research for the doctoral thesis may be done in theoretical or experimental geophysics and geochemistry, marine and terrestrial geology, planetary sciences, or other specialized areas of the earth sciences. Students specializing in geochemistry or geophysics will normally take some advanced courses in physics and chemistry as well as some of the departmental option courses. Other courses available are listed in the oceanography curriculum.

## COURSES

### UPPER DIVISION

**101. Introductory Geology** **F**

The origin and evolution of the earth, especially its crust, and the evolution of life as indicated by the fossil record. Emphasis is on the nature of rocks and minerals, their origin, reconstitution, and decay; the evolution of continents, ocean basins and mountain belts; processes of vulcanism; and the work of wind, water, and glaciers in modifying the earth's surface, with the aim of creating an awareness in the student of the geological environment in which we live. Three lectures; occasional field trips.

**102. Introductory Geochemistry** **W**

The chemistry of the earth and the solar system, and the applications of physical chemistry and nuclear physics to the study of the origin and geological history of the earth. Cosmic and terrestrial abundances of elements; nucleosynthesis; origin of the earth; mineralogy and chemistry of the earth's crust, mantle, and core; geochronology and the geological time scale; chemistry of the atmosphere and the oceans. Three lectures, one discussion period.

**103. Introductory Geophysics** **S**

Selected geophysical subjects are treated in some depth. The emphasis is on topics that involve the entire planet earth; the propagation of elastic waves through the earth, oceans and atmosphere; gravity, isostasy and the shape of the earth; oceanic, atmospheric and bodily tides; mountains, earthquakes and the movement of continents. Three lectures.

**115. Structural Geology** **W**

A descriptive study of geologic structures and an introduction to their interpretation in the light of scale model studies and experimental work on the mechanical properties and deformation of rocks and minerals. Includes an introduction to the use of descriptive geometry and stereographic projection in the description and understanding of complex structures. Three lectures.

**120. Mineralogy** **W**

An introduction to mineralogy designed primarily to prepare students of the earth sciences for the study of natural minerals. Lectures and laboratory work on symmetry, morphology, crystal projections, goniometry, crystal structure, elementary x-ray crystallography, physical and chemical properties of minerals. Emphasis is placed on the properties of representative natural materials. Two three-hour periods of laboratory and lectures.

**121. Optical Mineralogy** **S**

The principles and techniques of the microscopic study of rock-forming minerals. The course is designed to provide an understanding of optical methods utilizing polarized light in the interpretation of crystal structure and identification of minerals. Two three-hour periods of laboratory and lectures. Prerequisite: Earth Sciences 120.

**122. Petrology** **F**

Techniques learned in Earth Sciences 120 and 121 are applied to the study and identification of mineral assemblages in natural rocks. The chemical, mineralogical, and physical properties of igneous and metamorphic rocks are studied by microscopic and other laboratory methods, and the origin and genetic relations of rocks are interpreted in terms of geologic occurrence and theoretical or experimental data. Two three-hour periods of laboratory and lectures. Prerequisites: Earth Sciences 120, 121.

**129A-129B-129C. Topics in Geology** **F,W,S**

Reading course, with preparation of written reports, dealing with basic subjects and problems in earth sciences.

**133. Radiochemistry with applications to Geochemistry** **W**

Lectures and laboratory work on basic radiochemistry with emphasis on experimental techniques used in geochemical studies. Prerequisites: Chemistry 100A-100B-100C.

**150. Field Geology (Summer Course)** **Su**

Detailed field study of the geology of an area in the western United States. The area is chosen to permit broad application of principles of geology and various mapping techniques toward the solution of structural and stratigraphic problems as encountered in the field. Each student will complete a thorough geologic study of the area, and prepare a geologic report accompanied by a geologic map and structural and stratigraphic sections. This course normally requires full time for one summer month, and is given after the junior year.

**199. Independent Study for Undergraduates**

Independent reading or research on a problem by special arrangement with a faculty member. Prerequisite: consent of instructor.

## GRADUATE

****200. Geochemistry (3)** W

Mr. Goldberg

Chemistry of the lithosphere, atmosphere and oceans; the geochemical balance; marine chemistry, geochemical cycles of major and minor elements; geochronology. Prerequisite: Chemistry 210A or Physics 140 (can be carried concurrently).

****201. Thermodynamics of Natural Processes (3)** S

Mr. Craig

Applications of thermodynamics to general problems in the earth sciences. Topics include chemical and phase equilibria in heterogeneous multicomponent systems; properties of substances at high temperatures and pressures; models for solid solutions and gaseous mixtures; phase equilibria in silicate melts; critical mixing phenomena; equilibrium in a gravitational field; adiabatic and pseudo-adiabatic transport; steady flow systems; closed and open system models of the atmosphere, oceans and solid earth, based on the concepts of local equilibrium and entropy production. Prerequisites: Chemistry 210B or Physics 140, Mathematics 100.

****210. Solids in Nature (3)** S

Mr. Arrhenius

Experimental and theoretical evaluation of geologically important properties of solids. Characteristic differences between solid types, electronic structure of solids; microscopic significance of thermodynamic concepts. Interaction between matter and radiation, structure of geologically important crystals and glasses, order and disorder. Band and optical properties of solids, with particular consideration of geological systems. Prerequisite: consent of instructor.

**†211. Experimental Petrology (3)** F

Mr. Weill

Lectures and discussions on topics related to experimental investigations of petrological systems. Emphasis is placed upon interpretation and evaluation of experimental work on the stability and solubility of minerals of metamorphic and igneous rocks. Prerequisites: Earth Sciences 122, 201.

**†212. Igneous Petrology (3)** W

The Staff

Theoretical aspects of the genesis of igneous rocks are considered in the light of geologic and experimental evidence. Suites of thoroughly investigated and well described rocks are studied and discussed in detail. Current lines of research in problems of magmatic and volcanic processes are critically reviewed. Prerequisites: Earth Sciences 120, 121, 122 or equivalent and consent of instructor.

**†219. Crustal Evolution (3)** S

Mr. Engel

The properties, origin and evolution of the rocks in the Earth's crust. Prerequisite: one year of graduate study in Earth Sciences or Oceanography.

**220. Seminar in Petrology (3)** **F,W,S**
The Staff
Discussions of current research in petrology and mineralogy.

**224. Marine Geology (3)** **W**
Mr. Menard
Introduction to the geomorphology, sedimentation, stratigraphy, vulcanism, structural geology, and geologic history of the marine realm. Prerequisite: Earth Sciences 101 or equivalent, or consent of instructor.

****226. Tectonics (3)** **W**
Mr. Menard, Mr. Bass
The large-scale structural and morphological features of continents and ocean basins, crustal deformation, oceanic rises, mountain building, permanency of continents.

**230. Seminar in Geology (3)** **F,W,S**
The Staff
Discussions of current research and special topics in geology not treated in the general courses.

**†231. Nuclear Geology (3)** **F**
Mr. Hart
General principles of radioactive decay; geochronology based on long-lived natural radioactive isotopes with special emphasis on the K-Ar, Rb-Sr and U-Th-Pb systems; use of isotopic tracers in studies of crust-mantle relationships, origin of igneous rocks, and evolution of the continental crust and oceans. Prerequisite: Earth Sciences 200 or consent of instructor.

**†232. Nuclear Geochemistry (3)** **W**
Mr. Craig
Geochemistry of stable and radioactive isotopes. Emphasis is on application of recent research to important problems in earth sciences. Topics include theory of isotope fractionation, separation effects in heterogeneous systems, mixing rates and residence times, cosmic ray production of radioactive isotopes, use of natural isotopic tracers for mixing and exchange studies in the ocean and the atmosphere, the carbon cycle, stable isotope variations in minerals and rocks, paleotemperatures and geothermometry, geochemistry of volcanic waters and gases, etc.

**†233. Cosmochemistry (3)** **S**
Mr. Goles
A survey of important properties of the solar system, focused upon the extraction of general ordering principles which yield information on the evolutionary history of the system. Abundances of elements in the solar system and the galaxy. Meteorites, especially their histories as determined by various nuclear physical techniques, isotopic anomalies and their interpretations, mineralogy and petrology of the various classes of meteorites, geochemical data and theories of their origin. Implications for galactic nucleosynthesis and deductions on the history of the galaxy. The origin of the Earth and its early history. Prerequisites: Earth Sciences 231, 232 or consent of instructor.

**235. Seminar in Geochemistry (3)** F,W,S
The Staff
The subject matter will vary from year to year and will normally cover an area of geochemistry not treated extensively in other courses.

**240. Topics in Geophysical Continuum Mechanics (3)** F
Mr. Backus, Mr. Gilbert
Mathematical foundations, physical limitations, and selected geophysical applications of continuum mechanics. Topics include finite strain; thermodynamics of stress-strain relations; phenomenology and mechanisms of dissipation; continuum theory of dislocations; and generation and propagation of elastic waves in a nearly homogeneous medium. Prerequisites: differential and integral calculus and differential equations.

****241. Topics in Geophysical Fluid Dynamics (3)** W
Mr. Backus
Effects of viscosity, density gradients, and gravitational and electromagnetic fields on fluid motion. Topics include forced and free convection and percolation, Alfven waves, and the theory of the origin and secular variation of the Earth's magnetic field. Prerequisite: Earth Sciences 240.

****242. Geophysical Measurements (3)** S
Mr. Haubrich
Design of geophysical experiments and analysis of geophysical measurements, interpretation of geophysical time series; wave number filters, theory of arrays, geophysical systems analysis. Prerequisite: elementary complex variables.

**†244. Gravity and Geomagnetism (3)** W
Mr. Vacquier
Measurement and analysis of gravitational and magnetic fields of the Earth, with emphasis on applications to geologic problems and prospecting. Prerequisites: differential and integral calculus.

****245. Tides and the Rotation of the Earth (3)** W
Mr. Munk
Kepler's laws, tide generating potentials, static and dynamic theory of ocean tides; atmospheric tides; Love numbers and bodily tides; tidal friction and the length of day; Chandler wobble, historical variations, figure of the earth. Prerequisites: Earth Sciences 240, 241 and Physics 201.

****246A-246B. Internal Constitution of the Earth (3,3)** W,S
Mr. Raitt, Mr. Vacquier
Study of the physical nature of the Earth's interior revealed by observations of seismic waves, gravity and geomagnetic fields, electrical conductivity, heat flow, and related information from various geological sciences. Fundamentals of geophysical techniques of observation and analysis. Critical discussion of current knowledge. Prerequisites: calculus and differential equations, basic physics.

**†247. Seismology (3)** S
Mr. Gilbert
Equation of motion, exact transient solution of canonical problems, interface

pulses, geometrical diffraction theory, ray theory and mode theory in plane layered media, free oscillations of the Earth, radiation from moving sources, source determination, aeolotropic and heterogeneous media, dissipation, interpretation problems. Prerequisites: Earth Sciences 240, Physics 200A (Physics 200B may be taken concurrently), 201.

**250. Earth Sciences Summer Field Course (6)** **Su**

Mr. Bass, Mr. Bullard, Mr. Craig, Mr. Goldberg, Mr. Menard

Participation in a department summer expedition for 4-6 weeks. Field studies in geology, geochemistry and geophysics are conducted at sea and on islands and coastal regions. Areas recently studied include Central America and the Caribbean, Easter Island and the southeastern Pacific, and the western Mediterranean. In 1967 the area studied will be the S.W. Pacific and the Coral Sea.

**280. Spring Field Trip (No credit)**

Classical areas of the southwest United States such as the Colorado Plateau, Mojave Desert, Sierra Nevada and Peninsular Range are examined in successive years during six-day field trips. Normally required of all first and second year graduate students.

**299. Research (1-6, 1-6, 1-6)** **F,W,S**

The Staff

**Geophysics Seminar (No credit)** **F,W,S**

A geophysical seminar given every term in which students, staff and visitors report on recent papers or results of interest from their own work or reading.

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# ECONOMICS

Departmental Office, 3440 Humanities-Library Building

### Instructional Staff

Seymour E. Harris, *Ph.D., Professor of Economics*
*(Chairman of the Department)*
John W. Hooper, *Ph.D., Professor of Economics*
Donald V. T. Bear, *Ph.D., Associate Professor of Economics*
Daniel Orr, *Ph.D., Associate Professor of Economics*

### Undergraduate Program

Each student majoring in economics will be required to take Economics 1A-1B-1C, and at least four of the upper division course sequences. Ordinarily, he should take Economics 100A-100B, 110A-110B, 130A-130B-130C and either Economics 120A-120B-120C or Economics 140A-140B. The economics major must also take a seminar, preferably in his senior year. Honors students may be relieved of one regular course in order to take a double seminar thus facilitating writing an honors thesis.

The student concentrating in economics will have the usual privilege of elective courses in his sophomore year, as well as the required courses in science,

humanities, and social sciences. He would be advised, also, to take a few courses in related fields such as political science, history and mathematics.

The requirements for noncontiguous minor could be met by taking courses in the humanities, in mathematics, or in the sciences. An economics major, by exploiting these noncontiguous electives, may be able to write a seminar honors paper which could profit from courses in these noncontiguous fields. For example, he might study the relation of science to the economy, of research to growth, of education to growth, of medicine to income and growth, American literature in the last generation as reflecting the American economy, and the latter reflecting literature. Because mathematics and mathematical statistics play an important role in advanced economic study and in economic research, it behooves the student to acquire adequate background in these subjects.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## ECONOMICS DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| | Humanities 1 | Humanities 2 | Humanities 3 |
| **Freshman** | Language 1A or 2A | Language 1B or 2B | Language 1C or 2C |
| **Year** | Math 1A or 2A | Math 1B or 2B | Math 1C or 2C |
| | Fine Arts 1 | Physical Science 1A | Physical Science 1B |
| | Humanities 4 | Humanities 5 | Humanities 6 |
| **Sophomore** | Economics 1A | Economics 1B | Economics 1C |
| **Year** | Physical Science 1C | Physical Science 1D | Biology 1 |
| | Economics 100A | Economics 100B | Economics 110B |
| **Junior** | Economics 120A | Economics 110A | Economics 120C |
| **Year** | | Economics 120B | |

| | | | |
|---|---|---|---|
| Senior Year | Economics 130A/140A<br>Economics 190A | Economics 130B/140B<br>Economics 190B | Economics 130C/<br>Restricted Elective<br>Economics 190C |

## COURSES

### LOWER DIVISION

**1A-1B-1C. Elements of Economics** **F,W,S**

Introduction to economics. This course is required of all majors in economics. Ordinarily it will be taken in the sophomore year. The course covers the theory of economics, both micro and macro, and the application of this theory to large public issues of the day. Each student will have an opportunity to delve intensively into some aspect of this course in which he is especially interested. He will be required to write a paper on the subject of his special interest. Two lectures, one recitation. (Previously numbered 1,2,3).

### UPPER DIVISION

**100A-100B. Microeconomics** **F,W**

The theory of consumer behavior and the theory of the firm as foundations of demand and supply. Market structure and efficient resource allocation. Two lectures and one section meeting. (Previously numbered 100, 101).

***110A-110B. Macroeconomics** **W,S**

The theory of income determination; consumption and investment; money; the general price level and the rate of interest; fluctuations in income and employment. Two lectures and one section meeting. (Previously numbered 110, 111).

**120A-120B-120C. Quantitative Economics** **F,W,S**

Mathematical economics, statistics, and econometrics; the elements of the formulation and verification of economic models. Examples will be taken from both the micro and macro areas. Three lectures, one recitation. Prerequisite: Mathematics 1C or the equivalent. (Previously numbered 120, 121, 122).

***130A-130B-130C. Public Policy** **F,W,S**

The application of macroeconomic and microeconomic theory to issues of public policy and the contributions of related disciplines *e.g.*, political science, sociology, education, history to the solution of these problems. The student will be required to study one problem intensively. Two lectures, one recitation. (Previously numbered 130, 131, 132).

**134A. Economic Development** **F**

This is an attempt to deal with economic, political, and scientific aspects of underdeveloped countries. The integration will be through the cooperation of chemists, physicists, mathematicians, and economists. Students will prepare papers. Two-hour seminar weekly. Open to undergraduates and graduates.

***140A-140B. Economic History** **F,W**

A survey of economic history in both Europe and the United States with major emphasis on the period since 1789 and on the United States. Three lectures. (Previously numbered 140, 141).

***190A-190B-190C. Seminars and Independent Work** **F,W,S**

Each student will be required to take at least one seminar in his senior year. These seminars will encourage the student to work on a particular problem intensively, culminating in at least one major paper. Hours by arrangement. (Previously numbered 190, 191, 192).

## GRADUATE

**200A-200B-200C. Price and Allocation Theory** **W,S**

Mr. Orr

The role of theory in economics; demand analysis; the traditional theory of the firm; market structure and welfare; activity analysis and linear programming; dynamic models of the firm; market stability under uncertainty; capital theory and asset management. (Previously numbered 200, 201, 202).

**210A-210B-210C. Aggregate Economic Analysis** **F,W,S**

Mr. Bear

The theory of income determination, consumption and investment, money, the general price level and the rate of interest, fluctuations in income and employment. (Previously numbered 210, 211, 212).

**220A-220B*-220C*. Techniques of Economic Research** **S**

Mr. Hooper

Techniques of statistical inference in single equation and simultaneous equation economic models. (Previously numbered 220, 221, 222).

***230A-230B-230C. Problems of Economic Policy**

A discussion of topics to be announced.

**297. Independent Study** **F,W,S**

The Staff

**299. Research** **F,W,S**

The Staff

# HISTORY

Departmental Office, 1560 Humanities-Library Building

### Instructional staff

Samuel Baron, *Ph.D., Professor of History (Chairman of the Department)*
Geoffrey Barraclough, *Ph.D., Professor of History*
Gabriel Jackson, *Ph.D., Associate Professor of History*
Curtis Wilson, *Ph.D., Visiting Associate Professor of History*
Roger de Laix, *Acting Assistant Professor of History*
Miss Frances Tanikawa, *Acting Assistant Professor of History*

* * *

John S. Galbraith, *Ph.D., Professor of History (Chancellor)*

### Undergraduate Program

*American History & Institutions Requirement.* This requirement may be met by a passing grade in History 30, 33A, or 33B. In particular cases it may also be met by an examination to be arranged.

*Noncontiguous Minor for Students in Other Departments.* The subject matter of history includes the entire range of human activities. Therefore the Department of History wishes to encourage students to think in terms of the many possible relations between their study of history and their other courses. The noncontiguous minor will consist of six upper division courses in history. For the sake of continuity, it is suggested that one three-term sequence be chosen. The other three courses should be freely elected on the basis of the student's personal interest.

*Departmental Requirements.* Admission to courses in history will depend solely upon completion of the normal lower division requirements of Revelle College. However, the material of the Humanities Sequence and of lower division social science courses will be particularly important as preparation for upper division work. Also, for many courses in Ancient, Medieval, and Modern European History a fluent reading knowledge of at least one foreign language will be highly desirable.

*Major Program.* The history major will consist of twelve courses in history. Of these, at least six and preferably nine should be chosen from among the three-term sequences available in Ancient (104-106), Medieval (111A-111B-111C), British (131A-131B-131C) or Russian (145A-145B-145C) History. The remaining courses may be freely elected from the offerings listed below. In most cases a history major will be expected to do considerable reading in a foreign language.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence

Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## HISTORY DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2 C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C | Humanities 5<br>Social Science<br>Physical Science 1D | Humanities 6<br>Social Science<br>Biology 1 |
| **Junior Year** | *History<br>History elective | *History<br>History elective | *History<br>History elective |
| **Senior Year** | *History<br>History elective | *History<br>History elective | *History<br>History elective |

*6 courses must be selected from the following list: 104, 105, 106, 111A-111B-111C, 131A-131B-131C, 145, 146, 147.

## COURSES

### LOWER DIVISION

**25A-25B. World History of the Last Century** **F,W**
The origins of the contemporary world with balanced emphasis on non-European as well as Western History. Three hours lecture.

**30. The Emergence of Modern America** **F**
Social and political history of the United States from the Reconstruction to the First World War. The impact of industrialization, immigration, growth of cities, and movements for reform. Three hours lecture.

**33A. American Intellectual History to 1860** **W**
From colonial times through the pre-Civil War period; European origins and the development of political, social, economic and religious thought in the

American context. Emphasis on principal thinkers and ideas, with some reference to the general historical background and values. Three hours discussion.

**33B. American Intellectual History from 1860** S

American thought in the post-Civil War period, and some major trends in social, economic, political and religious thought of the 20th century. Developments in American philosophy, the social sciences, and literature. Three hours discussion.

## UPPER DIVISION

**104. The Mediterranean World in the Bronze Age** F

Special emphasis on the development of Minoan and Mycenaean civilization, with the use of materials from archaeology and art history as well as standard history readings. Three hours lecture and discussion.

**105. Greece in the Classical Age** W

Comparison and contrast of the main political, economic and social institutions of the leading city states in the 5th and 4th centuries B.C. Three hours lecture and discussion. Prerequisite: History 104 or consent of instructor.

**106. The Hellenistic Monarchies** S

The extension of Greek Civilization throughout the eastern Mediterranean World under Alexander the Great and his successors. Three hours lecture and discussion. Prerequisite: History 105 or consent of instructor.

**111A-111B-111C. The Rise of Europe** F,W,S

The development of European society from the decline of the Roman Empire to the close of the 15th century. Three hours lecture.

**131A-131B-131C. The British Empire Since 1783** F,W,S

The political and economic development of the British Empire, including the evolution of colonial nationalism. The development of the Commonwealth idea, a survey of Canada, and changes in British colonial policy. Three hours lecture.

**141. The French Revolution** W

The background and political development of the revolutionary decade 1789-1799. Emphasis on intellectual and social origins of the revolutionary leadership, and on the major interpretations of the revolution by Aulard, Mathiez, and Lefebvre. Three hours discussion.

**145A. Russia – 1533 to 1800** F

A survey of the development of Russian society and thought from Ivan the Terrible to Alexander I. Emphasis will be placed on the Westernization of Russia. Three hours discussion.

**145B. Russia – 1800 to 1914** W

An examination of Imperial Russia's last century, with special emphasis on currents of social thought and the revolutionary movement. Three hours discussion.

**145C. Russia – 1914 to the Present** S

The Russian Revolution, and the transformation of Russia under the Soviet Regime. Domestic and foreign policies will be considered. Three hours discussion.

**155. Ancient, Medieval, and Early Modern Science** F

Topics emphasized will be: planetary theories, the science of mechanics and mathematics from antiquity to the times of Kepler, Galileo, and Descartes. Three hours lecture.

**156. Science in the 17th and 18th Centuries** W

Emphasis will be placed upon the formalization of mechanics from Huygens, Newton, and Leibniz to Euler and Lagrange, and the development of chemical concepts from the alchemists and iatrochemists to Lavoisier and Dalton. Three hour lecture.

**157. Science in the 19th Century** S

The emergence of structural chemistry, energetics, field physics, statistical physics, and the theory of biological evolution. Three hours lecture.

**170. The Spanish Civil War** S

The cultural renaissance of 20th century Spain, the political and economic background, the Spanish Republic of 1931-1936, the Civil War seen as both a domestic and an international crisis.

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## HUMANITIES

Departmental Office, 3416 Humanities-Library Building

This sequence of courses, offered jointly by the Departments of Literature, Philosophy and History, has the purpose of introducing the student to the Western cultural tradition. He will learn to interpret major literary, historical and philosophical documents through lectures and discussions, as well as through the writing of bi-weekly themes. One aim of the course is to develop the student's ability to write clear and well-ordered expository prose.

A student may not graduate from Revelle College with a major in humanities. Students interested in the area of humanities must choose a specific major within the humanities, *i.e.*, literature, philosophy, etc. See *Subject A* for explanation of the Subject A course at UCSD.

## COURSES

**1. The Present Age** F

Analysis of some major 20th-Century books and cultural trends. Two lectures, one discussion.

**2. Jews and Greeks** W

Readings from the Bible, Homer and the Greek dramatists, historians and philosophers. Two lectures, one discussion.

**3. Rome and the Middle Ages** S
Documents in the literature, philosophy and history of Rome and Medieval Europe. Two lectures, one discussion.

**4. The Renaissance** F
Documents in the literature, philosophy and history of the Renaissance. Two lectures, one discussion.

**5. Classicism and Enlightenment** W
Documents in the literature, philosophy and history of the 17th and 18th centuries. Two lectures, one discussion.

**6. The West after the French Revolution** S
Documents in the literature, philosophy and history of the 19th century. Two lectures, one discussion.

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## LANGUAGE

Departmental Office, 445 Humanities-Library Building

The course sequences numbered 1A-1B-1C and 2A-2B-2C are designed partly to aid the student in meeting the lower division language proficiency requirements, but partly also to increase his general understanding of the nature of language itself and of the civilization in which that language is used. Some students who begin their study of the language at UCSD will be able to achieve the required proficiency at the end of the 1A-1B-1C sequence; a student who has not done so may continue in the 2A-2B-2C sequence for as many quarters (up to a maximum of three) as he requires. A student who has studied the language for two or more years in high school (or the equivalent elsewhere) is not permitted to enroll in the 1A-1B-1C sequence; instead, he normally enrolls each quarter (to a maximum of three) in the 2A-2B-2C sequence until he reaches the required level of proficiency.

Every course in the 1A-1B-1C and 2A-2B-2C sequence is comprised each week of 3 scheduled hours of tutorial classes with a native speaker of the language, 3 unscheduled hours of laboratory, 1-2 scheduled hours of conference classes with a linguist, and 3-6 hours of assigned homework. A student's tutorial section is reassigned to him weekly on the basis of his relative progress through the course; his assignment to a conference class is determined by his section assignment.

The non-credit course sequences numbered 11A-11B-11C and 12A-12B-12C are intended for upper division and graduate students preparing to meet degree requirements for reading proficiency.

## COURSES

**Lang/Fr 1A-1B-1C. Elementary French** F,W,S
See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist.

**Lang/Ge 1A-1B-1C. Elementary German** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist.

**Lang/Ru 1A-1B-1C. Elementary Russian** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist.

**Lang/Sp 1A-1B-1C. Elementary Spanish** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist.

**Lang/En 2A-2B-2C. Intermediate English as a Foreign Language** F,W,S

A sequence of courses for those undergraduate and graduate students whose native language is not English. Three hours tutorial, two hours laboratory.

**Lang/Fr 2A-2B-2C. Intermediate French** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist. Prerequisites: two or more years of high school instruction in the language or equivalent, French 1C.

**Lang/Ge 2A-2B-2C. Intermediate German** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist. Prerequisites: two or more years of high school instruction in the language or equivalent, German 1C.

**Lang/Ru 2A-2B-2C. Intermediate Russian** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist. Prerequisites: two or more years of high school instruction in the language or equivalent, Russian 1C.

**Lang/Sp 2A-2B-2C. Intermediate Spanish** F,W,S

See general description above. Three hours tutorial, three hours laboratory, 1-2 hours conference with linguist. Prerequisites: two or more years of high school instruction in the language or equivalent, Spanish 1C.

**Lang/Ch 11A-11B-11C. Elementary Chinese Reading** F,W,S

A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Fr 11A-11B-11C. Elementary French Reading** F,W,S

A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Ge 11A-11B-11C. Elementary German Reading** F,W,S

A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Gr 11A-11B-11C. Elementary Greek Reading** F,W,S

A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/La 11A-11B-11C. Elementary Latin Reading** F,W,S

A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Ru 11A-11B-11C. Elementary Russian Reading** **F, W, S**
A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Sp 11A-11B-11C. Elementary Spanish Reading** **F,W,S**
A non-credit course designed to prepare graduate students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Ch 12A-12B-12C. Intermediate Chinese Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Fr 12A-12B-12C. Intermediate French Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Ge 12A-12B-12C. Intermediate German Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Gr 12A-12B-12C. Intermediate Greek Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/La 12A-12B-12C. Intermediate Latin Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Ru 12A-12B-12C. Intermediate Russian Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

**Lang/Sp 12A-12B-12C. Intermediate Spanish Reading** **F,W,S**
A non-credit course designed to prepare graduate and upper division students to meet degree requirements for reading comprehension. Three hours tutorial.

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## LINGUISTICS

Departmental Office, 1512 Humanities-Library Building

### Instructional Staff

Leonard Newmark, *Ph.D., Professor of Linguistics*
*(Chairman of the Department)*
Sige-Yuki Kuroda, *Ph.D., Assistant Professor of Linguistics*
Ronald W. Langacker, *Ph.D., Assistant Professor of Linguistics*
Margaret H. Langdon, *Ph.D., Assistant Professor of Linguistics*
David A. Reibel, *Ph.D., Assistant Professor of Linguistics*
Sanford Schane, *Ph.D., Assistant Professor of Linguistics*

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William Bright, *Ph.D., Professor of Linguistics and Anthropology (University of California, Los Angeles)*
Peter N. Ladefoged, *Ph.D., Professor of Phonetics (University of California, Los Angeles)*

## Undergraduate Program

Broadly speaking, linguistics is simply the study of language *as* language. Like other rapidly developing fields, linguistics resists simple classification into one of the traditional categories of academic disciplines. Considered as one of the humanities, linguistics concentrates on the historical development of a particular language or language family, or on the relation between a language and the literature composed in that language. Considered as a social science, linguistics may be related to anthropology, in describing language as a part of culture; or it may be related to psychology, in describing language as a kind of behavior. One branch of linguistics, phonetics, may even be considered a natural science, related to the physical science of acoustics and the biological sciences of anatomy and physiology. Considered as an engineering science, linguistics has found many applications in fields as far apart as language pedagogy and mechanical translation. Finally, linguistics may be considered as a formal science in its own right, related to mathematics and formal logic.

An undergraduate major in linguistics in Revelle College is intended to give a student the background that would prepare him best for graduate work in the field of linguistics. Because linguistics shares its object matter, language, with so many other disciplines, this major is unlike many others in that relatively few courses in the Department of Linguistics itself are required in the major program; the major in linguistics consists of twelve courses: four basic required courses in the Department of Linguistics, complemented by eight other courses related directly to the study of language.

*Major Program*—In Revelle College two major programs in linguistics are recognized: Program A emphasizes linguistics as one of the humanities related to the study of literature; Program B emphasizes linguistics as a formal discipline related to mathematics and formal logic. If the student elects the Program A major, his noncontiguous minor must be taken in the social or natural sciences; if he elects the Program B major, his noncontiguous minor must be taken in the humanities.

All linguistics majors are required to take Linguistics 100 and the sequence 101A-101B-101C. This sequence of courses lays the groundwork for all serious modern study of language. Linguistics 100 may be taken in the lower division or it may be taken in the upper division concurrently with Linguistics 101A. In addition, every linguistics major is required to take at least three quarter courses in one or more language in addition to the one in which he has received his lower division proficiency. The remaining courses for the major will be selected with the advice and approval of the Department's Undergraduate Adviser in Revelle College. For Program A, the courses will normally be selected from undergraduate offerings in the Departments of Literature and History, or Linguistics 199. For Program B, the courses will normally be selected from undergraduate offerings in the Departments of Philosophy, Mathematics, and Applied Electrophysics, or Linguistics 199.

## UNDERGRADUATE CURRICULUM

**University Requirements:**

Subject A
American History
American Institutions

**Revelle College Requirements:**

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## LINGUISTICS DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE
## (PROGRAM A — LITERATURE)

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Linguistics 100 or Elective | Humanities 5<br>Social Science<br>Physical Science 1D | Humanities 6<br>Social Science<br>Biology 1 |
| **Junior Year** | Linguistics 100 or Elective<br>Linguistics 101A<br>Language<br>* | Linguistics 101B<br>Language<br>* | Linguistics 101C<br>Language<br>* |
| **Senior Year** | * | * | |

*Selected from the Departments of Literature, History or Linguistics 199.

## UNDERGRADUATE CURRICULUM

**University Requirements:**

Subject A

**Revelle College Requirements:**

Fine Arts

American History
American Institutions

Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## LINGUISTICS DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE
## (PROGRAM B — MATHEMATICS & FORMAL LOGIC)

| | Fall | Winter | Spring |
|---|---|---|---|
| Freshman Year | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| Sophomore Year | Humanities 4<br>Social Science<br>Physical Science 1C<br>Linguistics 100 or Elective | Humanities 5<br>Social Science<br>Physical Science 1D | Humanities 6<br>Social Science<br>Biology 1 |
| Junior Year | Linguistics 100 or Elective<br>Linguistics 101A<br>Language<br>* | Linguistics 101B<br>Language<br>* | Linguistics 101C<br>Language<br>* |
| Senior Year | * | * | |

*Selected from the Departments of Philosophy, Mathematics, Applied Electrophysics or Linguistics 199.

### Graduate Program*

To begin graduate study in linguistics, a student must know one or more foreign languages. Training in anthropology, literature, mathematics, philosophy, or psychology, also forms good undergraduate preparation for the graduate

student in linguistics. In general, the student intending to enter this graduate program should have a broad, liberal education as an undergraduate, as rich as possible in the humanities, behavioral sciences, and mathematics.

Because the study of linguistics demands more than ordinary language competence, before a student is advanced to candidacy for the Ph.D. he must have demonstrated (1) ability to read French and either German or Russian, (2) oral fluency in a language other than his native one, and (3) thorough knowledge of the structure of an Indoeuropean language and of a non-Indoeuropean language. For the M.A., the student needs to have satisfied language requirement (3) and one of the languages for requirement (1).

### Master's Degree Program

In his first year of graduate work, the student will pursue a course of study leading to the M.A. degree under Plan II. His basic courses will stress linguistic theory (particularly from the point of view of generative grammar) and linguistic analysis (with heavy emphasis on field techniques). For his advanced work, the student will specialize in one of the following: formal linguistic theory, Romance linguistics, English linguistics, psycholinguistics, anthropological linguistics. Both M.A. and Ph.D. students must pass a comprehensive examination – normally taken 4-6 quarters after beginning graduate study – testing the student's thorough familiarity with modern descriptive and historical linguistics. The total course requirement for the M.A. candidate is 36 quarter units, of which at least 14 must be in graduate courses in Linguistics, no more than 12 may be in courses below the 200 level, and no more than 16 may be research credit.

### Doctor's Degree Program

To be advanced to candidacy for the Ph.D., the student must also pass an oral qualifying examination over his field of specialization. This examination (normally taken no more than 9 quarters after the student's admission to graduate status) will be administered by a doctoral committee appointed by the Graduate Council after the student has satisfied his language requirements and passed the comprehensive examination. The candidate will be recommended for the Ph.D. after he has made a successful oral defense of a substantial written dissertation, incorporating the results of original and independent research carried on under the supervision and bearing the approval of his Doctoral Committee.

*M.A. and Ph.D. programs in linguistics are subject to University approval.

## COURSES

## UPPER DIVISION

### 100. General Linguistics F

An introduction to the study of language; the analytical and descriptive methods and devices of general linguistics; phonological, morphological and syntatic systems; comparative and historical linguistics, psycholinguistics, anthropological linguistics, and their relationships to general linguistics. Three hours lecture, two hours discussion, seven hours reading and exercises.

**101A-101B-101C. Linguistic Theory** F,W,S

Introduction to the theory of generative grammar; models for syntactic description; transformational rules and other rule schemata. The phonological component of a grammar; distinctive feature theory and notational conventions; syntactic and morphological constraints on phonological processes. Three hours lecture, two hours discussion, seven hours reading and exercise. (Previously numbered 101, 102, 103).

**199. Advanced Study for Undergraduates** F,W,S

Under the supervision of the Department's Undergraduate Adviser in Revelle College the student will undertake a program of research or advanced reading in linguistics. Under this course title superior students will be allowed to attend courses offered by the Department in its 200 series of graduate courses. May be repeated for credit.

## GRADUATE

The following course sequences will be offered by the Department. Within a one-year sequence, the choice of topics and amount of time devoted to them may vary from year to year; for example, in the sequence in linguistic theory, the distribution of syntax and phonology between quarters of the sequence may vary. The third quarter of a sequence will usually be conducted as a seminar.

Students specializing in linguistic theory, psycholinguistics, and Romance linguistics will be expected to take appropriate courses in the Departments of Philosophy, Psychology, and Literature respectively, upon the advice of their graduate advisers.

**211A-211B-211C. Linguistic Analysis** F,W,S

The techniques of linguistic analysis (phonetics, phonemics, morphology, syntax). Application of these techniques under simulated field conditions to the recording and analysis of a language by direct elicitation from native informants.

**221A-221B-221C. History and Structure of English** F,W,S

The first two quarters of this sequence survey the phonological, morphological, syntactic and lexical evolution of the English language. The third quarter concentrates on Old English (Anglo-Saxon); particularly with the view of instilling skills in the student to enable him to understand the literary documents written in the language.

**224A-224B-224C. Modern English** F,W,S

A detailed study of the syntax, phonology, and semantics of Modern English, with particular emphasis on current research on the general theory of grammars, as developed through the study of English.

**231A-231B-231C. Mathematical Linguistics** F,W,S

Fundamentals of discrete mathematics for non-mathematicians (first quarter only). Formal properties of grammatical systems. Formalized grammars of natural and artificial languages. Study of mathematical models that relate to linguistic competence and performance.

**241A-241B-241C. Romance Linguistics** **F,W,S**
The history and structure of Latin and contemporary Romance languages in the context of generative grammar; comparative Romance. Topics and problems will vary from quarter to quarter.

**251A-251B-251C. Historical Linguistics** **F,W,S**
A survey of Indoeuropean phonology and morphology; the techniques of linguistic reconstruction; theory of language change; advanced problems of historical linguistics.

**264A-264B-264C. Language Structures** **F,W,S**
Grammatical analysis of individual languages.

**271A-271B-271C. Anthropological Linguistics** **F,W,S**
Language and culture: the interrelationships of language and other aspects of human behavior. Areal linguistics: the focal area will vary from year to year; examples, Indian languages of North America, Oceanic languages, etc. Advanced problems in anthropological linguistics.

**281A-281B-281C. Psycholinguistics** **F,W,S**
The study of models of language and of language acquistion from the point of view of modern linguistics and psychology.

In addition to the above, the following courses will allow students to carry on research under the guidance of a member of the staff.

**298. Special Study** **F,W,S**

**299. Doctoral Research** **F,W,S**

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## LITERATURE

Departmental Office, 1003 Humanities-Library Building

### Instructional Staff

*Carlos Blanco-Aguinaga, *Ph.D., Professor of Spanish Literature*
Bernhard Blume, *Ph.D., Professor of German Literature*
Sigurd Burckhardt, *Ph.D., Professor of German Literature*
Joaquin Casalduero, *Ph.D., Professor of Spanish Literature*
Américo Castro, *Ph.D., Professor in Residence of Spanish Literature and Culture*
Robert C. Elliott, *Ph.D., Professor of English Literature*
Claudio Guillén, *Ph.D., Professor of Comparative Literature*
Roy Harvey Pearce, *Ph.D., Professor of American Literature (Chairman of the Department)*
Gian-Roberto Sarolli, *Ph.D., Professor of Romance Philology and Italian Literature*
John L. Stewart, *Ph.D., Professor of American Literature (Provost of Muir College)*
Andrew Wright, *Ph.D., Professor of English Literature*
Ronald Berman, *Ph.D., Associate Professor of English Literature*

Jack Behar, *Ph.D., Assistant Professor of American Literature*
David K. Crowne, *Ph.D., Assistant Professor of English Literature*
Edwin Dolin, *Ph.D., Assistant Professor of Classical and Comparative Literature*
Thomas K. Dunseath, *Ph.D., Assistant Professor of English Literature*
Peter C. Marlay, *Ph.D., Assistant Professor of Spanish Literature*
James T. Monroe, *Ph.D., Assistant Professor of Spanish Literature*
Donald Wesling, *Ph.D., Assistant Professor of English Literature*
Abraham Dijkstra, *Acting Instructor of English Literature*
*On Leave 1966-67

## Undergraduate Program

The only prerequisite to upper division literature courses is completion of freshman-sophomore requirements. However, literature majors who do not elect to take Literature 11 as part of their lower division program may find that, before enrolling in upper division foreign literature courses, they must bring their language proficiency up to the expected level by taking such lower division courses during their junior year. Accelerated lower division students may take advanced courses by permission of the Department.

Transfer students must demonstrate the same level of competence in a foreign language that is required of UCSD students. First-hand knowledge of the major documents of Western Civilization, such as is acquired in the UCSD humanities sequence, is assumed.

*Major Program*—The Literature Department expects its majors to take twelve upper division courses in the Department. Of these, a maximum of seven will be in one literature (the "primary" literature); the remaining five will be selected by the student, with the consent of his adviser, with this limitation: every major program must include at least three upper division courses taught in a language other than English.

Upper division courses are of two types—lectures and seminars. Lecture courses are unlimited in enrollment. Seminars are limited to ten students. In seminars, students will be expected not only to do work connected with the class meetings, but to undertake projects of independent study. They will accordingly be expected to have regular tutorial conferences with their instructor.

In each primary literature, the following courses are required: Literature 101A-101B-101C, 151.

Literature majors are required to pass a comprehensive examination, given in the last quarter of the senior year, as a prerequisite to the degree. They will be expected to demonstrate a reasonably continuous and coherent knowledge of the history of the primary literature they have selected, and a knowledge in depth of some periods, authors, and works in both the primary and another literature. Questions and answers will be, at least in part, in the language of the literature concerned.

For lower division students the Department of Literature offers courses of two kinds:

a. Courses numbered 11 are intermediate courses of readings and discussions in languages other than English. They are designed to develop language

skills beyond the generally required level of proficiency and to introduce the student to the cultural context of the literature concerned. Lower division language proficiency is a prerequisite for these courses. The courses are not prerequisite to each other; one is given each quarter.

b. Courses numbered 21-30 are introductory courses in which important documents of post-medieval Western literature will be studied by genre: the novel, the drama, lyric poetry. Each genre will be treated in a separate quarter course.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## LITERATURE DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| Freshman Year | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| Sophomore Year | Humanities 4<br>Social Science<br>Physical Science 1C | Humanities 5<br>Social Science<br>Physical Science 1D | Humanities 6<br>Social Science<br>Biology 1 |
| Junior Year | | | |

**Senior Year**

No recommended upper division schedule can be drawn up for majors in literature, since each student's program will depend on the primary and secondary literatures he elects. Individual major programs are to be worked out with and must be approved by the departmental major advisers.

## Graduate Program

### Doctor's Degree Program

The Department of Literature offers doctoral programs in English and American Literature and in Spanish Literature. It offers graduate instruction in French, German, Italian, and Classical Literature and in Comparative Literature, and it expects to present Ph.D. programs in these fields soon. The course of study makes explicit provision for a significant amount of independent work. Tutorial work and interdisciplinary study are encouraged. All students are required to do some teaching as an integral part of their training. Formal course requirements are kept to a minimum so that students may proceed toward the Ph.D. (the M.A. is not offered) at whatever rate their academic experience and their competence dictate. The program resembles those of other universities in that it requires each student to become professionally conversant with the literature of one language. It has also, however, a comparatist emphasis: each student must do advanced work related to his proposed field of specialization in at least one other literature.

Qualifying examinations, to be given at the end of the second year or thereabouts, are comprehensive in scope; the dissertation will serve to develop competence in a special field.

Requirements for admission:

1. A baccalaureate degree with a major in one of the literatures offered by the Department, or in another field approved by the Departmental Graduate Committee.
2. Satisfactory scores on the Graduate Record Examination, including, when available, the advanced examination in the literature of the student's specialty.
3. A working knowledge of one foreign language, to be tested during the first quarter of residence at UCSD.

The Department's foreign language requirement may normally be met by (a) demonstrated fluency in reading, writing and speaking one of the languages listed below, or (b) working knowledge of two of the languages listed below:

| | |
|---|---|
| French | Latin |
| German | Russian |
| Greek | Spanish |
| Italian | |

Other languages may be substituted for these with the approval of the student's graduate adviser, the chairman of the department and the Graduate Council. In all cases the languages presented must have a clear relation to the student's scholarly program.

NOTE: In certain departmental Ph.D. programs *e.g.*, Medieval Studies and Romance Literatures) knowledge of a third language may be required. Prospective students should direct inquiries to the chairman of the department.

## COURSES

### GENERAL LOWER DIVISION

(See also lower division courses listed under literature of the various languages)

**21A. Introduction to Literature: The Novel** F

Prose fiction from the 17th century to the present. Lecture and discussion. Three meetings. (Previously numbered 21).

**21B. Introduction to Literature: The Drama** W

Dramatic literature from the 17th century to the present. Lecture and discussion. Three meetings. (Previously numbered 22).

**21C. Introduction to Literature: Lyric Poetry** S

Major forms and modes of lyric poetry. Lecture and discussion. Three meetings. (Previously numbered 23).

### GENERAL UPPER DIVISION

(Upper division standing or consent of the instructor is prerequisite to all upper division courses.)

**151. Dante in English** W

An intensive study of Dante's works, primarily of the *Divine Comedy*. Readings and lectures in English. Lecture and discussion. Three meetings.

### GENERAL GRADUATE

**201. General Philology (3)** F

Historical introduction to general philology, with emphasis on the romance languages. Required of majors in Spanish Literature. Prerequisite: basic knowledge of Latin.

**202. Textual Criticism (3)** W

Textual problems in the *Roman de Thebes*. Topic varies from year to year. Offered for repeated registration.

**271. Critical Theory (3)** S

Problems of literary analysis; competing schools and major figures in literary criticism. Topic varies from year to year. Offered for repeated registration.

**274. Genre Studies (3)** W

Consideration of a representative selection of works relating to a theme, form,

or literary genre. Topic varies from year to year. Offered for repeated registration.

**297. Directed Studies (3 or 6)** **F,W,S**

Guided and supervised reading in a broad area of literature or linguistics. Offered in English, French, German and Spanish. Offered for repeated registration.

**298. Special Projects (1-6)** **F,W,S**

Treatment of a special topic in literature and language. Offered in English, French, German and Spanish. Offered for repeated registration.

**299. Thesis (3 or 6)** **F,W,S**

Research in English and American or Spanish literature for the dissertation. Offered for repeated registration. Prerequisite: student must be advanced to candidacy for the Ph.D. degree.

## ENGLISH AND AMERICAN LITERATURE

## Upper Division Courses — English and American Literature

(Upper division standing or consent of the instructor is prerequisite to all upper division courses.)

**Lit/En 101A-101B-101C. The Great Tradition** **F,W,S**

A chronological study of important English and American writers. Three hours lecture. (Previously numbered 101E-102E-103E).

***Lit/En 121. The Medieval Period**

Major literary works of the Middle Ages as seen against the historical and intellectual background of the period. Three hours lecture. (Previously numbered 121E).

***Lit/En 122. The Renaissance**

Major literary works of the Renaissance as seen against the historical and intellectual background of the period. Three hours lecture. (Previously numbered 122E).

***Lit/En 123. The Enlightenment**

The intellectual temper of the Age of Reason as reflected in the work of Dryden, Swift, Pope, Fielding, Stone, Johnson, and others. Three hours lecture. (Previously numbered 123E).

***Lit/En 124. The Nineteenth Century** **S**

Readings in the Romantics and Victorians; the intellectual background of the age. Three hours lecture. (Previously numbered 124E).

**Lit/En 125. American Literature: Nineteenth Century** **W**

A critical study of major American writers of the 19th century: Poe, Hawthorne, Melville, Thoreau, and others. Three hours lecture. (Previously numbered 125E).

**Lit/En 126. The Twentieth Century: English and American** **S**

A critical study of major American and English writers of our period. Three hours lecture. (Previously numbered 126E).

***Lit/En 131. Studies in Fiction**
Historical and critical problems in the art of fiction. Papers and discussion. Two hours seminar. (Previously numbered 131E).

**Lit/En 132. Studies in Poetry** **W**
Historical and critical problems in the art of poetry. Papers and discussion. Two hours seminar. (Previously numbered 132E).

***Lit/En 133. Studies in Drama**
Historical and critical problems in the art of drama. Papers and discussion. Two hours seminar. (Previously numbered 133E).

***Lit/En 134. Studies in Criticism**
The major theories and methods of literary criticism and interpretation. Papers and discussion. Two hours seminar. (Previously numbered 134E).

***Lit/En 141. History of the English Language**
A study of the historical development of the English Language. Papers and discussion. Two hours seminar. (Previously numbered 141E).

**Lit/En 151. Shakespeare** **F**
A study of selected plays. Papers and discussion. Two hours seminar. (Previously numbered 151E).

**Lit/En 199. Special Studies** **F,W,S**
Tutorial; individual guided reading in an area not normally covered in courses. (Previously numbered 199E).

## Graduate Courses—English and American Literature

**Lit/En 202. Bibliography and Methods of Research (3)** **F**
Tools, methods, and standards of scholarly research in literature, including establishment of texts and bibliographical description.

**Lit/En 211. Old English Literature (3)** **W**
Consideration of one or more major figures, texts, or trends in Old English literature, including medieval drama. Topic varies from year to year. Offered for repeated registration.

**Lit/En 214. Middle English Literature (3)** **S**
Consideration of one or more major figures, texts, or trends in Middle English literature, including medieval drama. Topic varies from year to year. Offered for repeated registration.

**Lit/En 221. Sixteenth Century English Literature (3)** **S**
Critical study of one or more major figures, texts, or literary trends in Tudor England. Topic varies from year to year. Offered for repeated registration.

**Lit/En 224. Early Seventeenth Century English Literature (3)** **F**
Consideration of one or more major figures, texts, or trends in early seventeenth century English literature, including the metaphysical poets and Jacobean Drama. Topic varies from year to year. Offered for repeated registration.

**Lit/En 226. Shakespeare (3)** W
Shakespeare's plays in relation to the Elizabethan background; selected major texts. Topic varies from year to year. Offered for repeated registration.

**Lit/En 231. Restoration and 18th Century English Literature: 1660-1745** F
Consideration of one or more figures, texts, or trends in Restoration and early eighteenth century English literature, including Dryden, Pope, Swift, the early novel, satire. Topic varies from year to year. Offered for repeated registration.

**Lit/En 236. Later 18th Century English Literature (3)** W
Consideration of one or more major figures, texts, or trends in later 18 century English literature, including Fielding, Johnson, Blake, Jane Austen, the major novelists. Topic varies from year to year. Offered for repeated registration.

**Lit/En 245. Nineteenth Century American Studies (3)** S
Consideration of some of the principal writers and movements in 19th century literature. Topic varies from year to year. Offered for repeated registration.

**Lit/En 246. Victorian Literature (3)** W
Consideration of one or more major figures, or trends in the Victorian Period, including Arnold, Tennyson, Ruskin, Pater, Swinburne. Topic varies from year to year. Offered for repeated registration.

**Lit/En 252. Studies in Modern American Literature and Culture (3)** S
Consideration of one or more major figures, texts, or trends in American literature, in particular the relationship between literature and culture. Topic varies from year to year. Offered for repeated registration.

## FRENCH LITERATURE

### Lower Division Courses—French Literature

**Lit/Fr 11A-11B-11C. Readings in French Literature and Culture** F,W,S
Three meetings. Prerequisite: satisfaction of Revelle College lower division language proficiency requirement in French. (Previously numbered 11).

### Graduate Courses—French Literature

**Lit/Fr 203. History of the French Language** S
History of the French language from the origin through the XVI century. Prerequisite: basic knowledge of French.

## GERMAN LITERATURE

### Lower Division Courses—German Literature

**Lit/Ge 11A-11B-11C. Readings in German Literature and Culture** F,W,S
Three meetings. Prerequisite: satisfaction of Revelle College lower division language proficiency requirement in German. (Previously numbered 12).

### Upper Division Courses—German Literature

(Upper division standing or consent of instructor is prerequisite to all upper division courses. The language of instruction is German).

**Lit/Ge 101A-101B-101C. The Great Tradition** **F,W,S**
A chronological study of important German writers. (Previously numbered 101G-102G).

***Lit/Ge 121. Medieval Literature**
Major literary works of the Middle Ages in their historical and intellectual context. Three lectures. (Previously numbered 121G).

***Lit/Ge 122. Reformation and Baroque**
The important literary and intellectual developments of the 16th and 17th centuries. Three lectures (Previously numbered 122G).

***Lit/Ge 123. The Classical Drama**
Selected plays by Lessing, Goethe, Schiller and Kleis in their historical context. Three lectures: (Previously numbered 123G).

***Lit/Ge 124. Romanticism**
The fiction, poetry and criticism of the major Romantic authors. Three lectures. (Previously numbered 124).

***Lit/Ge 131. Studies in the Eighteenth Century**
Historical and critical problems in the literature of the 18th century. Seminar. Two meetings. (Previously numbered 131G).

***Lit/Ge 132. Studies in the Nineteenth Century**
Historical and critical problems in the literature of the 19th century. Seminar. Two meetings. (Previously numbered 132G).

***Lit/Ge 133. Studies in the Twentieth Century**
Historical and critical problems in the 20th century. Seminar. Two meetings. (Previously numbered 133G).

***Lit/Ge 151. Goethe**
A study of some major works in the context of Goethe's life and milieu. Seminar. Two meetings. (Previously numbered 151G).

**Lit/Ge 199. Special Studies** **F,W,S**
Tutorial; individual guided reading in an area not normally covered in courses. (Previously numbered 199G).

## ITALIAN LITERATURE

## Graduate Courses—Italian Literature

**Lit/It 215. Dante (3)** **S**
A study of the poet, his cultural background and his political-historical mission. Prerequisite: basic knowledge of Italian.

## RUSSIAN LITERATURE

## Lower Division Courses—Russian Literature

**Lit/Ru 11A-11B-11C. Readings in Russian Literature and Culture** **F,W,S**
Three meetings. Prerequisite: satisfaction of Revelle College lower division

language proficiency requirement in Russian. (Previously numbered 15).

# SPANISH LITERATURE

## Lower Division Courses — Spanish Literature

**Lit/Sp 11A-11B-11C. Readings in Spanish Literature and Culture** F,W,S

Three meetings. Prerequisite: satisfaction of Revelle College lower division language proficiency requirement in Spanish. (Previously numbered 16).

## Upper Division Courses — Spanish Literature

(Upper division standing or consent of instructor is prerequisite to all upper division courses. The language of instruction is Spanish).

**Lit/Sp 101A-101B-101C. The Great Tradition** F,W,S

A chronological study of important Spanish writers. (Previously numbered 101S-102S-103S).

***Lit/Sp 121. Medieval Literature**

Major literary works of the Middle Ages in their historical and intellectual context. Three lectures. (Previously numbered 121S).

***Lit/Sp 122. Golden Age Drama**

The major dramatists of the 16th and 17th centuries. Three lectures. (Previously numbered 122S).

***Lit/Sp 123. The Nineteenth Century Novel**

Spanish fiction during the post-Napoleonic age. Three lectures. (Previously numbered 123S).

***Lit/Sp 124. The Generation of '98**

The renaissance of Spanish letters at the turn of the 20th century. Three lectures. (Previously numbered 124S).

***Lit/Sp 131. Studies in Golden Age Prose (except Cervantes)**

Historical and critical problems in 16th and 17th century prose. Seminar. Two meetings. (Previously numbered 131S).

***Lit/Sp 132. Studies in Golden Age Poetry**

Historical and critical problems in 16th and 17th century poetry. Seminar. Two meetings. (Previously numbered 132S).

***Lit/Sp 133. Studies in the Eighteenth and Nineteenth Centuries**

Historical and critical problems in the literature of the 18th and 19th centuries. Seminar. Two meetings. (Previously numbered 133S).

***Lit/Sp 134. Studies in Twentieth Century Literature**

Critical and cultural problems in contemporary literature. Seminar. Two meetings. (Previously numbered 134S).

**Lit/Sp 151. Cervantes** S

General survey of the major works of Cervantes. Seminar. Two meetings. (Previously numbered 151S).

**Lit/Sp 199. Special Studies** **F,W,S**
Tutorial; individual guided reading in an area not normally covered in courses. (Previously numbered 199S).

## Graduate Courses – Spanish Literature

**Lit/Sp 203. History of the Spanish Language (3)** **W**
Conducted in Spanish. A study of Latin and its development into Vulgar Latin and ultimately into the Peninsular vernacular speech, tracing the differentiation of the major languages and dialects, concentrating on Castillian. Attention will be given to Sephardic, Andalusian and American Spanish. Prerequisites: elementary knowledge of Spanish and Latin.

**Lit/Sp 212. Introduction to Hispano-Arabic Literature (3)** **F**
The course will deal particularly with poetry, its development in pre-Islamic Arabia and its flowering in Andalusia. Hispano-Arabic poetry and its possible relation to medieval European Lyricism will be discussed. Representative texts available in translations will be read and commented upon. Topic varies from year to year. Offered for repeated registration.

**Lit/Sp 224. Golden Age Studies (3)** **W**
Consideration of one or more major figures, texts, trends or problems in Spanish Golden Age Studies. Topic varies from year to year. Offered for repeated registration.

**Lit/Sp 226. Cervantes (3)** **F, W**
A critical reading of the *Quijote*. Prerequisite: knowledge of Spanish.

**Lit/Sp 241. Romanticism in Spain (3)** **F**
An historical review of Spanish Romanticism, with special attention to certain basic works. Prerequistie: knowledge of Spanish.

**Lit/Sp 254. Modern Spanish Poetry (3)** **S**
An historical approach to modern Spanish poetry with special attention to some of the major poets: Unamuno, Machado, Juan Ramon Jimenez, Lorca, Salinas. Prerequisite: knowledge of Spanish.

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# MARINE BIOLOGY

Departmental Office, 120 Scripps Building, SIO

### Instructional Staff

Andrew A. Benson, *Ph.D., Professor of Biology*
Denis L. Fox, *Ph.D., Professor of Marine Biochemistry*
Susumu Hagiwara, *M.D., Professor of Physiology*
Francis T. Haxo, *Ph.D., Professor of Biology*
Per F Scholander, *M.D., Ph.D., Professor of Physiology*
Benjamin E. Volcani, *Ph.D., Professor of Microbiology*
Claude E. ZoBell, *Ph.D., Professor of Marine Microbiology*
Carl L. Hubbs, *Ph.D., Professor of Biology Emeritus*

Ralph A. Lewin, *Ph.D., Associate Professor of Biology*
Richard Rosenblatt, *Ph.D., Assistant Professor of Marine Biology*

* * *

Martin W. Johnson, *Ph.D., Professor of Marine Biology Emeritus*
Edward W. Fager, *Ph.D., D.Phil., Professor of Biology*
Theodore H. Bullock, *Ph.D., Professor of Neurophysiology*
William A. Newman, *Ph.D., Assistant Professor of Oceanography*

* * *

Theodore Enns, *Ph.D., Research Physiologist, Lecturer in Physiology*

* * *

David Jensen, *Ph.D., Research Associate*
Charles R. Schroeder, *D.V.M., Research Associate*
Thomas W. Whitaker, *Ph.D., Research Associate*

**UCSD/Scripps does not offer an undergraduate major in marine biology.**

### Graduate Program

The Department of Marine Biology offers a program of studies leading to the M.S. or Ph.D., emphasizing experimental, as well as some areas of descriptive biology of marine organisms. These studies presently include microbiology, cellular and comparative physiology and biochemistry, physiological ecology, systematics and life histories, genetics and evolution.

Students intending to specialize in marine biology should be broadly oriented toward biology but with training in at least one specific discipline, *e.g.*, microbiology, animal or plant physiology, biochemistry, invertebrate or vertebrate zoology. Students in marine biology at San Diego are encouraged to supplement their training by course offerings in other departments of this campus, *e.g.*, oceanography, other teaching units in the biological sciences, the earth sciences and chemistry. Qualified students in the Department of Marine Biology may, with the approval of each department concerned, pursue their research under the joint guidance of a member of the major departmental faculty and a faculty member from another department.

Provisions can also be made for certain students working on marine plants, animals or microorganisms to complete some of the requirements for an advanced degree or to pursue their research through the Department of Marine Biology under the supervision of faculty members on this or another campus of the University of California

### Requirements for Admission

1. A baccalaureate degree with a major in one of the biological sciences, or the substantial equivalent thereof. Basic preparation in botany and zoology is required.
2. A one-year course in each of the following: English, mathematics (including calculus), and physics with laboratory.
3. At least a one-year course in chemistry, plus a course in organic chemistry; biochemistry and physical chemistry are recommended especially for students in experimental biology.
4. Preparation in two foreign languages (one only for the M.S. degree), chosen from the following: German, French, Russian.

### Master's Degree Program

Offered under Plan I (30 units and thesis) or Plan II (36 units and comprehensive examination). Unit requirements may be satisfied by approved selections from courses listed in marine biology, oceanography and other departments, but must include Oceanography 110, 112, 114 and a total of 18 units of graduate courses, including seminar work (*e.g.*, Marine Biology 252 or Oceanography 253) during at least two quarters in each year of residence. Research (Marine Biology 299) units may aggregate a maximum of 8 units under Plan I, and a maximum of 6 units under Plan II. A reading knowledge of German, French or Russian.

### Doctor's Degree Program

Ordinarily, the required courses listed for the M.S. degree; a reading knowledge of German and either French or Russian (to be demonstrated before the end of the second year). The student should pass a departmental examination during his second year, and a qualifying examination by the end of the first quarter of his third year. Independent study and research, with thesis, in such fields as those named above and listed below under Marine Biology 299.

## COURSES

### GRADUATE

**199. Special Studies (1-6, 1-6, 1-6)** **F,W,S**

The Staff

Prescribed reading, laboratory or field studies, oral or written reports in any of the listed areas of marine biology; or any combination of such assignments as issued by the student's supervisory instructor. Prerequisite: consent of instructor.

**221. Marine Microbiology (3)** **F**

Mr. ZoBell

Ecology, biochemical activities, and methods of studying bacteria and allied microorganisms in the sea, with particular reference to their effects on other organisms and as geochemical agents. Prerequisites: preparation in general microbiology, bacterial physiology and biochemistry. Oceanography 110, 112, 114 are recommended and may be taken concurrently.

**225. Physiology of Marine Algae (3)** **F**

Mr. Haxo

Lectures and laboratory in comparative physiology of algae with emphasis on marine problems. Prerequisites: basic courses in biology and chemistry.

**226. Marine and Comparative Biochemistry (3)** **W**

Mr. Fox

Chemistry of living matter; osmotic adaptation in the hydrosphere; marine colloids; comparative biochemical and physiological activities of aquatic organisms, biochemical cycles in the sea; animal pigments. Prerequisites: preparation in biology, organic chemistry and biochemistry or physiology; consent of instructor. Oceanography 112, 114 are recommended and may be taken concurrently.

**227. Biological Chemistry of Marine Organisms (3)** S

Mr. Benson

Biochemistry of major products of marine organisms with emphasis on carbohydrates and lipids. The current concepts of their structural and physiological function will be presented and discussed. Prerequisites: organic chemistry required, physical chemistry and biochemistry recommended.

**235. Biology of Fishes (4)** W

Mr. Rosenblatt

The comparative evolution, morphology, physiology and ecology of fishes. Special emphasis on local and deep-sea and pelagic forms in laboratory. Prerequisite: consent of instructor.

**252. Seminar in Experimental and Comparative Biology (2-2-2)** F,W,S

The Staff

**253. Seminar: The Species (2)** W

Mr. Lewin

The use and misuse of the species concept, and the diverse mechanisms of speciation, will be considered in relation to various groups of plants and animals, and to the special problems presented by each.

**255. Marine Biology Seminar (1-1-1)** F,W,S

Mr. Lewin and Staff

A seminar dealing with various topics in the biological sciences. Lectures given by visiting scientists and resident staff and students.

**260. Seminar in Advanced Ichthyology (2)** F,S

Mr. Hubbs, Mr. Rosenblatt

**270. Cellular Structure and Biochemical Function (3)** S

Mr. Volcani

Lectures and laboratory studies of subcellular structures and their function in cell metabolism. Experiments involving techniques for isolation and biochemical assay with special reference to marine organisms. Prerequisites: preparation in biology and biochemistry; consent of instructor. Marine Biology 227 and Biology 201 are recommended as background.

**275A-275B. Shore Microbiology (3-3)** W,S

Mr. Lewin

Field and laboratory investigations of the ecology, physiology and metabolic activities of marine littoral microorganisms: algae, bacteria, fungi and protozoans. Special methods for isolating and culturing selected organisms, individual research projects. Prerequisites: preparation in biological sciences, including physiology or microbiology. Introductory courses in chemistry and biology of the sea are recommended.

**285. Laboratory in Physiology (2-4)** S

Mr. Scholander

Research techniques and problems in selected areas of environmental physiology.

**286. Isotope Tracer Techniques in Physiology (2)** S

Mr. Enns

Physiological transport and related processes as determined by isotope tracers. Radiation physics and the quantitative detection of radioactive and stable isotopes. Prerequisite: physical chemistry recommended.

**299. Research (1-6, 1-6, 1-6)** F,W,S

The Staff

Research in such fields as comparative biochemistry or physiology of marine plants and animals, biophysics, microbiology, phycology, vertebrate and invertebrate zoology, genetics and evolution. Research reports are submitted at the end of each term.

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## MATHEMATICS

Departmental Office, 3234 Urey Hall

### Instructional Staff

Errett A. Bishop, Ph.D., *Professor of Mathematics*
Theodore T. Frankel, Ph.D., *Professor of Mathematics*
Adriano M. Garsia, Ph.D., *Professor of Mathematics*
Ronald K. Getoor, Ph.D., *Professor of Mathematics*
Jacob Korevaar, Ph.D., *Professor of Mathematics*
Clay L. Perry, Ph.D., *Professor of Mathematics*
*(Director of the Computer Center)*
Helmut Röhrl, D.Sc., *Professor of Mathematics*
Murray Rosenblatt, Ph.D., *Professor of Mathematics*
Stefan E. Warschawski, Ph.D., *Professor of Mathematics*
*(Chairman of the Department)*
Hubert Halkin, Ph.D., *Associate Professor of Mathematics*
Burton Rodin, Ph.D., *Associate Professor of Mathematics*
Edward D. Conway, III, Ph.D., *Assistant Professor of Mathematics*
Jay P. Fillmore, Ph.D., *Assistant Professor of Mathematics*
John A. R. Holbrook, Ph.D., *Assistant Professor of Mathematics*
Eugene Lee, Ph.D., *Assistant Professor of Mathematics*
Patrick J. Ledden, Ph.D., *Assistant Professor of Mathematics*
Donald R. Smith, Ph.D., *Assistant Professor of Mathematics*
Frank B. Thiess, Ph.D., *Assistant Professor of Mathematics*
Stanley G. Williamson, Ph.D., *Assistant Professor of Mathematics*

* * *

Ulrich Oberst, Ph.D., *Visiting Assistant Professor of Mathematics*
George Senge, Ph.D., *Acting Assistant Professor of Mathematics*
Klaus Wolffhardt, Ph.D., *Visiting Assistant Professor of Mathematics*

### Undergraduate Program

The upper division curriculum provides programs for mathematics majors as well as courses for students who will use mathematics as a tool in the physical and behavorial sciences and the humanities.

The student majoring in mathematics will take, in addition to the basic calculus sequence (Mathematics 2A-2B-2C) at least 15 quarter courses in the upper division. The program will normally include a basic course in differential equations (Mathematics 100), vector calculus and matrices (Mathematics 101) and an introduction to analysis (Mathematics 102), as well as a one-year course in linear algebra and group theory (Mathematics 110A-110B-110C). The remaining nine courses shall be chosen from areas in analysis, geometry, algebra and applied mathematics, fitted to the interests of the student, with the approval of a departmental adviser. The Department recommends that students who plan to go on to graduate study in mathematics include the "Introduction to Analysis and Topology" (Mathematics 150A-150B) in their program.

In accordance with the general requirements for the B.A. degree in Revelle College, the student will take 6 quarter courses in a noncontiguous minor field as approved by his major adviser.

In addition the student will take 3 quarter courses in an area in which mathematics plays a basic role (restricted elective). With a judicious choice of his program the student will still have three (unrestricted) electives open to complete the requirement for the B.A. degree.

Foreign languages recommended for mathematics majors are German, French and Russian.

Students who at the end of their freshman year expect to major in mathematics should use the three electives in the sophomore year to take Mathematics 100, 101 and 102. This will enable them to complete a strong major curriculum in the most orderly fashion as to preparation and continuity of courses.

Students who do not decide on a major until their junior year may satisfy one half of the requirements for the noncontiguous minor by a proper choice of their electives in the sophomore year. In this way they can complete all of the above requirements for the B.A. degree in the normal period of four years.

Students will be encouraged to progress at a rate commensurate with their abilities. They will be able to accelerate their work by independent study and special seminars and to demonstrate their progress by proficiency examination in place of taking courses.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## MATHEMATICS DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math 2C/Math 100 | Humanities 5<br>Social Science<br>Physical Science 1D<br>Math 100/Math 101 | Humanities 6<br>Social Science<br>Biology 1<br>Math 101/Math 102 |
| **Junior Year** | Math 110A<br>*<br>**<br>_____ | Math 110B<br>*<br>**<br>_____ | Math 102/Math 110C<br>*<br>**<br>_____ |
| **Senior Year** | *<br>†<br>_____<br>_____ | *<br>†<br>_____<br>_____ | *<br>†<br>_____<br>_____ |

*Choices from: Mathematics 150A-150B plus 160A or 166A
Mathematics 120, 121, 122
Mathematics 123, 124A-124B
Mathematics 126A-126B-126C
Mathematics 130A-130B-130C
Mathematics 130A, 133A-133B
Mathematics 141A-141B-141C
Mathematics 160A-160B-160C

**Three electives are to be taken in an area in which mathematics plays a major role.
†Any course †not previously taken.

## GRADUATE PROGRAM

The Department of Mathematics offers a graduate program leading to the M.A. and Ph.D. degrees.

Admission to the graduate program is in accordance with the general requirements of the Graduate Division of the University of California. Students with a bachelor's degree and a background in mathematics comparable with the requirements for the undergraduate major in mathematics at this university may apply for admission.

## MASTER'S DEGREE PROGRAM

Requirements for the Master of Arts degree are to be met according to Plan II (comprehensive examination). Students will be expected to have at least 18 units in graduate courses in mathematics, 9 units of graduate courses in mathematics or a related field, approved by the Department, and 9 units of graduate or upper division courses. The latter may be in mathematics or in a related field, subject to approval by the Department. No research units may be used in satisfaction of the requirements for the master's degree. The comprehensive examination will cover basic topics in two of the following six areas, to be selected by the candidate from two of the following three lists:

1. Algebra; topology
2. Real analysis; complex analysis
3. Applied mathematics; numerical analysis and computer sciences

A detailed list of the depth requirements in each of these areas with literature references and approved courses is available in the Office of the Mathematics Department.

A reading knowledge of one foreign language (French, German or Russian) is required. In exceptional cases other languages may be substituted upon petition to the Graduate Division.

## DOCTOR'S DEGREE PROGRAM

During the first two years the student will acquire a general background in mathematics and prepare himself for the departmental qualifying examinations. Written examinations must be taken in the following four areas:

1. Algebra
2. Real analysis
3. Topology
4. One of the following fields: complex analysis, ordinary or partial differential equations, applied mathematics, numerical analysis and computer sciences, probability and mathematical statistics, depending on the choice of the student.

A detailed list of the depth requirements in each of these areas with literature references and approved courses is available in the Office of the Mathematics Department.

After satisfactory completion of the departmental examinations a Doctoral Committee, appointed by the Graduate Division, will conduct the student's oral qualifying examination. Before taking the oral qualifying examination the student must demonstrate a satisfactory reading knowledge of two foreign languages (French, German or Russian). In exceptional cases other languages may be substituted upon petition to the Graduate Division.

Successful passage of the oral qualifying examination advances the student to candidacy for the doctor's degree. The student will subsequently devote himself to study and research for his doctoral dissertation. After completion of the dissertation he will take the final examination, which is conducted by his Doctoral Committee. The examination is oral and deals primarily with the dissertation and its relationship to the general field in which the subject lies.

# COURSES

## LOWER DIVISION

As part of the general program of the lower division all students take a one-year course in mathematics: Mathematics 1A-1B-1C or 2A-2B-2C depending on their high school preparation.

**1A. Elements of Mathematical Analysis** F

Review of topics in algebra and trigonometry. Differentiation and integration of algebraic functions; applications; basic analytic geometry in the plane. Three lectures, two recitations. Prerequisite: two units of high school mathematics. (Previously numbered 1).

**1B. Elements of Mathematical Analysis** W

Differentiation and integration of trigonometric functions, the logarithm and the exponential function. Three lectures, one recitation. Prerequisite: Mathematics 1A. (Previously numbered 2).

**1C. Elements of Mathematical Analysis** S

Definite integral and its applications; elements of linear algebra. Three lectures, one recitation. Prerequisite: Mathematics 1B. (Previously numbered 3).

**2A. Calculus and Analytic Geometry** F

Differential and integral calculus of functions of one variable: limit, continuity; differentiation of algebraic and trigonometric functions; applications. Definite integral, primitive functions, fundamental theorem of the calculus. Elements of analytic geometry as needed in the development of the calculus. Three lectures, two recitations. Prerequisites: three or more units of high school mathematics; in addition, one-half unit of trigonometry is desirable. (Previously numbered 4).

**2B. Calculus and Analytic Geometry** W

Continuation of calculus of functions of one variable: differentiation and integration of logarithm, exponential functions, Taylor's formula. Parametric representation. Applications of integration. Elements of linear algebra; analytic geometry in 3 space. Three lectures, one recitation. Prerequisite: Mathematics 2A. (Previously numbered 5).

**2C. Calculus and Analytic Geometry** S

Calculus of functions of several variables: partial differentiation; directional derivative; total differential. Maxima and minima of functions of several variables. Lagrange multipliers, multiple integration. Infinite Series, series with constant terms, power series. Three lectures, one recitation. Prerequisite: Mathematics 2B. (Previously numbered 6).

## UPPER DIVISION

**100. Differential Equations** F,W,S

Linear differential equations; equations with constant coefficients. Matrices. Systems. Solutions by infinite series, some special functions. Four lectures. Prerequisite or co-registration: Mathematics 2C.

**101. Vector Calculus and Matrices** F,W,S

Vector fields, differential operators, line-surface-volume integrals, Green's,

Stokes', and Gauss' theorems. Implicit function theorem, transformations, Jacobians, matrices, eigenvalue problems. Four lectures. Prerequisite: Mathematics 2C.

**102. Introductory Analysis** S

The real number system, properties of continuous functions, Riemann-Stieltjes integral. Functions defined in terms of integrals. Uniform convergence. Three lectures. Prerequisite: Mathematics 100.

**109. Undergraduate Seminar** F,W,S

Reports by students on assigned reading material and/or discussion of assigned problems in areas compatible with the students' background. Designed to develop insight and originality as well as mathematical techniques. Three periods. Prerequisite: consent of department.

**110A. Linear Algebra and Group Theory** F

Fields, vector spaces, direct products and sums, basis theorems, homomorphisms and matrices, dual spaces, transpose, subspaces and quotient spaces, induced endomorphisms, isomorphism theorems, exact sequences and splitting, invariant subspaces, trace. Three lectures. Prerequisite: Mathematics 2C. (Previously numbered 110).

**110B. Linear Algebra and Group Theory** W

Multilinear mappings with symmetry properties; tensor, symmetric and alternating products of vector spaces and homomorphisms; splitting theorems and basis theorems; determinants, forms. Three lectures. Prerequisite: Mathematics 110A. (Previously numbered 111).

**110C. Linear Algebra and Group Theory** S

Groups, homomorphisms, subgroups, quotients groups, homomorphism theorems, abelian groups as generalized vector spaces, classification of finitely generated abelian groups, permutation groups. Groups operating on vector spaces, classical groups, tensor representation of classical groups. Three lectures. Prerequisite: Mathematics 110B. (Previously numbered 112).

## Advanced Mathematics (120, 121, 122) for the Physical Science Majors

**120. Complex Variables** F

Complex numbers, complex valued functions, analytic functions. Cauchy-Riemann equations, elementary functions and conformal mapping, basic concepts of 2-dimensional potential theory, complex integration, Cauchy's theorem, Cauchy's formula, power series, residue theory and applications. Ordinary differential equations in the complex plane. Four lectures. Prerequisite or coregistration: Mathematics 100.

**121. Introduction to Ordinary and Partial Differential Equations** W

Bessel, Hermite, Legendre and other special functions. Orthogonal expansions, eigenvalue problems, Sturm-Liouville theory. Some partial differential equations of mathematical physics. Boundary value problems, separation of variables. Four lectures. Prerequisite: Mathematics 100.

**122. Integral Transforms** **S**

Additional topics on Fourier series. Fourier, Laplace and other transforms. Applications to ordinary and partial differential equations. Three lectures. Prerequisites: Mathematics 120, 121.

**123. Ordinary Differential Equations** **F**

Existence and uniqueness of solutions of differential equations and of systems. Linear systems with constant and variable coefficients; solutions in matrix form. Local and global theorems of continuity and differentiability. Autonomous systems. Stability; Lyapounov's theorem. Three lectures. Prerequisites: Mathematics 100, 101.

**124A-124B. Introduction to Control Theory** **W,S**

State space, dynamical system, control system. Optimal control problems; Pontryagin's maximum principle; the linear problem; the bang-bang principle and extensions; nonlinear problems; relations with calculus of variations and dynamic programming; Lyapounov's stability; numerical methods in system optimization. Applications to aeronautical engineering, electrical engineering and economics. Stochastic optimal control and programming under uncertainty. Three lectures. Prerequisites: Mathematics 100, 101, 102 or consent of instructor. (Previously numbered 124-125).

**126A. Elements of Partial Differential Equations and Integral Equations** **F**

Basic concepts and classification of partial differential equations. First order equations, characteristics, Hamilton-Jacobi theory, Laplace's equation, wave equation, heat equation. Separation of variables, eigenfunction expansions, existence and uniqueness of solutions. Three lectures. Prerequisite: Mathematics 121. (Previously numbered 126).

**126B. Elements of Partial Differential Equations and Integral Equations** **W**

Relation between differential and integral equations, some classical integral equations, Volterra integral equations, integral equations of the second kind, degenerate kernels, Fredholm alternative, Neumann-Liouville series, the resolvent kernel. Three lectures. Prerequisite: Mathematics 126A. (Previously numbered 127).

**126C. Elements of Partial Differential Equations and Integral Equations** **S**

Maximum-minimum problems, method of Lagrange, classical problems in the calculus of variations, general formulation of a variational problem, special methods of solution. Euler-Lagrange equations, applications to physics: Fermat principle. Lagrangean and Hamiltonian formulation of mechanics, theorem of E. Noether. Three lectures. Prerequisite: Mathematics 126B. (Previously numbered 128).

**130A. Introduction to Probability** **F and S**

Probability spaces, independence and conditional probability, random variables, distributions, expectations, joint distributions, law of large numbers, central limit theorem. Three lectures. Prerequisite: Mathematics 101. (Previously numbered 130).

**130B. Introduction to Probability** **W**

Random walk, generating functions, runs and recurrent events, discrete fluctuation theory; Markov chains with discrete state space. Three lectures. Prerequisite: Mathematics 130A. (Previously numbered 131).

**130C. Introduction to Probability** **S**

Markov chains with continuous state space, simple diffusion-processes, stationary processes, fluctuations and queuing theory. Three lectures. Prerequisite: Mathematics 130B. (Previously numbered 132).

**133A. Introduction to Statistics** **W**

Random samples, linear regression, least squares, testing hypotheses and estimation. Neyman-Pearson lemma, likelihood ratios. Three lectures. Prerequisite: Mathematics 130A. (Previously numbered 133).

**133B. Introduction to Statistics** **S**

Goodness of fit, special small sample distribution and use, nonparametric methods, Kolmogorov-Smirnov statistic, sequential analysis. Three lectures. Prerequisite: Mathematics 133A. (Previously numbered 134).

**140. Programming of Computers** **W**

Logical design of computers, number representations, machine languages, problem-oriented languages, flow diagrams, iterative algorithms, program organization, debugging methods and symbol manipulation. Three lectures. Prerequisite: Mathematics 100.

**141A. Numerical Analysis** **F**

Numerical approximations, interpolation, roots of equations and systems of linear equations, linear eigenvalue problems. Three lectures. Prerequisites: mathematics 101, 102. (Previously numbered 141).

**141B. Numerical Analysis** **W**

Difference equations, numerical differentiation and integration, numerical solution of ordinary differential equations, stability and error propagation. Three lectures. Prerequisite: Mathematics 141A. (Previously numbered 142).

**141C. Numerical Analysis** **S**

Extreme values, linear programming and monte carlo methods. Three lectures. Prerequisite: Mathematics 141B. (Previously numbered 143).

**144. Mathematical Programming**

Elementary topological properties of Euclidean spaces. Convex sets, separation theorems. Simplexes, Sperner lemma, Brouwer fixed point theorem. Duality, linear programming. Constrained maxima, Kuhn-Tucker theorem, mathematical programming. Three lectures. Prerequisites: Mathematics 100, 101 or 110A.

**150A. Introduction to Analysis and Topology** **F**

Set theory, Zorn's lemma, metric spaces, continuous mappings, completions, fixed point theorems, Baire's theorem, compactness, Lebesgue number, connectedness. Four lectures. Prerequisite: Mathematics 102. (Previously numbered 150).

**150B. Introduction to Analysis and Topology** **W**
Uniform convergence on subsets, function algebras, Ascoli's theorem, Stone-Weierstrass theorems, structure of function algebras. Four lectures. Prerequisite: Mathematics 150A. (Previously numbered 151).

**160A. Introduction to Geometry** **F or S**
Review of vector spaces, bilinear forms, inner product geometry, affine geometry, projective geometry, quadrics. Grassmanians. Three lectures. Prerequisite or co-registration: Mathematics 110A. (Previously numbered 160).

**160B. Introduction to Geometry** **W**
Dilatations and translations, coordinates, affine geometry associated with a field, theorems of Desargue and Pappus, projective geometry. Three lectures. Prerequisite: Mathematics 160A. (Previously numbered 161).

**160C. Introduction to Geometry** **S**
Algebraic curves in the complex plane, regular and singular points, Bezout's theorem, local parametrization, Plücker's formulas, Lüroth's theorem. Three lectures. Prerequisite: Mathematics 160B. (Previously numbered 162).

**166. Differential Geometry** **F or S**
Normed vector spaces and differentiation, inverse and implicit function theorems, tangent vectors and vector fields, cotangent vectors, tensors, differential forms, Poincaré lemma, differential manifolds, tangent and cotangent bundles, deRham groups, Stokes' theorems, deRham theorems. Three lectures. Prerequisite: Mathematics 150A, or consent of instructor.

**199. Independent Study for Undergraduates** **F,W,S**
Independent reading in advanced mathematics by individual students. Three periods. Prerequisite: consent of department.

## GRADUATE

**200A-200B-200C. Algebra (3,3,3)** **F,W,S**
Mr. Fillmore
Algebraic structures, Jordan-Holder theorem, Sylow theorems, rings and ideals, principal ideal rings, algebraic field extensions, Galois theory, transcendental field extensions, simple and semisimple modules, Wedderburn theory, representation of finite groups, places and valuations, polynomial and power series rings. Prerequisites: Mathematics 110A-110B-110C or consent of instructor.

**202A-202B-202C. Commutative Algebra (3,3,3)** **F,W,S**
Mr. Rohrl
Noetherian rings and modules; theory of multiplicity; local and semilocal rings; regular local rings; completions; spectrum of a ring; schemes. Prerequisites: Mathematics 110A-110B-110C, 200A-200B-200C, 290A.

**203A-203B-203C. Algebraic Geometry (3,3,3)** **F,W,S**
Mr. Oberst
Places. Hilbert Nullstellensatz. Varieties; product of varieties; correspondences; normal varieties. Divisors and linear systems; Riemann-Roch theorem; resolution of singularities of curves. Grothendieck schemes; cohomology. Hilbert

schemes; Picard schemes. Prerequisites: Mathematics 110A-110B-110C, 160C, 200A- 200B-200C.

***204A-204B-204C. Categorical Algebra (3,3,3)** **F,W,S**
Mr. Rohrl
Categories; functors; presentable functors; limits and continuous functors; adjoint functors; Abelian categories; homological algebra. Prerequisite: Mathematics 200A or consent of instructor.

**208. Seminar In Algebra**
The Staff
Prerequisite: consent of instructor.

**210A-210B-210C. Mathematical Methods in Physics and Engineering (4,4,3)** **F,W,S**
Mr. Korevaar
Vector spaces and linear transformations; convergence and approximation; metric spaces and normed spaces; distributions; Lebesgue integral; integration in the complex plane; Hilbert space; Fourier, Legendre and Hermite series; spherical harmonics; Fourier and Laplace Transforms; integral equations; eigenvalue problems; calculus of variations. Prerequisites: Mathematics 100, 101, 102 or advanced calculus.

***214A. Asymptotic Methods in Analysis (3)** **F**
Mr. Korevaar
Euler-MacLaurin sum formula; Poisson sum formula; Laplace method; saddle point method; method of stationary phase; asymptotic expansions; asymptotic solution of differential equations. Prerequisites: Mathematics 210A-210B-210C or consent of instructor.

**215A-215B. Mathematical Theory of Process Optimization (3,3)** **F,W**
Mr. Halkin
Optimal control problems for systems described by nonlinear differential equations: necessary conditions (Pontryagin's maximum principle); sufficient conditions (Hilbert's identity); existence theorems (Tonelli, Filipov); applications to classical calculus of variations and to various problems in electrical and aerospace engineering. Optimal control problems for systems described by nonlinear difference equations: necessary condition (discrete maximum principle), sufficient conditions, applications to the theory of optimal economic growth. Prerequisites: Mathematics 100, 101, 102 or advanced calculus.

**220A-220B-220C. Complex Analysis (3,3,3)** **F,W,S**
Mr. Wolffhardt
Complex numbers and functions. Cauchy theorem and its applications, calculus of residues, expansions of analytic functions, analytic continuation, conformal mapping and Riemann mapping theorem, harmonic functions, Dirichlet principle, Riemann surfaces. Prerequisites: Mathematics 150A-150B or consent of instructor.

***221A-221B-221C. Several Complex Variables (3,3,3,)** **F,W,S**
The Staff
Formal and convergent power series, Weierstrass preparation theorem; Car-

tan-Ruckert theorem; analytic sets; mapping theorems; domains of holomorphy; proper holomorphic mappings; complex manifolds; modifications. Prerequisites: Mathematics 200A, 220A-220B-220C or consent of instructor.

**225A-225B-225C. Conformal Mapping (3,3,3)** **F,W,S**
Mr. Warschawski
Riemann's mapping theorem. Behavior of the mapping function at the boundary, including discussion of prime ends. Analytic functions of class $H_p$. Mapping of multiply connected domains onto canonical domains. Variational techniques in conformal mapping. Univalent functions. Constructive methods. Uniformization Prerequisites: Mathematics 220A-220B-220C.

**227A-227B-227C. Topics in Complex Analysis (3,3,3)** **F,W,S**
Mr. Rohrl
Prerequisite: consent of instructor.

**228. Seminar in Complex Analysis**
The Staff

**230A-230B-230C. Ordinary Differential Equations (3,3,3)** **F,W,S**
Mr. Conway
Existence and uniqueness theorems. Linear systems with constant and periodic coefficients. Sturm-Liouville theory. Eigen function expansions. Stability and asymptotic behavior of nonlinear systems. Poincaré-Bendixon theorem. Linear systems in the complex domain and their singularities. Control theory. Equations in Banach space. Prerequisites: advanced calculus with consent of instructor.

**231A-231B-231C. Partial Differential Equations (3,3,3)** **F,W,S**
Mr. Smith
Existence and uniqueness theorems, Cauchy-Kowalewski theorem, first order systems, Hamilton-Jacobi theory, initial value problems for hyperbolic and parabolic systems, boundary value problems for elliptic systems, Green's function, eigenvalue problems, perturbation theory. Prerequisites: Mathematics 126A-126B or consent of instructor.

**240A-240B-240C. Real Analysis (3,3,3)** **F,W,S**
Mr. Holbrook
Lebesgue integral and Lebesgue measure; Fubini theorems; functions of bounded variation; Stieltjes integral; derivatives and indefinite integrals; the spaces L and C; equi-continuous families; continuous linear functionals; general measures and integration. Prerequisites: Mathematics 150A-150B or consent of instructor

***241A-241B-241C. Functional Analysis (3,3,3)** **F,W,S**
Mr. Bishop
Metric spaces and contraction mappings; topological vector spaces; continuous linear operators; open mapping theorem; closed graph theorem; uniform boundedness principle; Hahn-Banach theorem; representation of continuous linear functionals, conjugate space; weak topologies; extreme points; Krein-Milman theorem; fixed point theorems; Riesz convexity theorem; Banach algebras. Prerequisites: Mathematics 240A-240B-240C or 210A-210B-210C or consent of instructor.

**243A-243B-243C. Fourier Analysis (3,3,3)** F,W,S

Mr. Garsia

Convergence and summability of Fourier series. Fourier transforms, Hilbert transform. Trigonometric approximation and interpolation. Tauberian theorems, Prime Number theorem. Applications of Fourier analysis to probability theory: characterization of infinitely divisible and stable laws. Prerequisite: Lebesgue integration or consent of instructor.

**244B-244C. Distributions (3,3)** W,S

Mr. Korevaar

Various definitions of distributions; derivatives and antiderivatives; structure of distributions; spaces of test functions and distributions; multiplication and convolution Fourier transforms; division problem; generalized functions; applications. Prerequisites: 210A-210B-210C or 240A-240B-240C.

**248. Seminar in Real Analysis (3)** F,W,S

**250B-250C. Differential Geometry (3,3)** W,S

Mr. Frankel

Differential manifolds, Sard theorem, Tensor bundles, Lie derivatives, deRham theorem, connections, Geodesics, Riemannian metrics, curvature tensor and sectional curvature, completeness, characteristic classes. Differential manifolds immersed in Euclidean space. Prerequisites: Mathematics 110A-110B-110C, 166, or consent of instructor.

**270A-270B-270C. Numerical Analysis (3,3,2)** F,W,S

Mr. Perry

Approximation of functions; numerical methods for solving algebraic equations, inverting matrices, computing eigenvalues; finite difference methods; numerical solutions of ordinary and partial differential equations; convergence and stability; numerical solutions of integral equations. Prerequisites: advanced calculus, or Mathematics 101, 102, 110A or consent of instructor.

**280A-280B-280C. Probability Theory (3,3,3)** F,W,S

Mr. Getoor

Probability measures; Borel fields; conditional probabilities; sums of independent random variables; limit theorems; zero-one laws. Prerequisites: advanced calculus and consent of instructor.

**281A-281B-281C. Mathematical Statistics (3,3,3)** F,W,S

Mr. Rosenblatt

Testing and estimation; sufficiency; regression analysis; sequential analysis; statistical decision theory; non-parametric inference. Prerequisite: advanced calculus and consent of instructor.

**290A-290B-290C. Topology (3,3,3)** F,W,S

Mr. Bishop

Topological spaces; filters and limits; Hausdorff spaces; compact and locally compact spaces; uniform spaces; function spaces; singular homology and cohomology; CW complexes; duality theorems; the cohomology ring; axiomatic homology and cohomology theory; homotopy of mappings; homotopy groups; homotopy sequences. Prerequisites: for Mathematics 290A: Mathematics

110A, 110B; for Mathematics 290B-290C: either Mathematics 150A-150B or 290A.

**297A-297B-297C. Topics in Topology (3,3,3)** F,W,S
The Staff
Advanced material in special areas of topology to be selected by instructor. Prerequisite: consent of instructor.

**298. Seminar in Topology** F,W,S
The Staff
Prerequisite: consent of instructor.

**299. Reading and Research (1-6)** F,W,S
The Staff
This course is to be used for "Independent Study" and for "Research for Doctoral Dissertation." 1-3 credits will be given for independent study (reading). Prerequisite: consent of instructor.

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# MUSIC

Departmental Office, Building 235, Matthews Campus

### Instructional Staff

Rosalyn Tureck, *M.A., Professor of Music*
*Robert Erickson, *M.A., Professor of Music*
Donald Ogden, *Ph.D., Professor of Music (Chairman of the Department)*
Daniel Lewis, *M.A., Associate Professor of Music*

*On Leave 1966-67.

## COURSES

### LOWER DIVISION

**1A. The Nature of Music, I** S
The first of a sequence of three courses on fundamental aspects of music. Lectures and reading on the media and musical forms will be supplemented by laboratory work with percussion instruments and electronic sound sources. Two hours lecture, two hours laboratory.

## UPPER DIVISION

**114. Music of the Twentieth Century** F
Music since the revolt against nineteenth-century forms: atonalism, serial music, *musique concrète*, electronic music, chance music. Special emphasis will be given to the sound and shape of today's music.

**115. Bach** S
A study of the art of J. S. Bach with particular attention to problems of style and structure.

**123. The Orchestra and its Literature** **W**

A study of the instruments of the orchestra since Mozart: their resources, tonal effects; their use by major composers; methods of writing for modern instruments; analysis of representative scores. Three hours lecture. Prerequisite: ability to read music.

**130A. Seminar in the Literature and Performance of Music for a Small Ensemble** **F**

Small classes for the study of the music for such ensembles as the string quartet. (The exact make-up to be determined by available instruments.) Analysis by means of performance and study of scores by appropriate composers such as Mozart, Beethoven, and Brahms. Four hours seminar. Prerequisites: proficiency on a musical instrument and the consent of instructor.

**130B-130C. Seminar in the Literature and Performance of Music for a Small Ensemble** **W,S**

Similar to Music 130A. Either a similar ensemble working at a more advanced level or a different combination of instruments. Four hours seminar. Prerequisites: proficiency on a musical instrument and consent of instructor.

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## OCEANOGRAPHY

Departmental Office, 108 Scripps Building, SIO

### Instructional Staff

Robert S. Arthur, *Ph.D., Professor of Oceanography*
Charles S. Cox, *Ph.D., Professor of Oceanography*
Edward W. Fager, *Ph.D., D.Phil., Professor of Marine Ecology*
Douglas L. Inman, *Ph.D., Professor of Oceanography*
John D. Isaacs, *B.S., Professor of Oceanography*
Fred B Phleger, *Ph.D., Professor of Oceanography*
†Roger Revelle, *Ph.D., D.Sc., Professor of Oceanography*
Milner B. Schaefer, *Ph.D., Professor of Oceanography (Director of the Institute of Marine Resources)*
Fred N. Spiess, *Ph.D., Professor of Oceanography (Director of the Marine Physical Laboratory, Associate Director of Scripps Institution of Oceanography)*
Warren S. Wooster, *Ph.D., Professor of Oceanography (Chairman of the Department)*
Michael Longuet-Higgins, *Ph.D., Senior Lecturer*
Klaus F. Hasselmann, *Ph.D., Associate Professor of Geophysics*
Charles D. Keeling, *Ph.D., Associate Professor of Oceanography*
John A. McGowan, *Ph.D., Associate Professor of Oceanography*
Edward L. Winterer, *Ph.D., Associate Professor of Geology (Vice-Chairman of the Department)*
James T. Enright, *Ph.D., Assistant Professor of Oceanography*
Myrl C. Hendershott, *Ph.D., Assistant Professor of Oceanography*
Ferren MacIntyre, *Ph.D., Assistant Professor of Oceanography*
William A. Newman, *Ph.D., Assistant Professor of Oceanography*

Melvin N. Peterson, *Ph.D., Assistant Professor of Oceanography*
Michael M. Mullin, *Ph.D., Assistant Professor of Oceanography*

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Rudolph W. Preisendorfer, *Ph.D., Research Mathematician, Lecturer*
John D. H. Strickland, *Ph.D., Research Oceanographer and Lecturer*
Tjeerd H. van Andel, *Ph.D., Research Geologist, Lecturer*
Joseph R. Curray, *Ph.D., Associate Research Geologist, Lecturer*
William R. Riedel, *M.S., Associate Research Geologist, Lecturer*

* * *

Milton N. Bramlette, *Ph.D., Professor Emeritus*
Carl H. Eckart, *Ph.D., Professor of Geophysics*
Edward D. Goldberg, *Ph.D., Professor of Chemistry*
Francis T. Haxo, *Ph.D., Professor of Biology*
Carl L. Hubbs, *Ph.D., Professor of Biology Emeritus*
Martin W. Johnson, *Ph.D., Professor of Marine Biology Emeritus*
George E. McEwen, *Ph.D., Professor of Oceanography Emeritus*
Henry W. Menard, *Ph.D., Professor of Geology*
Walter H. Munk, *Ph.D., Professor of Geophysics*
Norris W. Rakestraw, *Ph D , Professor of Chemistry Emeritus*
Francis P. Shepard, *Ph.D., Professor of Submarine Geology Emeritus*
[1]On leave 1966-67.

**UCSD/Scripps does not offer an undergraduate major in Oceanography.**

### Graduate Program

The Department of Oceanography offers a program of studies designed to reveal the interdependence of the biological chemical, geological and physical processes operating in the oceans. Students are required to gain a general knowledge of all these fields. Although most students will specialize in one, the Department encourages qualified students to become competent in any appropriate combination of these fields.

Biological studies in the Department of Oceanography include systematics, life histories, and geographical distribution of zooplankton; distribution patterns, behavior, population dynamics and community relationships of marine invertebrates; ecology and population dynamics of marine fishes.

Chemical studies in the Department of Oceanography include the use of chemical techniques in the effort to understand the behavior of the ocean; the part that the ocean plays in general geochemistry; the distribution of the chemical elements; the chemical processes that go on within the ocean and in the exchange between the ocean itself and the atmosphere and the sea bottom.

Geological studies in the Department of Oceanography include marine micropaleontology; mechanics of sedimentation; petrology of sediments, and the structure and morphology of the ocean floor and the continental margins

Physical studies in the Department of Oceanography include observation, analysis, and theoretical interpretation of problems of general circulation and the distribution and variation of properties in the ocean; interchange of kinetic and thermal energy across the ocean surfaces; propagation of sound and light and other electromagnetic energy in the ocean; properties of ocean waves.

### Requirements for Admission

1. A baccalaureate degree in one of the physical or biological sciences
2. Mathematics through differential and integral calculus.
3. Geology, one semester (or equivalent).
4. Physics, chemistry and biology, one year of each with laboratory.
5. An additional year of either physics or chemistry. If chemistry is selected, quantitative analysis, physical chemistry or organic chemistry is recommended; if physics is selected, the course should stress the fundamentals of mechanics, electricity, magnetism, optics, thermodynamics, or a combination of these topics.
6. Preparation in at least one foreign language chosen from the following: German, Russian, and a Romance Language.

Students intending to specialize in biological oceanography should ordinarily have an undergraduate major in biology. Courses in limnology or ecology, invertebrate zoology and general or comparative physiology are recommended.

Students intending to specialize in chemical oceanography should ordinarily have an undergraduate major in chemistry and be well prepared in physical, organic, analytical and inorganic chemistry. Those intending to specialize in physical and geological aspects of marine chemistry should have the equivalent of two years of college physics. Those intending to specialize in biological aspects of marine chemistry should have one year of physics and an additional year of organic chemistry or biochemistry.

Students intending to specialize in marine geology should ordinarily have an undergraduate major in geology including courses in physical geology, historical geology, structural geology, paleontology, optical mineralogy, petrology and a field course in geology.

Students intending to specialize in physical oceanography should ordinarily have an undergraduate major in physics, including three years of physics, and mathematics through differential equations; vector analysis is recommended.

Students may be admitted with a single deficiency, other than mathematics, on condition that they make it up during their first year in residence. Students with only a minor in their intended field of specialization may be admitted if their preparation and record are considered satisfactory by the Department.

### Master's Degree Program

Because of limited facilities, the Department does not at the present time encourage students who wish to proceed only to the master's degree. Special arrangements can, however, be made if circumstances warrant it.

### Doctor's Degree Program

All students are required to obtain experience at sea in a research vessel and satisfactorily complete a departmental examination. This examination will usually be taken at the beginning of the second year of study. It will be primarily oral, but written parts may be included if the departmental examining committee so recommends. The examination will require the student to bring together concepts from the several fields of oceanography and to show an understanding of the interaction of the physical, chemical, biological and geological factors and processes in the ocean and an ability to discuss them quantita-

tively and analytically. All students will be responsible for the material included in the following courses: Oceanography 110, 111, 112, 113 and 250. In addition, each student will be responsible for some more advanced material (selected from courses 210-219) in at least two fields of oceanography as well as for any material that would ordinarily be included in an undergraduate curriculum in his major field.

After the student has passed the departmental examination, completed an appropriate period of additional study and satisfied the language requirements (reading ability in two of the following: German, Russian and a romance language) the Department will recommend appointment of a Doctoral Committee. This Committee will determine the student's qualifications for independent research and will supervise the performance and reporting of the research.

## COURSES

### UPPER DIVISION

**110. Introduction to Physical Oceanography (3)** F

Mr. Wooster

Physical description of the sea, physical properties of sea water, methods and measurements with demonstration at sea, boundary processes, regional oceanography. Prerequisites: the mathematics and physics required for admission to the graduate curriculum in oceanography or consent of instructor.

**111. Marine Geology (3)** W

Mr. Menard

Introduction to the geomorphology, sedimentation, stratigraphy, vulcanism, structural geology, and geologic history of the marine realm. Prerequisites: the physics and geology required for admission to the graduate curriculum in oceanography or consent of instructor.

**112. Biological Oceanography – Environment and Organisms (3)** F

Mr. McGowan, Mr. Mullin

An introduction to the biota and life zones of the open ocean; descriptions of the physical, chemical and biological factors of this environment; discussions of the influence of the factors on oceanic populations. Prerequisites: the biology and chemistry required for admission to the graduate curriculum in oceanography or consent of instructor.

**112L. Marine Organisms (2)** F

Mr. McGowan

Laboratory and discussion of the phylogeny; comparative morphology; life histories and taxonomy of marine organisms. Emphasis will be placed on planktonic groups. Prerequisites: consent of instructor and concurrent registration in Oceanography 112.

**113. Introduction to Chemical Oceanography (3)** W

Mr. Keeling

Chemical description of the sea; the distribution of chemical species in the world oceans and their relation to physical and biological processes. Prerequisites: the mathematics, physics and chemistry required for admission to the graduate curriculum in oceanography or consent of instructor.

**††118A-118B. Statistics (3-2)** **W,S**

Mr. Fager

Methods of statistical analysis, including both parametric and nonparametric procedures; sampling and design of experiments, with emphasis on those procedures particularly useful in marine studies. Prerequisite: the mathematics required for admission to the graduate curriculum in oceanography or consent of instructor.

**199. Special Studies (1-4, 1-4, 1-4)** **F,W,S**

The Staff

Prerequisite: consent of instructor.

## GRADUATE

**210. Introduction to Dynamical Oceanography (3)** **W**

Mr. Arthur, Mr. Cox

Mechanics of fluids on a rotating Earth; Navier-Stokes equations, boundary layer phenomena, turbulent flow and wave motion with oceanographic applications. Prerequisites: Oceanography 110 and consent of instructor.

**211. Introduction to Wind Waves (3)** **W**

Mr. Cox

Wind waves, swell and surf; propagation of energy, the spectrum of waves; methods of observation; long waves, internal waves. Prerequisite: Oceanography 210 or consent of instructor.

**212. Biological Oceanography – Processes and Events (3)** **S**

Mr. McGowan, Mr. Mullin

An analysis of the concepts and theories used to explain the biological events observed in the ocean. Prerequisites: Oceanography 110, 112 or consent of instructor.

**212L. Laboratory in Biological Productivity (2)** **S**

Mr. Mullin

Introduction to techniques, especially those usable at sea, for measuring the standing crop and productivity of marine communities. Prerequisites: Oceanography 212 (may be taken concurrently) and consent of instructor.

**213. Chemical Oceanography (3)** **S**

Mr. Keeling

Extension of the topics of Oceanography 113 and the chemistry of sea water with emphasis on thermodynamic considerations. Prerequisite: Oceanography 113 or consent of instructor.

**214. Marine Sediments (3)** **F**

Mr. van Andel, Mr. Peterson

Processes of sediment supply to the oceans; distribution, composition and genesis of marine sediments; marine sedimentary facies with special regard to sediments of the continental margins; implications for stratigraphy and historical geology; trends in sediment research. Prerequisite: consent of instructor.

**215. Mechanics of Marine Sedimentation (3)** S

Mr. Inman

Mechanics of sediment transportation by water, wind, waves and density flows; energetics of sediment transport. Prerequisite: Oceanography 210 or equivalent.

**216. Marine Stratigraphy (3)** S

Mr. Winterer, Mr. Riedel

Principles of stratigraphy as applied to marine environments; laboratory study and interpretation of microfossils in oceanic sediments. Prerequisite: Oceanography 111 or consent of instructor.

**††218A-218B. Marine Ecology (3,3)** W,S

Mr. Fager

Single-species population dynamics and interspecific relationships in communities; theory, observation and interpretation. Behavior, environmental factors and productivity as they relate to the distribution and abundance of organisms. Prerequisite: Oceanography 112.

**219. Physical Oceanography – General (3)** F

Mr. Arthur

Dynamics of ocean currents, transport phenomena, turbulent processes and the air-sea boundary layer. Prerequisites: differential equations and consent of instructor.

**220. Special Topics in Oceanography (1-4, 1-4, 1-4)** F,W,S

The Staff

Within the next few years the following subjects will be covered: principles of oceanographic research systems, sound and light in the sea, comparative regional oceanography, advanced methods of fisheries research, numerical analysis, studies of turbulence and waves.

**221. Ocean Waves (2)** S

Mr. Cox

Mechanisms of generation, transformations of energy and momentum in surface and internal waves, effects of Earth rotation on waves. Prerequisite: Oceanography 211 or consent of instructor.

**††222A-222B. Hydrodynamics (3,3)** W,S

Mr. Eckart

Applications of hydrodynamics to the motion of stratified fluids, such as the atmosphere and oceans. Internal waves, steady currents and related phenomena. Prerequisite: consent of instructor.

**223. Wind-Driven Ocean Circulation (2)** S

Mr. Arthur

Wind currents, theories of ocean circulation, boundary currents. Prerequisites: Oceanography 219 and consent of instructor.

**226A-226B. Advanced Invertebrate Zoology (3,3)** F,W

Mr. Newman

The natural history, zoogeography, taxonomy and phylogeny of selected invertebrate groups. Emphasis will be on the broader aspects of current research.

Two special problems will be undertaken; original problems will be encouraged. Prerequisites: Oceanography 112, 112L or consent of instructor.

**††228. Population Dynamics (3)** **F,W**
Mr. Schaefer
Theories and mathematical models concerning growth and dynamics of single-species populations, interspecific competition, predatory-prey relationships, dynamics of exploited marine populations and other animal associations. Prerequisite: Oceanography 218A or consent of instructor.

**††229. Oceanic Zoogeography (3)** **F**
Mr. McGowan
The patterns of distribution and abundance of oceanic organisms, the nature of oceanic habitats, the relation of zoogeography to paleoceanography; lectures, student reports and discussions. Prerequisite: Oceanography 212 (Oceanography 111 is desirable).

**230. Sedimentary Petrology (3)** **W**
Mr. Winterer
Characteristics and origin of sediments and sedimentary rocks. Prerequisite: consent of instructor.

**231. Minerals and Mineral Assemblages of Sediments (3)** **F**
Mr. Peterson
Origin and distribution of minerals and mineral assemblages of sediments; important mineral groups, clays, zeolites, feldspars, etc. considered by crystal structure and composition; directed toward oceanic sediments; laboratory on instrumental methods, x-ray diffractometry and spectroscopy. Prerequisite: consent of instructor.

**234A-234B. Marine Micropaleontology (3,3)** **W,S**
Mr. Phleger
Introduction to the ecology of Foraminifera with applications to problems of oceanography and paleoceanography. Prerequisites: for Oceanography 234A: Oceanography 111 or consent of instructor, for Oceanography 234B: Oceanography 234A.

**††235. Sedimentary Processes (2)** **W**
Mr. Inman
Application of principles of sedimentary mechanics to selected environments, including the littoral; the transportation of sediment and the formation of sedimentary structures by waves and currents; methods of measurement. Prerequisite: Oceanography 215 or consent of instructor.

**250. Seminar in Oceanography (1,1,1)** **F,W,S**
The Staff

**251A-251B. Problems in General and Physical Oceanography (Seminar) (2,2)** **W,S**
Mr. Isaacs
Presentation of reports, review of literature, and discussion of various regions and aspects of the ocean, oceanography and related fields.

**253. Problems in Biological Oceanography (Seminar) (2)** **F**
Mr. Fager
Presentation of reports, review of literature and discussion of current research in biological oceanography.

**255. Problems in Marine Geology (Seminar) (2)** **F**
The Staff
Origin and structure of ocean basins and continental margins and their physiographic features; origin, distribution, interpretation and methods of study of marine sediments.

**280. Oceanography Field Course (2-4, 2-4, 2-4, 2-4)** **F,W,S,Su**
The Staff
Methods of measurement, observation and sampling used at sea; oceanic cruise dealing with problems of current interest; analysis and interpretation of results with a report. Prerequisites: Oceanography 110, 111, 112, 113.

**299. Research (1-6, 1-6, 1-6)** **F,W,S**
The Staff
Research in one or more of the oceanographic sciences.

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## PHILOSOPHY

Departmental Office, 3112 Humanities-Library Building

### Instructional Staff

*Paul Dibon, *Doct. es Lett., Professor of Philosophy*
†Paul Henry, *S.J., Doct. es Lett., D.D., Professor of Philosophy*
Herbert Marcuse, *Ph.D., Professor of Philosophy*
**Richard H. Popkin, *Ph.D., Professor of Philosophy (Chairman of the Department)*
Jason L. Saunders, *Ph.D., Professor of Philosophy (Graduate Adviser)*
Avrum Stroll, *Ph.D., Professor of Philosophy (Acting Chairman of the Department 1966-67)*
**William W. Bartley, III, *Ph.D., Associate Professor of Philosophy*
Rudolph Makkreel, *Ph.D., Assistant Professor of Philosophy*
David Fate Norton, *Ph.D., Assistant Professor of Philosophy (Undergraduate Adviser)*
Ronald Kirkby, *M.A., Acting Assistant Professor of Philosophy*
Stanley Moore, *Ph.D., Senior Lecturer in Philosophy*
Piero Ariotti, *M.A., Lecturer in Philosophy*

* * *

Abraham I. Melden, *Ph.D., Adjunct Professor of Philosophy (Chairman of the Department, University of California, Irvine)*

* * *

*Fall Quarter, 1966-67
†Spring Quarter, 1966-67
**On Leave 1966-67

### Undergraduate Program

Students who wish to major in philosophy must have satisfied the general lower division requirements. No specific sophomore courses are recommended.

The Department feels that an undergraduate major in philosophy should acquaint himself with the achievements and methods of a variety of differing disciplines since these are in part the subjects of philosophical inquiry. The background thus acquired should be complemented by a small group of required courses in philosophy itself. Accordingly, we wish to arrange a major-minor program for each student, as well as a suitable, integrated grouping of noncontiguous courses. It is the view of the Department that specialized professional training in philosophy should be deferred until the student has reached the graduate level.

The specific upper division philosophy course requirements are:

1. Three courses in history of philosophy.
2. One course in logic.
3. Two courses in the following: ethics, political philosophy, philosophy of religion, or aesthetics.
4. Participation in a junior-senior seminar on specific problems, or major philosophers (2 courses). (TOTAL: 8 courses required)

In addition, it is required that students take 4 courses in three of the following areas: psychology, literature, history or economics, or linguistics.

Requirements can be met by examination. In upper division courses, students will normally be expected to read materials in foreign languages, usually in French or German.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## PHILOSOPHY DEPARTMENTAL REQUIREMENTS

## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| | Humanities 1 | Humanities 2 | Humanities 3 |
| Freshman | Language 1A or 2A | Language 1B or 2B | Language 1C or 2C |
| Year | Math 1A or 2A | Math 1B or 2B | Math 1C or 2C |
| | Fine Arts 1 | Physical Science 1A | Physical Science 1B |

| | | | |
|---|---|---|---|
| **Sophomore Year** | Humanities 4 | Humanities 5 | Humanities 6 |
| | Social Science | Social Science | Social Science |
| | Physical Science 1C | Physical Science 1D | Biology 1 |
| | *Philosophy 10A | *Philosophy 10B | *Philosophy 12 |
| **Junior Year** | Philosophy 100A | Philosophy 100B | Philosophy 100C |
| | †Philosophy 160A | †Philosophy 160B | †Philosophy 160C |
| | ** | ** | ** |
| | | | |
| **Senior Year** | Philosophy 110 | ††Philosophy 111 | ††Philosophy 122 |
| | ††Philosophy 120 | ††Philosophy 121 | ** |
| | ** | ** | |
| | | | |

*Not required, but recommended.

†2 courses so marked required. May be taken in junior or senior year.

**4 courses in three of the following: psychology, literature, history or economics, or linguistics.

††2 courses so marked required.

### Graduate Program

The Department of Philosophy offers programs in many fields of philosophical study leading to the Master of Arts and Ph.D. degrees. Courses of study for the individual student are determined according to his needs, interest, and previous work in philosophy; there is no established sequence of required courses in the graduate program.

The members of the Department of Philosophy hold the view that an adequate program of studies in philosophy should provide the student with a thorough training in the history of philosophy, the systematic study of philosophical issues, and in varying approaches to these issues. The intent of the graduate program is, thus, to give the student a depth of understanding of divergent philosophical traditions and to aid in his development as a philosopher in his own right.

### Master's Degree Program

Offered under Plan II (comprehensive examination).

The student will be required to take 36 quarter-units of upper division and graduate work, of which at least 14 must be in graduate courses in the major field, 10 additional units in graduate courses and 12 units in graduate or upper division courses. Candidates for advanced degrees in Philosophy are required to have passed one foreign language examination (Greek, Latin, French or German) prior to attempting the written, qualifying examination. The comprehensive examination will be identical with the written portion of the qualifying examinations for the Ph.D. This will consist of written examinations in each of the following four areas:

1. History of philosophy: ancient, medieval, Renaissance, early modern, modern and nineteenth century.

2. Metaphysics: epistemology, logic, philosophy of science, contemporary philosophy.
3. Value theory; ethics, aesthetics, philosophy of religion, political and social philosophy.
4. (a) Individual men: Plato, Aristotle, St. Thomas, Descartes, Leibniz, Spinoza, Kant, Locke, Berkeley, Hume, Wittgenstein, etc.
   (b) Specific problems: freedom of the will, the problem of universals, other minds, problems of evil, etc.

The examinations in categories 1, 2, 3, and 4 will each take three hours. The candidate may choose to write on two of the subjects mentioned in 4a, or he may choose to write on one of the subjects mentioned in 4a and one of the subjects mentioned in 4b. If he chooses the former option, the examination will last three hours. In the latter case, each part of the examination will last one and a half hours.

### Doctor's Degree Program

During the period between admission to graduate standing and advancement to candidacy, a graduate student will normally be required in each academic year of residence to take at least 6 units in philosophy courses numbered from 201-299 inclusive. Ordinarily the course of study for the Doctor of Philosophy will include the course requirements for the Master of Arts or their equivalent.

After successfully completing the written examinations, as described above for the Master of Arts, the student must pass an oral qualifying examination focusing upon his own special areas of interest. This examination will be conducted by his Doctoral Committee.

The Philosophy Department recommends the following language requirement for advancement to candidacy for the Ph.D. degree in philosophy: the student will be required to demonstrate a satisfactory reading knowledge of two foreign languages from the following list: classical Greek, Latin, French, German, and such other languages as the student's research may require, subject to the approval of the Graduate Council.

Candidates will write a dissertation demonstrating a capacity to engage in original and independent research under the supervision of a Doctoral Committee appointed for this purpose.

The candidate will defend his thesis in an oral examination by the Doctoral Committee.

## COURSES

### LOWER DIVISION

**10A. The Nature of Philosophy** **F**

An introduction to metaphysics and the theory of knowledge, dealing with such matters as the ultimate constituents and structure of the world, the nature of the mind, knowledge and truth. Two lectures and one discussion. (Previously numbered 10).

**10B. The Nature of Philosophy** **W**

An introduction to value theory, dealing with questions about morality, politics, religion and art. Two lectures and one discussion. (Previously numbered 11).

**12. Introduction to Logic** S
An inquiry into the nature of argument, inference and proof, fallacies, etc. Three lecture-discussions.

**20A-20B-20C. Theories of Society** F,W,S
A course dealing with the main stages of the development of social and political thought and institutions since Plato. Three hours lecture.

## UPPER DIVISION

**100A. History of Philosophy** F
Pre-Socratic, Hellenic and Hellenistic philosophy. Examination of original sources in Greek and Roman philosophy. Three lecture-discussions. (Previously numbered 100).

**100B. History of Philosophy** W
Medieval and Renaissance philosophy. Examination of original sources from early Judeo-Christian philosophy through the Moslem and Christian Middle Ages up to the Renaissance and Reformation. Three lecture-discussions. Prerequisite: 100A. (Previously numbered 101).

**100C. History of Philosophy** S
17th and 18th century. Examination of original sources from Francis Bacon to Kant. Three lecture-discussions. Prerequisite: 100B. (Previously numbered 102).

**110. Symbolic Logic** F
Introduction to mathematical logic. Three lecture-discussions.

**111. Ethics** W
An inquiry into the nature of human conduct. Three lecture-discussions.

**112A-112B-112C. Contemporary Philosophy** F,W,S
Some main problems found in the literature of recent and contemporary Anglo-American and European philosophy. Three lecture-discussions. **112A and 112B not given 1966-67.**

***120. Political Philosophy** F
An examination of problems and theories concerning the nature of the state, society, and government. Three lecture-discussions.

**121. Aesthetics** W
An inquiry into the nature of human artistic experience and works of art. Three lecture-discussions.

**122. Philosophy of Religion** S
An examination of the nature of religious experience, the nature of faith, and the role of reason in religion. Three lecture-discussions.

**160A-160B-160C. Junior-Senior Seminar in Special Topics in Philosophy** F,W,S
An examination of a problem set by the instructor. Seminar. Prerequisite: consent of the instructor. (Previously numbered 160, 161, 162).

**199. Individual Study** F,W,S
Prerequisite: permission of departmental adviser.

## GRADUATE

***201. Advanced Symbolic Logic (3)** **F**
The Staff
An intensive examination of propositional and quantificational logic as a basis for further deductive development.

**202. Topics in the History of Philosophy (3,3)** **F and S**
Mr. Saunders, Mr. Norton
A course of studies designed to prepare students for advanced work in seminars.

**203. Topics in Contemporary Epistemology and Metaphysics** **W**
Mr. Stroll
A course of studies designed to prepare students for advanced work in seminars.

**204. Topics in Moral and Political Philosophy** **F,W**
Mr. Moore, Mr. Marcuse
A course of studies designed to prepare students for advanced work in seminars.

**250. Seminar in Contemporary Analytic Philosophy (3,3,3)** **F,W,S**
Mr. Stroll
An analysis of some important problems in recent and contemporary Anglo-American philosophy as illustrative of major movements of thought.

***251. Seminar in Contemporary European Philosophy (3,3,3)** **F,W,S**
The Staff
An analysis of some important problems in recent and contemporary Continental philosophy as illustrative of major improvements of thought.

**252. Seminar in Ancient Philosophy (3,3,3)** **F,W,S**
Mr. Saunders
An examination of typical problems and philosophic issues found in the study of Greek and Roman philosophers: *e.g.*, the origin and development of Greek philosophical concepts; the philosophic schools from the beginnings of Stoicism, Epicureanism, Skepticism down through Neo-Platonism.

***253. Topics in Philosophy of Logic (3,3)** **W,S**
The Staff
A study of major topics included in the scope of logical theory together with a close examination of contributions by different philosophical schools to the analysis of central issues in philosophy of logic.

**254. Seminar in Social and Political Philosophy (3,3,3)** **F,W,S**
Mr. Marcuse
An analysis of social philosophies and ideologies as they emerge from basic types of social structure.

**255. Seminar in Medieval Philosophy (3,3,3)** **F,W,S**
Mr. Saunders
The medieval development of the Western philosophical tradition. Representative writings of Greek Gnosticism and the rise of the Latin Western Chris-

tian tradition: Clement of Alexandria, Tertullian, Philo, Augustine, Erigena, Bonaventura, Arabian and Jewish authors, Anselm, Thomas Aquinas and William of Ockham.

***256. Seminar in Aesthetics (3,3,3)** **F,W,S**
The Staff
An exploration of problems in philosophy of art, aesthetic experience and aesthetic judgment within the context of a critical survey of some current aesthetic theories and their illustrative application in the various fields of art.

***257. Seminar in Philosophy of Religion (3,3,3)** **F,W,S**
Mr. Bartley
A study of the philosophical foundations of religious experience, including such problems as belief and knowledge, faith and reason, the nature of God, the character and meaning of religious commitment.

**258. Seminar in Ethics (3,3,3)** **F,W,S**
Mr. Melden
An examination of the nature of moral problems, judgments and principles, with emphasis on recent developments in moral philosophy and classic formulations of ethical theories.

***260. Seminar in Renaissance Philosophy (3,3,3)** **F,W,S**
Mr Saunders
Philosophical and intellectual currents of the Renaissance, with reference to the origins and development of classical humanism and medieval scholasticism and the emergence of a Renaissance philosophy of man.

**261. Seminar in 17th and 18th Century Philosophy (3,3,3)** **F,W,S**
Mr. Popkin
An examination of the origins and development of early modern philosophy, together with its philosophical and intellectual foundations, including a study of such authors as Descartes, Malebranche, Spinoza, Leibniz, Newton, Locke, Bayle, Berkeley, Hume and Kant.

***262. Seminar in Philosophy of Science (3)** **W**
Mr. Ariotti
An examination of such problems as concept formation, the explanation of law, the role of logic and mathematics in the sciences.

**263. Seminar in Theory of Knowledge (3)** **S**
Mr. Kirkby
An examination and critique of representative theories of mind, reality, knowledge and perception.

***264. Seminar in Philosophy of History (3,3,3)** **F,W,S**
The Staff
An examination of basic concepts, categories, and presuppositions of historical experience in the context of representative philosophies of history.

**265. Seminar in 19th Century Philosophy (3)** **F**
Mr. Marcuse
A study of representative philosophical movements of the 19th century, as

found in the writings of such authors as Hegel, Schopenhauer, Comte, Mill and Nietzsche.

**269. Departmental Colloquium (1-3, 1-3, 1-3)** **F,W,S**

The Staff

Special topics submitted by visiting philosophers for critical appraisal by staff and students.

**270. Seminar on Special Topics (1-3, 1-3, 1-3)** **F,W,S**

The Staff

A seminar for examination of a specific philosophical problem.

**280. Independent Study (1-6, 1-6, 1-6)** **F,W,S**

Open to properly qualified graduate students who wish to pursue a problem through advanced study under the direction of a member of the staff.

**299. Thesis Research (1-6, 1-6, 1-6)** **F,W,S**

## PHYSICAL EDUCATION

Departmental Office, Temporary Gymnasium, Building 269, Matthews Campus.

### Instructional Staff

Theodore W. Forbes, *Ed.D., Supervisor (Chairman of the Department)*
Howard F. Hunt, *M.A., Assistant Supervisor*
Richard N. Johnson, *B.A., Junior Supervisor*
Neale R. Stoner, *B.A., Junior Supervisor*
Elizabeth Ann Dale, *B.A., Junior Supervisor*

The Department of Physical Education offers a variety of programs including scheduled classes, intramural and intercollegiate athletics, and recreational activities affording all students in Revelle College an opportunity to participate in a variety of ways commensurate with their abilities. Classes are voluntary and without credit.

Courses of instruction during 1966-67 will be available in swimming, tennis, sailing, karate, wrestling, golf, weight training, conditioning, adaptive, trampolining, skin diving and modern dance.

Revelle College faculty considers physical exercise and recreation essential and complementary to the sustained intellectual pursuits of its students. Physical skills are an important component of education with dedicated participation in competitive sports of great value in developing leadership, sportsmanship and fellowship. Departmental programs are designed to make these values attainable by all students at levels depending entirely upon their individual abilities. All undergraduates are encouraged to engage in some form of continuing physical activity. Intercollegiate and intramural athletics are considered a part of the educational program. Competitive activities will be encouraged in an ever increasing variety of sports at various proficiency levels of the participants. Recreational facilities are available for football, baseball, volleyball, tennis, handball, archery, sailing, boating, swimming and fishing.

# PHYSICAL SCIENCE

Departmental Office, 3430 Physics-Chemistry Building.

The courses listed below, 1A thru 1E, 1DL and 1EL, are given jointly by the Departments of Physics and Chemistry. These courses form an integrated sequence, designed to eliminate unnecessary overlap of content, and contain material equivalent to traditional lower division chemistry and physics courses. The lower division Physical Science courses are subject to change.

Physical Science 1A through 1E also have honors sections (1AH, etc.). An additional course sequence in physical science is being developed. Information will be available in fall 1966.

## COURSES

### 1A. Physical Science — W

Introductory lectures on the range of natural phenomena which can be understood in terms of the physical sciences are followed by the study of particle motion, and special relativity. Applications are made to astronomy and to the structure of matter. Three hours lecture, one hour recitation, three hours problem session. (Previously numbered 1).

### 1B. Physical Science — S

A continuation of Physical Science 1A to the electrical effects of moving charges, time dependent fields, and waves. Three hours lecture, one hour recitation, two hours problem session. (Previously numbered 2).

### 1C. Physical Science — F

The study of waves is followed by an introduction to the quantum theory as applied to atoms and their radiation. The exclusion principle is used to study the chemistry and physics of covalent and ionic binding in molecules and solids. Three hours lecture, one hour recitation, and three hours laboratory. Prerequisite: Physical Science 1B. (Previously numbered 3).

### 1D. Physical Science — W

The interactions of atoms and bulk properties of matter are further explored. Elementary thermodynamics; kinetic theory of gases; states of matter; ionic and covalent bonding are developed in more detail, with emphasis on systems of biological interest. Three lectures, one recitation, and one three-hour laboratory. (Previously numbered 4).

### 1E. Physical Science — S

A further development of the chemical properties of matter; acids and bases; complex ions; oxidation-reduction; electrochemistry; rates of chemical reactions. Three lectures, one recitation, one three-hour laboratory. (Previously numbered 5).

### 1DL. Physical Science — S

Recommended for students intending to major in chemistry and others who wish to acquire some proficiency in the experimental methods of modern chemistry. Students attend the same lecture and classroom sessions as those in Physical Science 1D. The laboratory will include work in qualitative and quantitative analysis, including instrumental methods. Two three-hour laboratory sessions. (Previously numbered 4L).

**1EL. Physical Science** S

This course bears the same relation to 1E as 1DL does 1D. The laboratory will include further analytical work, along with other physical measurements, including the study of kinetics. Emphasis will be precision and accuracy of technique as well as the theoretical basis of experimental design. Two three-hour laboratory sessions. (Previously numbered 5L).

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## PHYSICS

Departmental Office, 3426 Physics-Chemistry Building

### Instructional Staff

Keith A. Brueckner, *Ph.D., Professor of Physics*
Geoffrey R. Burbidge, *Ph.D., Professor of Astrophysics*
George Feher, *Ph.D., Professor of Physics*
Walter Kohn, *Ph.D., Professor of Physics*
Norman M. Kroll, *Ph.D., Professor of Physics*
Leonard N. Liebermann, *Ph.D., Professor of Physics*
Ralph H. Lovberg, *Ph.D., Professor of Physics*
Bernd T. Matthias, *Ph.D., Professor of Physics*
Maria Goeppert Mayer, *Ph.D., Sc.D., Professor of Physics*
Carl E. McIlwain, *Ph.D., Professor of Physics*
Oreste Piccioni, *Ph.D., Professor of Physics*
Marshall N. Rosenbluth, *Ph.D., Professor of Physics*
Norman Rostoker, *Ph.D., Professor of Physics in-Residence*
Harry Suhl, *Ph.D., Professor of Physics (Chairman of the Department)*
William B. Thompson, *Ph.D., Professor of Physics*
John C. Wheatley, *Ph.D., Professor of Physics*
Herbert F. York, *Ph.D., Professor of Physics*
William F. Frazer, *Ph.D., Associate Professor of Physics*
Francis R. Halpern, *Ph.D., Associate Professor of Physics*
George E. Masek, *Ph.D., Associate Professor of Physics*
Robert A. Swanson, *Ph.D., Associate Professor of Physics*
David Y. Wong, *Ph.D., Associate Professor of Physics*
Barry Block, *Ph.D., Assistant Professor of Physics*
Joseph C. Y. Chen, *Ph.D., Assistant Professor of Physics*
Donald R. Fredkin, *Ph.D., Assistant Professor of Physics*
John M. Goodkind, *Ph.D., Assistant Professor of Physics*
Robert J. Gould, *Ph.D., Assistant Professor of Physics*
Suso Gygax, *Ph.D., Assistant Professor of Physics*
Kazumi Maki, *Ph.D., Assistant Professor of Physics*
Xuong Nguyen-Huu, *Ph.D., Assistant Professor of Physics*
Laurence E. Peterson, *Ph.D., Assistant Professor of Physics*
Sheldon Schultz, *Ph.D., Assistant Professor of Physics*
Wayne Vernon, *Ph.D., Assistant Professor of Physics*

### Undergraduate Program

Students expecting to major in physics are strongly advised to take Mathematics 100, Mathematics 101, and Physical Science 1E in the lower division. Also, if graduate study in physics is planned, the language requirement should be met in German, Russian or French, preferably German or Russian.

The upper division program is intended to provide basic education in several principal areas of physics, with some opportunity for study in neighboring areas in the form of restricted electives. Provision is made, both in the main course and in the elective subjects, for some training in a few of the more technological aspects of physics.

In the junior year the emphasis is on macroscopic physics; the two principal physics subjects are electromagnetism and mechanics. The mathematics background required for the physics program is completed in this year.

In the senior year a sequence of courses in quantum physics provides the student with the modern view of atomic and some aspects of subatomic physics, and teaches him the principal analytical methods appropriate in this domain. The relation of the microscopic to the macroscopic world is the subject of courses in thermodynamics and statistical physics, with illustrations drawn from gas dynamics and solid state physics. The quantum physics sequence aims at an integrated, descriptive and analytical treatment of those areas of physics where quantum effects are important, particularly atomic and nuclear physics and elementary particles.

*Mathematics*—For the restricted elective in mathematics in the junior year, Mathematics 120 is strongly recommended.

Students entering the upper division with a deficient mathematics background will have to make up this deficiency in the junior year. For example, a student who failed to take Mathematics 100 and 101 will be required to take these courses in the junior year in place of the noncontiguous minor. Depending on the use such a student might have made of his electives in the sophomore year, he may find it necessary to use some or all of his senior year free electives to complete the noncontiguous minor.

*Chemistry*—The Department of Physics considers that a knowledge of the fundamentals of chemistry is essential for the study and practice of physics. Consequently, Physical Science 1E, or equivalent, or any upper division chemistry course with associated laboratory, is required for the B.A. degree in physics.

*Restricted Electives*—The restricted electives in mathematics are discussed above. The other restricted electives may be chosen from upper division or graduate courses in physics, chemistry, biology, or mathematics, subject to the approval of the Physics Department.

*Noncontiguous Minor in Physics for Major outside the Sciences*—Noncontiguous minor programs in physics can be arranged in consultation with the Physics Department. Examples of such programs are:

a. Mathematics 100, 121; Physics 110A, 130A-130B-130C
b. Mathematics 100, 121, Physics 110A, 130A, 160, 161
c. Mathematics 100, 101; Physics 100A-100B-100C, 112, plus 101A-101B
d. Mathematics 100, 101; Physics 110A-110B, 140, 141

Because of the large number of mathematics prerequisites required for physics courses, students electing their noncontiguous minors in the field of physics may find it desirable to supplement their noncontiguous minor by devoting some of their free elective time to additional courses in physics.

## UNDERGRADUATE CURRICULUM

### University Requirements:

Subject A
American History
American Institutions

### Revelle College Requirements:

Fine Arts
Humanities Sequence
Mathematics Sequence
Physical and Biological Science Sequence
Social Science Sequence
Lower Division Language Proficiency
Upper Division Language Proficiency
Noncontiguous Minor
48 Courses

## PHYSICS DEPARTMENTAL REQUIREMENTS
## RECOMMENDED SCHEDULE

| | Fall | Winter | Spring |
|---|---|---|---|
| **Freshman Year** | Humanities 1<br>Language 1A or 2A<br>Math 1A or 2A<br>Fine Arts 1 | Humanities 2<br>Language 1B or 2B<br>Math 1B or 2B<br>Physical Science 1A | Humanities 3<br>Language 1C or 2C<br>Math 1C or 2C<br>Physical Science 1B |
| **Sophomore Year** | Humanities 4<br>Social Science<br>Physical Science 1C<br>Math 2C/Math 100 | Humanities 5<br>Social Science<br>Physical Science 1D<br>Math 100/Math 101 | Humanities 6<br>Social Science<br>Biology 1<br>Math 101/*Physical Science 1E |
| **Junior Year** | Physics 110A<br>Physics 100A<br>Restricted Elective in Mathematics | Physics 110B<br>Physics 100B<br>Physics 101A<br>Math 121 | Physics 112<br>Physics 100C<br>Physics 101B<br>Restricted Elective |
| **Senior Year** | Physics 130A<br>Physics 131A<br>Physics 140 | Physics 130B<br>Physics 131B<br>Physics 141 | Physics 130C<br>Restricted Elective |

*Recommended but not required.

### Graduate Program

The Department of Physics offers curricula leading to the degree of Master of Science and Doctor of Philosophy.

The entering graduate student will be required to have a sound knowledge of undergraduate mechanics, electricity, magnetism, and also to have had senior courses or their equivalent in nuclear physics, atomic physics, thermody-

namics and statistical physics. Upper division courses numbered 130 or higher are available for students who have minor deficiencies in undergraduate training.

### Master's Degree Program

Requirements for the Master of Science degree may be met either according to Plan I (thesis) or Plan II (comprehensive examination). Plan I is available, however, only in very special circumstances, and it is expected that nearly all the M.S. degrees conferred will be earned through Plan II. No student should enter UCSD expecting to undertake a master's thesis in physics unless special arrangements have been made with the Physics Department. A detailed specification of the Physics Department course requirements together with a list of approved courses is available from the Physics Department Office.

### Doctor's Degree Program

Upon a student's admission to the Department, the Chairman of the Department will appoint an adviser to assist the student in planning his program and in preparing for the qualifying examination.

During the first two years, the student will take a number of courses and spend a few hours each week in association with some departmental research activity to prepare him for the general departmental examination. There are no specific course requirements, but courses usually taken are the following:

1st Year

Mathematics 210A-210B-210C. Mathematical Methods
Physics 200A-200B-200C. Theoretical Mechanics
Physics 203A-203B. Advanced Classical Electrodynamics
Physics 212A-212B. Quantum Mechanics

2nd Year

Physics 210A-210B-210C. Statistical Mechanics and the Properties of Matter
Physics 212C-212D. Quantum Mechanics
Physics 213A-213B. Theoretical Nuclear Physics
Physics 215. High Energy Nuclear Physics

The general departmental examination is offered in April and September of each year and is normally taken after two years of graduate work. The examination consists of a written and an oral part.

In order to be admitted to the oral qualifying examination for candidacy for the doctor's degree, a graduate student must first pass the general departmental examination, be accepted by a faculty member as a thesis student, and pass the language examinations. To satisfy the language requirement, a student has the option of a reading knowledge of two languages (one language must be German or Russian; the second may be German, Russian, French, Italian or Spanish); or a reading and speaking knowledge of one language (German, Russian, French, Italian or Spanish; English will be acceptable for foreign students, on the approval of the department).

After admission to candidacy, the student will engage in his thesis research as well as take some of the advanced graduate courses. The normal duration of the entire Ph.D. program is four years, but shortening of this period is possible for the exceptional student.

# COURSES

## UPPER DIVISION

**100A. Electromagnetism** F

Coulomb's law, electric fields, electrostatics; conductors and dielectrics; steady currents, elements of circuit theory. Four hours lecture. Prerequisite or co-registration: Mathematics 100. (Previously numbered 100).

**100B. Electromagnetism** W

Magnetic fields and magnetostatics, magnetic materials, induction; AC circuits; displacement currents; development of Maxwell's equations. Three hours lecture. Prerequisite: Physics 100A; prerequisite or co-registration: Mathematics 101, co-registration: Physics 101A. (Previously numbered 101).

**100C. Electromagnetism** S

Electromagnetic waves, radiation theory; application to optics; motion of charged particles in electromagnetic fields; relation of electromagnetism to relativistic concepts. Four hours lecture. Prerequisite: Physics 100B; co-registration: Physics 101B. (Previously numbered 102).

**101A. Electricity and Magnetism Laboratory** W

Experiments with AC and DC circuits and electromagnetic phenomena in general; magnetism. Four hours. Co-registration: Physics 100B. Required for Physics majors. (No course credit will be given toward graduation.) (Previously numbered 100L).

**101B. Electricity and Magnetism Laboratory** S

Microwaves, electrodynamics; electrical and electronic measurements and test equipment; construction and testing of active circuits. Four hours. Prerequisite: Physics 101A; co-registration: Physics 100C. Required for Physics majors. (No course credit will be given toward graduation.) (Previously numbered 101L).

**110A. Mechanics** F

Mechanics of systems of particles; planetary motion; Lagrange's and Hamilton's equations; statics and dynamics of rigid bodies; relativistic mechanics. Four hours lecture. Prerequisite or co-registration: Mathematics 100. (Previously numbered 110).

**110B. Mechanics** W

Theory of small vibrations; elasticity; elements of fluid mechanics. Four hours lecture. Prerequisite: Physics 110A; prerequisite or co-registration: Mathematics 101. (Previously numbered 111).

**112. Electronics Laboratory** S

Electrical networks, vacuum tube and transistor circuit analysis and design, with emphasis on applications to physical research. Two hours lecture, four hours laboratory. Prerequisites: Physics 100B, 110B, 101A.

**130A. Quantum Physics** F

Atomic physics in the 19th century; radioactivity, Rutherford experiments; Bohr model, optical spectra, x-ray spectra, electron spin, vector model. Three

hours lecture. Prerequisites: Mathematics 121, Physics 110A; co-registration: Physics 131A. (Previously numbered 130).

**130B. Quantum Physics** **W**

Atomic structure according to wave mechanics; Schrödinger equation for hydrogenlike atoms; Pauli principle, Heisenberg principle; particle in a periodic potential. Three hours lecture. Prerequisite: Physics 130A; co-registration: Physics 131B. (Previously numbered 131).

**130C. Quantum Physics** **S**

Elementary nuclear physics; quantum mechanics of radiation; elementary particles and scattering. Four hours lecture. Prerequisite: Physics 100C, 130B. (Previously numbered 132).

**131A. Modern Physics Laboratory** **F**

Experiments in atomic physics, optics, physical electronics, fluid dynamics, surface physics, etc. Four hours. Co-registration: Physics 130A. Required for Physics majors. (No course credit will be given toward graduation.) (Previously numbered 130L).

**131B. Modern Physics Laboratory** **W**

Continuation of Physics 131A. Experiments in radioactivity, x-rays, atomic physics, resonance physics, solid state physics, etc. Four hours. Prerequisite: Physics 131A. Required for Physics majors. (No course credit will be given toward graduation.) (Previously numbered 131L).

**140. Thermodynamics** **F**

Classical thermodynamics including the first, second, and third laws; thermodynamic potentials; phase transitions; applications to low temperature physics, radiation, and chemical reactions. Four hours lecture. Prerequisite or co-registration: Mathematics 100.

**141. Statistical Physics** **W**

Elementary statistical mechanics, probabilistic interpretation of entropy, fluctuation phenomena, transport phenomena. Four hours lecture. Prerequisites: Physics 140, 110A.

**150. Continuum Mechanics** **F**

Mechanics of continuous media; waves, instabilities, applications to earth sciences, oceanography, and aerodynamics. Three hours lecture. Prerequisite: Physics 110B.

**152. Solid State Physics** **S**

Crystal symmetry, free electron gas, band structure, properties of insulators, semiconductors and metals; atomic diffusion, alloys, electronic transport phenomena. Four hours lecture. Prerequisites: Physics 130B, 141.

**160. Survey of Astronomy and Astrophysics** **F**

Introduction to modern astronomy and astrophysics. Four hours lecture. Prerequisite: Physics 110A.

**161. Astrophysics** **W**

The physics of stars, interstellar matter, and stellar systems. Four hours lecture. Prerequisites: Physics 160, 130A.

**170. Advanced Laboratory (Half Course)** S

Experimental study of a special problem in optics, cryogenics, resonance physics, nuclear physics, etc., using existing apparatus or development of new apparatus, or both. Hours by arrangement. Prerequisites: Physics 101A-101B, 131A-131B. (Previously numbered 170L).

**171. Advanced Electronic Laboratory** F

Electrical networks, vacuum tube and solid state electronics, analysis and design, and components. Power supplies. Amplifiers, noise and feedback, oscillators, digital and logic circuits, microwaves and special topics. Emphasis on applications to physical research. Six hours. Prerequisite: Physics 112. (Previously numbered 171L).

**172. Computer Laboratory**

Computer solution of practical problems in science and engineering; mathematics of approximation methods, computer programming. Students will use the University computer to solve specific problems. This course may be offered as a mathematics course. Four hours. Prerequisite: Mathematics 121. (Previously numbered 172L).

**199. Special Project** F,W,S

Independent reading or research on a problem by special arrangement with a faculty member. Four hours. Prerequisite: consent of instructor.

## GRADUATE

**200A. Theoretical Mechanics (3)** F

Lagrangian and Hamiltonian theory and its application to the motion of mass points and rigid bodies. Prerequisites: undergraduate mechanics, advanced calculus or partial differential equations.

**200B. Theoretical Mechanics (3)** W

The motion of a particle according to the special and general relativity theories. The N-particle problem and its relation to continuum mechanics. The generation of entropy, and empirical dissipative laws; viscosity. Prerequisite: Physics 200A.

**200C. Theoretical Mechanics (3)** S

Hydrodynamics, in Eulerian and Lagrangian form. Shock waves; theory of solid substances: deformation and distortion, elasticity and plasticity, magnetohydrodynamics. Prerequisite: Physics 200B.

**203A. Advanced Classical Electrodynamics (3)** F

The boundary value problems of electrostatics and the electrostatics of macroscopic media, magnetostatics and the properties of magnetic materials, currents in extended media, macroscopic properties of superconductors, electromagnetic induction and quasi-static phenomena, Maxwell theory and wave propagation. Prerequisite: Physics 100C or equivalent.

**203B. Advanced Classical Electrodynamics (4)** S

Applications of Maxwell's equations to radiating systems and boundary value problems, such as wave guides and diffraction phenomena; relativistic electrodynamics; radiation by moving charges; classical electron theory; nonlinear phenomena. Prerequisites: Physics 100C or equivalent, Physics 203A.

**210A-210B-210C. Statistical Mechanics and the Properties of Matter (3,3,3)** **F,W,S**
Systems of weakly interacting elements; general ensemble theory; applications to systems with interactions such as imperfect gases, plasma, liquids, order-disorder transitions; fluctuations, irreversible processes. Principles of the dynamics of ions and electrons in solids; applications to electric, magnetic and thermal properties. Prerequisites: Physics 140, 141, 152 or equivalent, Physics 212B.

**212A. Quantum Mechanics (3)** **W**
Physical basis of quantum mechanics, the Schrödinger equation and the quantum mechanics of one particle system, matrices and the transformation theory of quantum mechanics, approximation methods for discrete stationary states. Prerequisite: Physics 130B or equivalent.

**212B. Quantum Mechanics (3)** **S**
Translational and rotational invariance, angular momentum and spin, the formal theory of scattering. Prerequisite: Physics 212A.

**212C. Quantum Mechanics (3)** **F**
Approximation methods in the continuum and for time dependent problems, identical particles and the quantum theory of atomic structure, the statistical matrix and the quantum mechanical theory of measurement. Prerequisite: Physics 212B.

**212D. Quantum Mechanics (3)** **W**
Relativistic one particle theory, quantization of the electromagnetic field and particle fields, nonrelativistic interaction of the quantized electromagnetic field with atomic systems. Prerequisite: Physics 212C.

**213A-213B. Theoretical Nuclear Physics (3,3)** **F,W**
Nuclear forces, two-nucleon system, interaction of nucleons with the electromagnetic field, beta transformation of nucleons; nuclear systematics, models of nuclear structure, nuclear transformations and reactions. Prerequisites: Physics 132 or equivalent; co-registration: Physics 212C, 212D.

**214. Advanced Quantum Mechanics (3)** **S**
Covariant perturbation theory, mass and charge renormalization of quantum electrodynamics, radiative corrections to scattering and atomic energy levels, introduction to dispersion theory. Prerequisite: Physics 212D.

**215. High Energy Nuclear Physics (3)** **S**
An introduction to the elementary particles with particular emphasis on the invariance principles by which they are classified. Prerequisites: Physics 212D, 213B.

**217A. Astrophysics (3)** **F**
Stellar spectroscopy (line, molecular and continuum), stellar atmospheres, determination of abundances of elements in stars. Prerequisites: Physics 130C, 141 or equivalent.

**217B. Astrophysics (3)** **W**
Stellar structure, degenerate matter, stellar evolution (theoretical and empirical), nuclear energy and nucleosynthesis. Prerequisite: Physics 217A.

**217C. Astrophysics (3)** **S**
Galactic structure, stellar populations, star clusters, interstellar medium, radio emission from galaxies. Prerequisite: Physics 217A.

**220. Group Theoretical Methods in Physics (3)** **F**
Study of the representation and applications of groups to problems in physics, particular emphasis on the permutation of unitary groups. Prerequisite: Physics 212C.

**230. Advanced Solid State Physics (4)** **F**
A selection of advanced topics such as electrical and thermal transport phenomena, cooperative magnetic phenomena, nuclear and electron magnetic resonance, superconductivity. Prerequisite: Physics 210C.

**232A-232B. Advanced Plasma Physics (3,3)** **F,W**
Vlasov equations and elementary excitations of an infinite medium; kinetic theory with applications to diffusion, scattering, etc.; quasi-linear theory and turbulence. Invariants of single particle motions; stability theory; magnetohydrodynamics and generalizations to include resistivity and finite Larmor radius; microinstabilities; application to fusion, MHD power generation and propulsion. Prerequisites: Physics 200C, 203B, 210B.

**233. Elementary Particle Theory (4)** **W**
Current problems in elementary particle theory, especially the theory of strong interactions. Prerequisite: Physics 215.

**234. High Energy Experimental Physics (4)** **S**
Current elementary particles research. Techniques used in experiments with high energy accelerators. Prerequisite: Physics 215.

***235. Numerical Methods in Theoretical Physics (3)** **W**
Approximation of functions, interpolation and smoothing of data, numerical solution of ordinary and partial differential equations, and integral and integro-differential equations of particular interest to physicists. Prerequisite: consent of instructor.

**236. Many-Body Theory (4)** **W**
Dilute classical systems; virial expansions; relation to statistical mechanics; quantum mechanical formulations; dilute systems, perturbation theory; calculation of ground state energy; nuclear matter; uncharged and charged Bose and Fermi liquids; collective modes of motion; screening; superconductivity and superfluidity; Green's function method; the selfconsistent field; interacting systems of magnetic moments, ferromagnetism. Prerequisites: Physics 210C, 212D.

**250. Solid State Physics Seminar (1,1,1)** **F,W,S**
Discussions of current research in solid state physics.

**251. High Energy Physics Seminar (1,1,1)** **F,W,S**
Discussions of current research in nuclear physics, principally in the field of elementary particles.

**252. Plasma Physics Seminar (1,1,1)** **F,W,S**
Discussions of recent research in plasma physics.

**253. Astrophysics and Space Physics Seminar (1,1,1)** **F,W,S**
Discussions of recent research in astro- and space-physics.

**299. Research in Physics (1-6, 1-6, 1-6)** **F,W,S**

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# PSYCHOLOGY

Departmental Office, 4202 Urey Hall

### Instructional Staff

Norman H. Anderson, *Ph.D., Professor of Psychology*
J. Anthony Deutsch, *D.Phil., Professor of Psychology*
David M. Green, *Ph.D., Professor of Psychology*
George Mandler, *Ph.D., Professor of Psychology (Chairman of the Department)*
William J. McGill, *Ph.D., Professor of Psychology*
Harry L. Munsinger, *Ph.D., Associate Professor of Psychology*
Donald A. Norman, *Ph.D., Associate Professor of Psychology*
George S. Reynolds, *Ph.D., Associate Professor of Psychology*
Peter H. Lindsay, *Ph.D., Assistant Professor of Psychology*

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Irving L. Janis, *Ph.D., Professor in Residence in Psychology*

### Undergraduate Program

An undergraduate major in Psychology will not be offered at UCSD until the 1967-68 academic year.

### Graduate Program

The Department of Psychology will provide broad training in experimental psychology. Increased specialization and the general burgeoning of the field of psychology make it impossible to provide training in depth in all aspects of experimental psychology for all students, but research activities will be represented in all major areas of experimental psychology. One area of concentration of departmental effort will be in communication and information research and human information processing. In addition, the department will have strong representation in the areas of animal learning, physiological psychology (including motivation and emotion), and in developmental psychology.

Apart from the University's requirements for admission to the graduate division, the Department of Psychology will require adequate preparation in psychology during the student's undergraduate career. Completion of a major in psychology, or at least a strong minor, would normally be a prerequisite.

### Master of Arts Degree

Generally speaking, students will be accepted for a plan of study that envisions proceeding to the doctoral level. In special circumstances, students will be admitted for study to the master's level only.

Plan I for the M.A. degree has been adopted by the Department of Psychology. The candidate for the M.A. degree will be required to have completed 24 units of upper division and graduate work, of which at least 16 must be in graduate courses in psychology. The master's thesis will be evaluated by a committee of three faculty members appointed by the Dean of Graduate Studies. All candidates for the M.A. degree must also satisfy the comprehensive evaluation outlined below.

**Doctor of Philosophy Degree**

Graduate study leading to the Ph.D. degree will consist of the following components:

(1) A sequence in quantitative mothods (Psychology 201A-201B-201C)
(2) Basic and Advanced seminars
(3) Research practicum
(4) Teaching participation
(5) A comprehensive evaluation
(6) The qualifying examination
(7) The dissertation

*Basic Seminars*—(Psychology 202-219) are intended to cover current psychological knowledge and to provide the basis for more intensive and specialized study.

*Advanced Seminars*—(Psychology 220-239) focus on the specific areas and represent an opportunity to cover current knowledge and research in depth.

All students (whether candidates for the M.A. or Ph.D. degree), during the first year of graduate study, will normally be required to take no less than 4 and no more than 6 quarter seminars at the basic level. Typically, two of these Basic Seminars should be taken in the first quarter, and one each in the second and third quarter. During the first year of graduate study, a student may take up to two Advanced Seminars during the second and third quarter. Graduate and upper division courses in other departments may be substituted for Advanced Seminars with the approval of the department. Course work in the second year will usually be confined to Advanced Seminars and to interdisciplinary work. No further formal course requirements are established.

Beginning with the first year of graduate study, all students will be enrolled in a Research Practicum. Graduate students will be assigned to ongoing research projects in the department and will receive the personal supervision of a member of the staff. In addition all graduate students will participate in the teaching program of the department.

*Comprehensive Evaluation*—At the end of the first year of graduate study, each student will be evaluated by the staff, and this evaluation will be communicated in writing. Registration beyond the first year will be contingent on the outcome of the evaluation.

During the second year, the department will survey the comprehensive preparation of the student. Additional written or oral evidence of competence in certain areas may be sought at this time, and where necessary, additional course work will be required.

*Qualifying Examination*—At the end of the second year of graduate study, the student will be expected to prepare a paper outlining the major problems and

findings in his area of specialization, describing his thesis topic, and including any preliminary results obtained in pilot studies and other preparatory research. He will be examined by his doctoral committee on the contents of this paper.

*Foreign Language*—No foreign language requirement is imposed at the M.A. level. Graduate students proceeding to the Ph.D. must demonstrate comprehension of one of the following languages: German, French, or Russian. Substitution of another language may be permitted with the approval of the Graduate Council, if a significant psychological literature can be shown to exist in that language.

## COURSES

### LOWER DIVISION

**10. Developmental Psychology** F

An introduction to the psychological development of the human organism with special reference to cognitive development in the child. Three hours lecture.

**11. Human Learning** W

An introduction to basic principles of human learning and information processing. Three hours lecture.

**12. Human Communication** S

An overview of the human organism as an information processing system. Three hours lecture.

### GRADUATE

**201A-201B-201C. Quantitative Methods in Psychology (3,3,3)** F,W,S

Mr. Anderson, Mr. McGill

An intensive course in statistical methods and the mathematical treatment of data, with special reference to research in psychology.

**202. Psychophysics (2)** F

Mr. Green

An introduction to problems and methods.

**203. Physiological Psychology (2)** F

Mr. Deutsch

The central nervous system and its relation to behavior.

***204. Social Psychology (2)** F

The behavior of man as a function of social variables.

**205. Human Learning (2)** W

The development and function of human response systems, with special reference to memory and language.

**206. Animal Learning (2)** F

Classical and operant conditioning in lower animals.

**207. Developmental Psychology (2)** **S**
Mr. Munsinger
The original behavioral repertory of the child and its subsequent development.

***208. Personality Systems (2)** **S**
Theory and research in human personality.

**220. Detection Theory in Psychology (2)** **W**
Mr. Green
The application of detection theory to human information processing.

**221. Judgmental Processes (2)** **W**
Mr. Anderson
The psychology of judgments and information integration.

**222. Brain Functions (2)** **W**
Mr. Deutsch
Selected topics.

**223. Advanced Topics in Psychophysics (2)** **S**
Mr. McGill

**224. Verbal Learning and Memory (2)** **S**
Mr. Mandler
Selected problems.

**280. Seminar in Communication and Information Research (1,1,1)** **F,W,S**
The Staff and Visiting Lecturers

**296. Research Practicum (1-6, 1-6, 1-6)** **F,W,S**
The Staff
Research in psychology under supervision of individual staff members.

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## SUBJECT A

Departmental Office, 3416 Humanities-Library Building

The first quarter of Subject A in Revelle College is taught in conjunction with Humanities 1. The sections for Humanities 1/Subject A are smaller than the regular humanities sections, and allow more individual attention and more writing. A student must receive a grade of "C" or better in Humanities 1/Subject A to satisfy the Subject A requirement. Students who do not pass this course may not continue in the Humanities Sequence until they pass the following non-credit course:

**Subject A.** **W**
English composition for students who have failed the combined Humanities 1/Subject A course. Must be passed with a grade of "C" or better before further courses in the Humanities Sequence can be taken.

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# VISUAL ARTS

Departmental Office, Art Gallery, Matthews Campus

### Instructional Staff

David Rifat, *Diploma of Art, Assistant Professor of Visual Arts*
Donald Lewallen, *M.A., Lecturer in the Visual Arts*

## COURSES

### LOWER DIVISION

**1A-1B-1C. The Nature of the Visual Arts** **F,W,S**
A sequence of three courses on fundamental aspects of the visual arts. Lectures and reading on the media and visual forms will be supplemented by drawing, painting, and modelling, and analysis of existing works. Three hours lecture and two hours supervised studio work. (Previously numbered 10 and 11).

**2. Basic Drawing** **W**
Freehand drawing problems using pencil, pen, and other instruments to develop observation and representation and aesthetic judgment. Six hours of studio instruction in the form of 3 two-hour meetings.

**10. Life Drawing** **S**
Drawing from the figure. Six hours of studio instruction in the form of 3 two-hour meetings. Prerequisite: Art 2.

**11A. Elements of Painting** **F**
Basic instruction in painting in oils, acrylic pigments, and other media. Still life problems. Four hours in the form of 2 two-hour meetings in painting studio. Prerequisite: Fine Arts 10 as offered 1965/66 or Art 2 or consent of instructor.

**11B-11C. Intermediate Painting** **F,W**
Continuation of 11A, on a higher level, of instruction in painting in oils, acrylic pigments, and other media. Four hours in the form of 2 two-hour meetings in painting studio. Prerequisite: distinguished work in Fine Arts 10 as offered in 1965/66 or Art 11A.

**12A. Elements of Sculpture** **F**
Basic instruction in sculpture with studio exercises using clay, wood, metal, plaster, and other materials. Four hours in the form of 2 two-hour meetings in the studio. Prerequisite: Fine Arts 10 or consent of instructor.

**12B. Intermediate Sculpture** **W**
A continuation of Art 12A on a more advanced level of instruction and problems. Four hours in the form of 2 two-hour meetings in the studio.

### UPPER DIVISION

**110A. Advanced Drawing and Painting** **W**
Advanced creative work in various media with much attention to the individual student. May be repeated with consent of instructor. Four hours of studio instruction. Prerequisite: Art 11B.

**110B. Advanced Drawing and Painting** S

Similar to Art 110A, except that different media and problems will be studied. May be repeated with consent of instructor. Four hours of studio instruction. Prerequisite: Art 11B.

**139. Modern Art** S

From Cubism through Abstract Expressionism. Three hours lecture.

**199. Special Studies in the Visual Arts** S

Independent reading, research, or creative work under direction of a faculty member. Three hours tutorial. Prerequisite: consent of instructor.

# John Muir College

**John Muir College will accept its first students in the fall of 1967. Much of the curriculum to be offered at that time has been agreed upon although changes and additions are to be expected before the first students enter.**

**The Muir College faculty will teach courses in Visual Arts and Music for the benefit of Revelle College undergraduates during the 1966-1967 academic year.**

**The following information on the philosophy and curriculum of Muir College is included for students who will begin college work in the fall of 1967 and for Revelle College students who wish to elect courses in Muir College. While Revelle College students may take courses in Muir College, they may not transfer to the College in 1967.**

In the fall of 1967, John Muir College, second of the twelve colleges planned for UCSD, will admit its first students. Only freshmen will enter, but sophomores and upperclassmen in Revelle College will be welcome to take courses and may even pursue a major program in those departments and interdisciplinary areas of the college that have a sufficient number of faculty members. Certain departments offering majors in Revelle College during 1966-1967 will be transferred to John Muir College and will continue to provide to qualified students the same programs from 1967-1968 onward.

## THE CHARACTER OF THE COLLEGE

John Muir College has been planned as a community of scholars engaged in inquiry and the exchange of ideas. The key words here are *community*, *inquiry*, and *exchange*.

The collegiate system of UCSD is intended to make possible "life-size" dimensions among which community is possible, and the planners of John Muir College have taken this into account in everything from the curriculum to the design and placing of the buildings. They intended that learning should reach beyond the classrooms into many other aspects of life in the college. The problems and issues drawn from that life will furnish some of the substance of the courses.

The buildings of John Muir College are intended to facilitate the integration of activities in the college. Several small classrooms have been placed in the residence halls so that the discussions begun in them can continue beyond the end of a class and spill into the corridors, lounges, and the campus itself. These rooms will be available at other times to student organizations and discussion groups. Several faculty offices are also placed in the halls, and faculty members known to enjoy informal conversations with students will be able to meet

them more easily in agreeable surroundings. Through the generosity of Mr. Ernest W. Mandeville, the first Honorary Fellow of John Muir College, a suite for distinguished visitors will be provided in one of the residential halls. Here an important lecturer can stay for several days, enjoying as much privacy or accessibility as he desires. Students not living in the residential halls will be able to participate fully in most of the life of the college. The lounge areas of the college are planned to include them; they will have ample room for storing books and equipment; and there will be rooms in the residential halls in which they can stay overnight when they wish to remain on the campus to study, attend a lecture, take part in a discussion or organizational meeting, rehearse for a play or concert, or simply be with their friends. Finally, the flow of life in the college as a whole is intended to stimulate curiosity about all aspects of research and learning in the college—curiosity which should lead to conversations and perhaps to unexpected and adventuresome choices of courses, as, for example, when a student specializing in music becomes inquisitive enough to elect a course in experimental psychology or one of the computer sciences.

In 1967-1968 and 1968-1969 the college will be located in temporary buildings on the Matthews campus. Thus students entering in the fall of 1967 will spend two years in the buildings just described.

The general education requirements and the curriculum as a whole encourage active rather than passive learning by involving the students directly with research and creative work. The courses in science will provide opportunities for a student to choose his own problem and design his own experiment; those in the fine arts will include periods of studio work or its equivalent. All first-year students are required to complete a course in contemporary issues in which problems in public affairs will be taken up under circumstances that invite intensive discussion. There will be a "public affairs laboratory" available to them wherein they can find periodicals and newspapers from all over the world, maps, charts, pictures, and other visual aids on exhibition, and books specially chosen for their relevance to the topics under inquiry. Most important of all, the students will be working among faculty members, postdoctoral fellows, and graduate students who are themselves actively engaged in creation and discovery.

Such active learning fosters *self*-education in ways and with an intensity that no passive education can attain. It necessitates opportunities for independent study—and the curriculum provides them. The programs in the science and fine arts obviously foster independent study. Moreover, subject to certain restrictions, a student may substitute reading courses for regular courses. This will permit him to investigate in more than usual depth topics of special interest to himself, to fill in gaps in his learning, to proceed at his own speed, and to take responsibility for his own program. Superior students will be eligible for the Honors Program of the college. Once admitted to the program a student may be allowed to complete by means of independent study any general education requirements he has still to finish. Exceptional students will occasionally be admitted upon entering the college and thus be eligible to meet any of the general education requirements by independent study. The major programs, which are not confined to the last two years but may be under-

taken by students of the college whenever the departments or the directors of interdisciplinary majors judge them to be ready, provide many forms of independent study. Finally, those students who choose not to pursue a major (see below) will be expected to complete projects that demand much independent investigation.

Little need be said here about the exchange of ideas. When inquiry and independent study characterize a genuine community having learning as its common purpose, exchange of ideas is inevitable. In John Muir College no new theory, no new discovery, no new work of art will long go unexamined or undiscussed. It will not be a comfortable place for those whose minds are made up.

## The Requirements for Graduation

To receive a bachelor's degree from John Muir College a student must:

1. Pass 45 full courses or their equivalent.

2. Fulfill the general education requirements described below. Exemption from part or all of the course work taken to fulfill a given requirement will be granted to properly qualified students. (Exemption does not reduce to less than 45 the number of courses required for graduation.) Others who have prior training which is not enough to warrant exemption but does put them ahead of the ordinary student may be allowed to fulfill part or all of a requirement by independent study. Finally, as noted above, a student admitted to the Honors Program may be allowed to complete by means of independent study any general education requirements still to be finished.

3. Show in some form a concentration and focus of studies as part of his preparation for the bachelor of arts degree. This requirement may be fulfilled by a departmental or interdisciplinary major, but a major itself is not required. (For discussion of major programs, see below.) Normally a student affiliated with John Muir College and wishing to undertake a major program as his form of concentration would choose one offered in the college. (The opportunity to engage in the program would be an important reason for choosing to come to John Muir College.) However, the student may fulfill this requirement by completing any major program offered at UCSD to which he can gain admission.

A student who does not choose to meet this requirement by means of a major must complete a special project, normally undertaken in the senior year, having such scope and significance that it integrates and summarizes much of the student's learning. Examples of appropriate projects are a thesis-length essay in literature, history, or anthropology; field research on a social problem of the San Diego area; composing a three-movement work for a string quartet; and painting a mural.

Students who do not undertake a major must have their programs for the junior and senior years approved by a faculty advisor and the Provost of the college. Their plans of study must have some rationale, and they will be expected to explain for what purposes they have chosen a particular pattern of courses. Under no circumstances should students suppose that a non-major program is, or can be made to be, less authentic than the ordinary one involving a major.

## The General Education Requirements

Unless granted an exemption or permitted to fulfill part or all of a requirement by independent study, each student is expected to complete satisfactorily the following:

1. A three-term sequence of courses which will serve as an introduction to the cultural tradition of a nation.
2. A three-term sequence of courses in one of the humanities or fine arts.
3. A three-term sequence in mathematics. This requirement must be completed before the end of the sophomore year.
4. A six-term sequence in science. Normally the first five courses of this sequence are completed by the end of the sophomore year.
5. A course on contemporary issues. This requirement must be met during the first year.

There is no required course in composition as such. Students are expected to develop their competence in writing clear and precise expository prose by means of the essays they prepare in the courses taken to fulfill the requirements. Nor is there a foreign language requirement. But students planning to enter the college should take note that the courses on the cultural tradition of a nation require competence in a foreign language equal to the ordinary requirement of most colleges and universities.

## Description of the General Education Programs

1. *Introduction to a Cultural Tradition:* Students select one from among several three-term sequences which inquire into the natures of particular cultures by way of their literary, artistic, historical, philosophical, and socio-anthropological aspects. The sequences imply not so much a breadth of coverage as a variety of perspectives. *From the beginning students will read works in the original language, and the texts will increase in difficulty and quantity as the sequence progresses.* Thus when they come to John Muir College students can enter upon one of the sequences only if they have had adequate prior language training. Students with no language training and those whose competence is not enough to enable them to cope with the material will be expected to take as much training as is needed to bring them up to the level of the first course. Such training will ordinarily be begun during the freshman year. With normal high school preparation in language most students will require about a year of work. The language courses are the same as those offered in Revelle College.

The courses offered in satisfaction of the cultural tradition requirement during 1967-1968 are listed on page 166.

2. *The Humanities and Fine Arts Sequences:* Students select one from among several three-term sequences which provide either (a) an introduction to one of the humanities or (b) an introduction to an artistic medium (visual arts, drama, or music) intended to develop sensitivity and standards of critical judgment. In addition to the ordinary lectures and discussion meetings, the courses in the arts include some "studio" work and attendance at performances or exhibitions.

The courses offered in satisfaction of the humanities or fine arts requirement are listed on page 168.

3. *The Mathematics Sequences:* With the help of the Mathematics Department students will select from among three sequences one which best fits their diverse interests, training, and educational goals. Students who will not use mathematics as a tool in further work can select a sequence which deals with fundamental concepts of mathematics without insisting upon technical proficiency. Students planning to take advanced courses or major in the physical sciences can select a more traditional sequence in calculus and analytic geometry. Certain well prepared and well motivated students will be encouraged to take three courses on special topics such as probability and statistics or the theory of games. During each term at least one such topics course will be offered. Students initially enrolled in another sequence will be allowed to transfer to a topics course if they show sufficient aptitude. Students who have had college-level mathematics for which UCSD grants credit will be considered to have satisfied part or all of the mathematics requirement.

Departments may designate particular mathematics sequences as prerequisites for advanced work in their fields. (For further information on this point see the discussion of major programs below.)

The courses offered during 1967-1968 in satisfaction of the mathematics requirement are listed on page 169.

4. *The Science Sequence:* The science requirement is intended to inculcate general literacy with respect to the basic assumptions, ideas, and methodologies underlying scientific inquiry, together with some understanding of the role of science itself as a social institution whose dynamism profoundly affects modern cultures. Each student will take a five-term sequence, to be completed by the end of the sophomore year, and a separate one-term course.

Students planning to go on to advanced work in the physical sciences should take the sequence consisting of Science 1A through 1F. Science 1F is a special course on the social and philosophical implications of modern science. Students may find it to their advantage to defer taking this course until their senior year, when their acquaintance with science is both wider and deeper.

Students not planning to do advanced work in the physical sciences may satisfy the requirement by taking the sequence Science 2A through 2E, followed by either Science 3 or Science 4. No laboratory work is included in the first five courses; laboratory experience is gained in Science 3 or Science 4.

Departments may designate particular science sequences as prerequisites for major work in their fields. (For further information on this point see the discussion of major programs below.)

The courses offered in satisfaction of the science requirement are listed on page 167.

5. *The Contemporary Issues Courses:* The contemporary issues requirement can be met in one of two ways: by attending a series of lectures and discussions involving members of the faculty and distinguished visitors, or by enrolling in a freshman seminar which concentrates upon a single area or problem.

The lecture course is under the direction of the Provost and a steering committee of faculty members and students. Particular effort will be made to present leaders in public affairs of the moment. In so far as possible, discussions will be guided by the students themselves. The course will be supplemented by selected reading and occasional papers.

The freshman seminars will be offered each term and will be limited to fifteen students. The staff will consist of members of the faculty from all areas of learning chosen for their interest in the topics without regard to college affiliation. Freshmen wishing to fulfill the requirement by means of a seminar must indicate their preference at the beginning of the year even though the seminar of their choice may not come until the second or third term. They are welcome to attend the lectures given in the large course (but not the discussion meetings).

Both the large lecture course and the freshman seminars will make use of the facilities of a "public affairs laboratory" in which students may study at leisure books, periodicals, newspapers, and pictures and other visual aids accumulated from all parts of the globe and arranged to supplement the discussions then under way.

## Major Programs

As previously indicated, a student in John Muir College may pursue any major program offered at UCSD for which he is prepared, though normally he would undertake one offered in the college. He may begin the major whenever he is judged ready for it. However, all programs can be completed by students who start them at the beginning of the junior year, and it is likely that most students will wait until then to begin.

Below is a list of subjects in which major programs will be available. A single asterisk in parentheses (*) signifies that the program will be offered in 1967-1968 as a service to Revelle students. A double asterisk (**) signifies that the program requires a particular mathematics sequence. A triple asterisk (***) signifies that the program requires the science sequence designed for those going on to advanced work in the sciences.

| | | |
|---|---|---|
| Anthropology | History (*) | Music |
| Applied Electrophysics (*) (**) (***) | Linguistics (*) | Psychology (*) (**) |
| Biology | Literature | Sociology |
| Drama | Mathematics (**) | Visual Arts |

Interdisciplinary programs will be developed later.

## The Honors Program

Entry into the honors program calls for special recommendation by either the Provost or a departmental chairman, and normally requires at least a B average. In special cases a student may be permitted to enter the Honors Program immediately upon arrival at John Muir College, but this would require, for a freshman, an A average at high school or, for a transfer student, an A minus average at his previous institution. To remain in the Honors Program a student must normally maintain at least a B average and must demonstrate by superior achievement his capacity for honors work. As has been indicated, once admitted a student may be allowed to complete by means of independent study any general education requirements still to be finished.

Honors students engaged upon a major program will be offered opportunities and be expected to show accomplishments beyond those of the ordinary student. These will include participating in special seminars, tutorial programs, or courses normally open only to graduate students, or undertaking an especially challenging project of one's own. Honors students not pursuing a major would differ from other non-major students in having more opportunities for independent work, especially on the senior project. Whether majoring or not the honors student will be able to develop a pattern of study that gives scope to his superior qualifications.

The Honors Program will be supervised by a faculty accreditation committee consisting of the Provost, his adviser for non-departmental honors students (both those not taking a major and those pursuing an interdisciplinary major), and the relevant departmental advisers for other honors students.

## Reading Courses and Examinations

Subject to certain restrictions, a student in John Muir College can substitute reading courses for regular courses. To help him to comprehend a reading course as a whole and to understand how it relates to the content of his regular courses, he will be allowed a suitable period of reflection (not to exceed two terms after the end of the reading course) and then be required to take an examination on the reading.

A student may use reading courses during a particular term only if he has had his program approved by an appropriate faculty member at *least one term in advance of his entering the program.* Arrangements for the examinations on the reading must be made and approved at the same time. Proposals for reading that necessitate an inordinate amount of special faculty work will have to be denied.

## The First Year

John Muir College offers the incoming student considerable freedom in choosing the courses for his first year. It should be wisely used to fit a program to the student's particular training and interests, leaving some scope for exploration of new areas of learning while attending to the requirements for graduation which are best fulfilled during the first two years.

To help incoming students and their advisers with the planning of the first year's program, four possible combinations are offered.

**The first combination** is suited to students with the usual preparatory training in language and mathematics who do not expect to take advanced work in the physical sciences.

| Fall | Winter | Spring |
|---|---|---|
| Science 2A | Science 2B | Science 2C |
| Mathematics 1 or 4 | Mathematics 2 or 5 | Mathematics 3 or 6 |
| Language 1 | Language 2 | Language 3 |
| Literature 1A | Literature 1B | Literature 1C |
| Contemporary Issues | | |

*Comment:* Since a student taking this combination does not plan to do advanced work in the physical sciences, he can begin at once to take the courses which will satisfy the science requirement. If he wished to do such advanced work, he would need to take Mathematics 1 or 4 *before* beginning the sequence of Science 1A, 1B, etc. (See next example.) The mathematics requirement must be met before the end of the sophomore year. Thus one is not compelled to begin it immediately. However, many students will not wish to have an interval of a year between finishing high school and beginning their mathematics courses and as a consequence will schedule a sequence that will enable them to meet the mathematics requirement during the first year. Moreover, this combination assumes that a student following it needs a full year of language study before taking a cultural traditions sequence. It also assumes that the student wants to meet the humanities and fine arts requirement in the freshman year and has chosen a sequence of three literature courses for that purpose. Finally, the Contemporary Issues course of lectures, required of all freshmen except those admitted to a freshman seminar, is spread across two terms. It will not impose an undue burden on the class.

**The second combination** is appropriate to students interested in majoring in Applied Electrophysics or taking other advanced courses in the physical sciences.

| Fall | Winter | Spring |
|---|---|---|
| Elective | Science 1A | Science 1B |
| Mathematics 1 or 4 | Mathematics 2 or 5 | Mathematics 3 or 6 |
| Language 1 | Language 2 | Language 3 |
| Music 1A | Music 1B | Music 1C |
| | Contemporary Issues | |

*Comment:* The science sequence for students planning more work in the physical sciences should not be started until the students have completed either Mathematics 1 or 4. Therefore Science 1A is undertaken in the winter term, which means that the students will complete Science 1E in the spring of the second year as prescribed in the General Education requirements. (Thereafter a student may take the sixth course, Science 1F, at any time before graduation.) This example assumes that the student using it has to do a full year of language work to prepare for the cultural traditions courses and that he has decided to fulfill his humanities and fine arts requirement in the first year by studying music for three terms. Note that the student has a free elective in the first term which can be used to explore subjects such as Psychology and Sociology which he has not encountered before coming to college. On the other hand, if he were to use this elective to gain admission to a freshman seminar, he would not need to take the Contemporary Issues lecture course (though he would be welcome to attend the lectures voluntarily).

**The third combination** would be an appropriate one for students who do not plan to use mathematics as a tool for further work and who are qualified to begin a major program in the freshman year. (Students may begin a major as soon as they are judged ready for it. On the other hand, those who wish may wait until the first term of the junior year before undertaking it.) In this example we assume that the major is in the Visual Arts.

| Fall | Winter | Spring |
|---|---|---|
| Science 2A | Science 2B | Science 2C |
| Mathematics 7 | Mathematics 8 | Mathematics 9 |
| Language 1 | Language 2 | Language 3 |
| Art 11A | Art 110A | Art 139 |
| Contemporary Issues | | |

*Comment:* Only an unusually well prepared student should think of attempting to begin a major in the first year. Here, the student, after demonstrating great skill in Art 11A, is admitted to Art 110A. It should be noted that the art courses listed here do *not* satisfy the humanities and fine arts requirement. Therefore the student following this program will need to take a three-course sequence in one of the humanities, such as literature, or one of the other arts, such as drama, sometime before graduation.

**The final combination** is appropriate to those students who are far more prepared in language and mathematics than most entering American colleges and universities. As a consequence of their training, such students have more free electives and can do more advanced work from the outset.

| Fall | Winter | Spring |
|---|---|---|
| Sociology 1 | Science 1A | Science 1B |
| National Cultures 1A | National Cultures 1B | National Cultures 1D |
| Mathematics 10A | Elective | Elective |
| Drama 1A | Drama 1B | Drama 1C |
| Contemporary Issues | | |

*Comment:* In this example, the student plans to do advanced work in the physical sciences and selects the sequence of Science 1A, 1B, etc. Thus he takes Sociology in the first term instead of a science-sequence course. His training in mathematics is so excellent that he gains admission to Mathematics 10A and demonstrates such understanding of the subject that he is considered to have fulfilled the mathematics requirement. As a consequence, he has at least two electives in his first year. He might wish to use them for more mathematics courses, since one of the advantages of good prior training is that one has greater freedom either to concentrate on those subjects that most interest him or to roam widely. This same student is so well prepared in Spanish that he can begin a national cultures sequence (ending with Mexican culture) at once.

There are, of course, many other possible combinations. In seeking the one which best suits him, an entering student needs to keep in mind that:

1. The science requirement must be fulfilled in the first two years, except that students choosing the Science 1A through 1F sequence take the last course sometime during the junior or senior year.
2. The mathematics requirement must be fulfilled by the end of the second year and it is usually good practice to complete it during the freshman year so that skills acquired in high school will not decline.
3. Those who need to take more language training should certainly begin it promptly.
4. Students should avoid aimless shopping around. The college grants freedom of choice in the assumption that it will be used to prepare a rational plan.

## Courses of Instruction

The courses here listed are those to be available in 1967-1968 to students of both John Muir College and Revelle College. (Unless otherwise indicated, however, courses offered in relation to the general education requirements of John Muir College will not be open to students of other colleges.) Many more courses will be added as the faculty of the college is enlarged and students entering UCSD in 1967 will soon be offered a far greater range of subjects than can be provided during the first year of operation.

## Courses to be Taken in Fulfillment of the General Education Requirement

I. *Interdisciplinary Courses*

**A. Courses related to the "Introduction to a Cultural Tradition" requirement:**

National Cultures 1A: Modern Spanish Culture I. Prerequisite: ability to read current Spanish and Mexican newspapers, general periodicals, and literary works at the level of the writings of the contemporary Spanish essayist, novelist, and dramatist Azorin (José Martínez Ruiz).

National Cultures 1B: Modern Spanish Culture II. Prerequisite: National Cultures 1A.

National Cultures 1C: Modern Spanish Culture III. Prerequisite: National Cultures 1B.

National Cultures 1A, 1B and 1C form a sequence of studies in the history, philosophy, literature, and cultural patterns of modern Spain. Much of the reading is in Spanish, and the level of language competence called for is gradually raised during the sequence. Occasional essays are assigned. Lectures and discussions—three hours a week. *Completion of the sequence fulfills the Introduction to a Cultural Tradition requirement.*

National Cultures 1D: Modern Mexican Culture. Prerequisites: National Cultures 1A and 1B. This course may be taken in place of National Cultures 1C to complete the sequence and fulfill the requirement by students especially interested in modern Mexican culture.

National Cultures 2A: Modern French Culture I. Prerequisite: ability to read current French newspapers, general periodicals, and literary works at the level of the writings of Albert Camus.

National Cultures 2B: Modern French Culture II. Prerequisite: National Cultures 2A.

National Cultures 2C: Modern French Culture III. Prerequisite: National Cultures 2B.

National Cultures 2A, 2B and 2C form a sequence of studies in the history, philosophy, literature, and cultural patterns of modern France. Much of the reading is in French, and the level of language competence called for is gradually raised during the sequence. Occasional essays are assigned. Lectures and discussions - three hours a week. *Completion of the sequence fulfills the Introduction to a Cultural Tradition requirement.*

[*Important note:* These seven National Cultures courses will be offered in 1967-1968 in the expectation that some freshmen entering John Muir College will have had enough training in Spanish or French to begin the sequences with-

out further preparation. Soon similar sequences calling for the use of other languages such as German, Italian, and Russian, will be developed and entering students planning to study these languages can look forward to using them to meet the "Introduction to a Cultural Tradition" requirement.]

**B. Courses related to the "Contemporary Issues" requirement:**

Contemporary Issues: A lecture course extending over two terms and treating social issues of the moment. The lectures will be supplemented by discussion meetings, reading in the Public Affairs Laboratory, and the preparation of occasional papers.

*To be taken during the Freshman year.* Students enrolled in a freshman seminar are exempted from the course but may attend the lectures if they wish.

Freshman Seminars on Contemporary Issues: Seminars directed by members of the UCSD faculty and visiting professors and treating in depth one contemporary issue or small group of related issues. Enrollments are limited to 15, and students must sign up for a seminar at the beginning of the academic year even though the seminar may not be offered until the second or third term. A list of the topics to be covered and the instructors will be available at the time of registration in the fall of 1967.

*Completion of either the lecture course or one of the seminars fulfills the "Contemporary Issues requirement."*

**C. Courses related to the Science requirement:**

Science 1A. Prerequisite: Mathematics 1 or 4. To be taken concurrently with Mathematics 2 or 5.

Science 1B. Prerequisite: Science 1A, Mathematics 2 or 5. To be taken concurrently with Mathematics 3 or 6.

Science 1C. Prerequisite: Science 1B, Mathematics 3 or 6.

Science 1D. Prerequisite: Science 1C.

Science 1E. Prerequisite: Science 1D.

Science 1F. The philosophical and social implications of modern science. Required of John Muir College students taking Science 1A through 1E to satisfy the science requirement. May be elected by other students. No prerequisite, but students taking the course will normally have completed Science 1A through 1E or the science sequence in the Revelle College general education program.

Science 1A through 1F make up an integrated sequence intended for students with a special interest in the sciences and those needing preparation for advanced courses in Applied Electrophysics, Chemistry, and other physical sciences. The first five courses should be completed by the end of the second year. Their exact nature is still to be determined as this bulletin is being prepared, but they will be similar to the Physical Science courses of Revelle College described on page 140. *Completion of the sequence Science 1A through 1F fulfills the science requirement of John Muir College.*

Science 2A. No prerequisites

Science 2B. Prerequisite: Science 2A

Science 2C. Prerequisite: Science 2B

Science 2D. Prerequisite: Science 2C

Science 2E. Prerequisite: Science 2D

Science 2A through 2E, together with either Science 3 or Science 4 (see be-

low), make up an integrated sequence intended for students who do not plan to do more specialized work in science. The exact nature of the first five courses is still to be determined as this bulletin is being prepared, but they will afford a comprehensive view of scientific methodology and of the major facts and concepts drawn from all areas of science, together with an exposure in depth to selected topics pertaining to the principal integrating themes of the sequence. No laboratory work is included in these courses. It is provided by Science 3 or 4.

Science 3: Special Laboratory Topic. A laboratory course in a limited sector of science to provide experience in laboratory methods of investigation. Examples of possible areas of concentration include: electronics, orbital motion, symmetry, the nature of the chemical bond, communication, vision and hearing, and fundamental particles. Prerequisite: Science 2E.

Science 4: Research Project. A laboratory inquiry into a problem area selected to provide meaningful approaches to unsolved questions. Emphasis will be upon the student's learning through personal investigation of a problem of his own choosing how to formulate questions, design experiments, collect data, and verify and interpret his results. Examples of areas in which problems might be sought are the feeding habits of local species, information storage and retrieval systems, temperature effects upon behavior, chromatography, and electronic circuits. Full-time laboratory space will be available to each student during the term. Exigencies of scheduling may necessitate a student's taking Science 4 before completion of Science 2A through 2E, but this will not impair the effectiveness of the course or make it more difficult for him.

*Completion of the sequence Science 2A through 2E plus either Science 3 or Science 4 fulfills the science requirement of John Muir College.*

II. *Departmental Courses*

Art 1A: The Nature of the Visual Arts, I.

Art 1B: The Nature of the Visual Arts, II. Prerequisite: Art 1A.

Art 1C: The Nature of the Visual Arts, III. Prerequisite: Art 1B.

A sequence of integrated courses on the fundamental aspects of the visual arts. Throughout the program, lectures, discussions, and reading on the nature of the plastic media and the organizing principles of visual forms will be supplemented by direct experience in drawing, painting, and modeling and by analysis of works of art from the present and earlier periods, especially when these are available for study in the university art gallery. Historical awareness and artistic sensibility will be developed simultaneously. These courses are intended primarily for students of John Muir College seeking to fulfill the Humanities and Fine Arts requirement, and they have first claim on places in the classes. Other students, including students from Revelle College, may elect the courses until the optimum class size is reached. Five hours a week divided between lectures and supervised studio work.

*Completion of the sequence fulfills the Humanities and Fine Arts requirement of John Muir College.*

Drama 1A: The Nature of Drama, I.

Drama 1B: The Nature of Drama, II. Prerequisite: Drama 1A.

Drama 1C: The Nature of Drama, III. Prerequisite: Drama 1B.

A sequence of integrated courses on the fundamental aspects of drama. The program begins with a study of the physical aspects of the theatre and dramatic

action and how they shape dramatic content, moves on to the literary study of dramatic texts within an historical and critical orientation, and concludes with a production which applies the students' acquired knowledge to problems of creation and performance. These courses are intended primarily for students of John Muir College seeking to fulfill the Humanities and Fine Arts requirement, and they have first claim on places in the classes. Other students, including students from Revelle College, may elect the courses until the optimum class size is reached. Three hours a week.

*Completion of the sequence fulfills the Humanities and Fine Arts requirement of John Muir College.*

Literature 1A: The Interpretation of Literature, I.

Literature 1B: The Interpretation of Literature, II. Prerequisite: Literature 1A.

Literature 1C: The Interpretation of Literature, III. Prerequisite: Literature 1B.

A sequence of integrated courses that may be taken to satisfy the Humanities and Fine Arts requirements of John Muir College.This course is designed to encourage students to become more responsive readers of literature.

Focusing on a relatively small number of works, the course will treat, in any given year, some of the major literary modes: for 1967-1968 the topic will be Ideas of Tragedy and Comedy. The course will be comparative in spirit, offering works from Greek, Latin, Spanish, German, French, and English literatures. The works will be studied in translation except where the special competence of the student permits study in the original. Taking as its premise the importance of close scrutiny, this course will emphasize problems of type and genre in the process of understanding and interpreting particular works and relating them to literary tradition.

Mathematics 1: Elements of Mathematical Analysis, I. Prerequisite: Two units of high school mathematics. Differentiation and integration of elementary algebraic functions; applications. Basic analytic geometry in the plane. Three lectures, two recitations.

Mathematics 2: Elements of Mathematical Analysis, II. Prerequisite: Mathematics 1. Analytic trigonometry. Differentiation and integration of trigonometric functions; the logarithm and exponential function. Three lectures, one recitation.

Mathematics 3: Elements of Mathematical Analysis, III. Prerequisite: Mathematics 2. Definite integral and its applications, elements of linear algebra. Three lectures, one recitation.

*Mathematics 1, 2, and 3 constitute a sequence that may be taken to fulfill the mathematics requirement by less advanced students who plan to major in a physical science.*

Mathematics 4: Calculus and Analytic Geometry, I. Prerequisite: Three or more units of high school mathematics; in addition, one-half unit of trigonometry is desirable. Differential and integral calculus of functions of one variable: limit, continuity; differentiation of algebraic and trigonometric functions; applications. Definite integral, primitive function, fundamental theorem of the calculus. Elements of analytic geometry as needed in the development of the calculus. Three lectures, two recitations.

Mathematics 5: Calculus and Analytic Geometry, II. Prerequisite: Mathematics 4. Continuation of calculus of functions of one variable: differentiation and integration of logarithms, exponential functions, Taylor's formula. Parametric representation. Applications of integration. Elements of linear algebra; analytic geometry in 3 space. Three lectures, one recitation.

Mathematics 6: Calculus and Analytic Geometry, III. Prerequisite, Mathematics 5. Calculus of functions of several variables: partial differentiation; directional derivative; total differentiation; maxima and minima of functions of several variables, Lagrange multipliers; multiple integration. Three lectures, one recitation.

Students are directed to either Mathematics 1, 2, and 3 or 4, 5, and 6 after consultation with representatives of the Mathematics Department. *Mathematics 4, 5, and 6 constitute a sequence that may be taken to fulfill the mathematics requirement by more advanced students who plan to major in a physical science.*

Mathematics 7: Introduction to Mathematics, I.

Mathematics 8: Introduction to Mathematics, II. Prerequisite: Mathematics 7.

Mathematics 9: Introduction to Mathematics, III. Prerequisite: Mathematics 8.

Among the topics covered in these three courses during the year are:

The Number System (Natural numbers, rational numbers, irrational numbers)

Elements of Number Theory (Primes, factorization, Euclidean algorithm, diophantine problems)

Concept of Limit and Basic Concepts of Calculus

Elements of Probability

Axiomatic Method in Algebra and Geometry

Elements of Topology

Elements of Set Theory

*Mathematics 7, 8, and 9 constitute a sequence that may be taken to fulfill the mathematics requirement by students who will not use mathematics as a tool in further work.*

Mathematics 10A: Topics in Mathematics. Computer Sciences. Numerical algorithms, algorithms for games; computing machines with automatic control programs; Turing machines; fundamentals of Fortran computations.

Mathematics 10B: Topics in Mathematics. Probability and Statistics. Probability, problems concerning random walks on an infinite line, random walks with finitely many states, random walks with infinitely many states. Sample surveys, simple random sampling; estimation of sample size.

Mathematics 10C: Topics in Mathematics. Elementary Topology. Theory of graphs, bridge problems. Knots; braids. Polyhedra in three-space and Euler formula, orientability, Möbius strips, coloring problems. Tiling problems for the plane. Surfaces in three-space with self-intersections.

The "Topics in Mathematics" courses are recommended primarily for well motivated and well prepared students. During each term at least one "Topics" course (and possibly more than one) will be offered. The three listed above are representative of the many such courses that might be developed. Other topics

that have been suggested are:

Groups in Geometry
Theory of Games
Elementary Logic and Set Theory
Elementary Number Theory
Projective Geometry

*A student who has passed three topics courses will have fulfilled the mathematics requirement.* Students initially enrolled in the Mathematics 1, 2, and 3 sequence or in the 4, 5, and 6 sequence can transfer to the "Topics" program after the first or second term if they show sufficient aptitude and fulfill the requirement in that way.

Music 1A: The Nature of Music, I.

Music 1B: The Nature of Music, II. Prerequisite: Music 1A.

Music 1C: The Nature of Music, III. Prerequisite: Music 1B.

Students begin by organizing sound and silence into aural forms by means of tape recording using various sound sources, electronic and live, the latter including percussion instruments. Students also participate in improvising ensembles with their colleagues using instruments not necessarily demanding specialized performing techniques.

The courses are intended primarily for students of John Muir College seeking to fulfill the Humanities and Fine Arts requirement, and they have first claim on places in the classes. Other students, including students from Revelle College, may elect the courses until the optimum class size is reached. Three hours a week.

*Completion of the sequence fulfills the Humanities and Fine Arts requirement of John Muir College.*

## Courses Not Related to the General Education Requirements

### Anthropology

A Department of Anthropology is being formed. Courses available in 1967-1968 will be announced later.

### Applied Electrophysics

The major in Applied Electrophysics is designed as an introductory educational experience for students interested in applying physics and mathematics in science and engineering, and particularly in the electrical and electronic aspects of science and engineering. Electronic engineering is an area of human activity where dramatic developments have been and are likely to continue occurring from time to time. Future developments may have little to do with well-established technology but will certainly be based on well-established laws of physics and mathematics. To understand and exploit future technological breakthroughs, individuals need to develop their minds as students by adequate study of physics and mathematics, and to use this mental experience to follow relevant developments as they subsequently occur. The major in Applied Electrophysics is designed to launch students interested in electrical and electronic applications of physics and mathematics on an educational program that will enable them to survive a lifetime of exposure to new developments.

It is planned to provide two options, an applied physics option for students interested more in applications of physics, and an information and computer sciences option for students interested more in applications of mathematics. In the junior year both options will involve courses in mechanics, electromagnetism, electronics, differential equations and complex variables. In the senior year the applied physics option will include courses in quantum and statistical physics, together with elective courses in solid state physics, quantum electronics and space-oriented topics. The senior year program in the information and computer sciences option will be concerned with system theory, information theory, communication theory, electronic computers, data processing and numerical analysis. Specific course titles and descriptions will be given at a later time.

To enter either option in Applied Electrophysics students must have obtained satisfactory grades in Science 1A, 1B, 1C, 1D, 1E and Mathematics 4, 5 and 6. They will also be required to have passed the following courses in Mathematics: Mathematics 100 (Infinite series and differential equations), Mathematics 101 (Vector Calculus and matrices), and a course in probability.

### Biology

The Biology program of John Muir College is still being developed. A description of courses offered and of the form of the Biology major program to be offered in the college will be announced later. It is foreseen that the following courses offered in Revelle College will be part of the program:

Biology 101. Biology of Organisms, I.

Biology 102. Biology of Organisms, II. Prerequisite: Biology 101.

Biology 103. Biology of Organisms, III. Prerequisite: Biology 102.

Biology 113. Population Biology and Evolution. Prerequisite: Biology 103.

Additional electives to be added will emphasize genetics, behavior, evolution and population biology. These courses, combined with the core courses in Biology offered in Revelle College, will enable students of John Muir College to pursue a biology major. They may also be meaningfully combined with courses in Psychology, Anthropology and Sociology to form interdisciplinary major programs or areas of concentration for students not taking a major program.

### Drama

A program of courses in the drama is being developed. Three courses, described on page 168, will be offered in 1967-1968 for students electing to study drama as a means of fulfilling the Humanities and Fine Arts requirement of the college. Other courses may be offered. Though some of these will include technical study of stagecraft, as this bulletin is being prepared there are no plans for technical courses of a pre-professional or professional character. Rather, drama will be studied as one of the liberal arts. Students will be encouraged to participate in presenting plays as a rewarding extra-curricular activity and the facilities of the drama program will, as far as possible, be made available to drama groups. Those aspiring to a professional career in drama are urged to take a general undergraduate program with an emphasis on liberal education and to defer until after graduation intensive concentration on drama. The theatre being built by the university and the Theatre Arts Foundation of San Diego, scheduled to open in 1969 on a site just south of the UCSD campus, will

probably offer opportunities for advanced technical training during the summer and after graduation.

## History

Admission to upper division courses in history will depend solely upon completion of the normal lower division requirements of John Muir College and Revelle College. However, the material of History 1A, 1B, and 1C, the John Muir College Cultural Traditions Sequences and the Revelle College Humanities Sequence, and of lower division social science courses will be particularly important as preparation for upper division work. Also, for many courses in Ancient, Medieval, and Modern European History a fluent reading knowledge of at least one foreign language will be highly desirable.

**American History and Institutions Requirement**

This requirement may be met by a passing grade in History 161, 164, or 165. In particular cases it may also be met by an examination to be arranged with Professor Tanikawa.

**Major Program**

The history major will consist of twelve upper division courses in history. Of these, at least six and preferably nine should be chosen from among the three-term sequences available in Ancient (104-106), Medieval (111-113), British (131-133), or Russian (145-147) History. The remaining courses may be freely elected from the offerings listed below. In most cases a history major will be expected to do considerable reading in a foreign language.

**Courses:**

Three courses, History 1A, 1B, and 1C, may be taken to fulfill the John Muir College Humanities and Fine Arts requirement.

Muir College Humanities and Fine Arts requirement are described above on page

History 104: The Mediterranean World in the Bronze Age. Special emphasis on the development of Minoan and Mycenaean Civilization, with the use of materials from archaeology and art history as well as standard history readings. Three hours a week.

History 105: Greece in the Classical Age. Comparison and contrast of the main political, economic, and social institutions of the leading city states in the 5th and 4th centuries B.C. Three hours a week.

History 106: The Hellenistic Monarchies. The extension of Greek Civilization throughout the eastern Mediterranean World under Alexander the Great and his successors. The cultural background of Christianity. Three hours weekly.

History 111: The Rise of Europe, I.

History 112: The Rise of Europe, II.

History 113: The Rise of Europe, III.

Taken together these three courses cover the development of European society from the decline of the Roman Empire to the close of the 15th century. Each course meets three times weekly.

History 121: World History of the Last Century, I.

History 122: World History of the Last Century, II.

Taken together these two courses cover the origins of the contemporary world with balanced emphasis on non-European as well as Western history.

Each course meets three times weekly.

History 131: The British Empire Since 1783, I.

History 132: The British Empire Since 1783, II.

History 133: The British Empire Since 1783, III.

Together these three courses cover the political and economic development of the British Empire, including the evolution of colonial nationalism. The development of the Commonwealth idea, a survey of Canada, and changes in British colonial policy. Each course meets three times weekly.

History 141: The French Revolution. The background and political development of the revolutionary decade 1789-1799. Emphasis on intellectual and social origins of the revolutionary leadership, and on the major interpretations of the revolution by Aulard, Mathiez, and Lefebvre. Three times weekly.

History 145: Russia, 1533 to 1800. A survey of the development of Russian society and thought from Ivan the Terrible to Alexander I. Emphasis will be placed on the Westernization of Russia. Three weekly meetings.

History 146: Russia, 1800-1914. An examination of Russia's last century, with special emphasis on currents of social thought and the revolutionary movement. Three times weekly.

History 147: Russia, 1914 to Present. The Russian Revolution, and the transformation of Russia under the Soviet Regime. Domestic and Foreign Policies will be considered. Three weekly meetings.

History 150: Europe in the 19th Century. Europe from the Vienna Settlement of 1815 to the outbreak of the First World War. Emphasis on industrialization, nationalism, and the major artistic and scientific developments of the 19th Century. Three weekly meetings.

History 161: The Emergence of Modern America. Social and political history of the United States from Reconstruction to the First World War. The impact of industrialization, immigration, growth of cities, and movements for reform. Three weekly meetings.

History 164: American Intellectual History, to 1860. From colonial times through the pre-Civil War period. European origins and the development of political, social, economic and religious thought in the American context. Emphasis on principal thinkers and ideas, with some reference to the general historical background and values. Three weekly meetings.

History 165: American Intellectual History, from 1860. American thought in post-Civil War period, and some major trends in social, economic, political and religious thought of the 20th century. Developments in American philosophy, the social sciences, and literature. Three weekly meetings.

History 199: Independent Study for Undergraduates. Independent reading in history by individual students. Prerequisite: consent of instructor.

*Note:* Not all courses listed above will be offered during 1967-1968. Those to be given will be announced later.

### Language

In the description of the General Education requirements of John Muir College it was pointed out that though the college has no foreign language requirement

as such, there is the requirement that each student complete before graduation a three-course sequence on the cultural traditions of a foreign nation. This necessitates the ability to read ordinary material – *e.g.*, newspapers and rather simply written literature – in a foreign language.

Students already able to read ordinary material can enter one of these three-course sequences without further language study. Those unable to do so must take as many courses as needed to attain such proficiency. Normally these courses would be begun in the freshman year so that any proficiency already achieved would not be lost. Students who have had the usual high school preparation in language will probably require about a year of course work to prepare for the cultural traditions sequence, but some students will take less time and some more, because of differences in ability, industry, and previous language work. To enable the student to attain the necessary proficiency, John Muir College offers three special kinds of aid in its language courses:

(1) The most advanced self-instructional materials and equipment available in this country, which the student can use to advance his proficiency at his own optimum speed.

(2) A program of small tutorial classes, conducted by native-speaking tutors. A student's assignment to a new tutorial class will be a measure of his increased proficiency; the classes will be recomposed weekly to maintain homogeneity of class membership, permitting each class to be conducted at the highest level possible for each of its members.

(3) Instruction by linguistic scientists about language and the learning of languages. This instruction is intended to serve the broad aims of general education as well as to assist the student in his own language study.

The course sequences numbered 1A, B, C are designed partly to aid the student preparing for a cultural traditions sequence, but partly also to increase his general understanding of the nature of language itself and of the civilization in which that language is used. Some students who begin their study of the language at UCSD will be able to achieve the necessary proficiency at the end of the 1A, B, C sequence; a student who has not done so may continue in the 2A, B, C sequence for as many quarters (up to a maximum of three) as he requires. A student who has studied the language for two or more years in high school (or the equivalent elsewhere) is not permitted to enroll in the 1A, B, C sequence; instead he normally enrolls each quarter (to a maximum of three) in the 2A, B, C sequence until he reaches the required level of proficiency.

Every course in the 1A, B, C and 2A, B, C sequences is comprised each week of 3 scheduled hours of tutorial classes with a native speaker of the language, 3 unscheduled hours of laboratory, 1-2 scheduled hours of conference classes with a linguist, and 3-6 hours of assigned homework. A student's tutorial section is reassigned to him weekly on the basis of his relative progress through the course; his assignment to a conference class is determined by his section assignment.

The non-credit workshop sequences numbered 11A, B, C and 12A, B, C are intended for Upper Division and Graduate Division students preparing to meet degree requirements for reading proficiency.

Sequences are offered in these languages: French, German, and Russian.

### Linguistics

In 1967-1968 the Department of Linguistics plans to offer no major program. However, qualified students interested in linguistics will be allowed to take the following basic courses.

100. General Linguistics: An introduction to the study of language. The analytical and descriptive methods and devices of general linguistics. Phonological, morphological and syntactic systems. Comparative and historical linguistics, psycholinguistics, anthropological linguistics, and their relationships to general linguistics. Three hours lecture, two hours discussion, seven hours reading and exercises.

101. Syntax and Morphology: The syntax and morphology of natural languages and the relationship between grammatical and semantic structures will be examined. Three hours lecture, two hours discussion, seven hours reading and exercises. Prerequisite: Linguistics 100.

102. Phonology: The phonological structure of a number of natural languages will be examined. The role of a phonological description in the overall description of a natural language, and the relationship between phonological units and syntactic and morphological units. Three hours lecture, two hours discussion, seven hours reading and exercises. Prerequisite: Linguistics 100.

199. Independent Study for Undergraduates: Independent reading in linguistics by individual students. Prerequisite: consent of department.

### Literature

The Department of Literature is represented in both John Muir College and Revelle College and students will be able to pursue major programs in literature in either college. The exact apportioning of courses between the colleges is still to be determined, but students in John Muir College are assured that a varied and extensive list of courses will be offered in that college beginning in 1967-1968. Among these will be a group of introductory courses in which important works of post-medieval Western literature will be studied by genre: the novel, the drama, and lyric poetry.

### Mathematics

The Department of Mathematics is housed in John Muir College, though its members are divided between the faculties of that college and Revelle College. Beginning in 1967-1968, the department will offer upper division courses and major programs in both colleges; the upper division courses presently listed in the curriculum of Revelle College will also be available to John Muir College students when they are ready for them. The exact apportioning of courses between the colleges is still to be determined.

### Music

The Music Department has been formed, but as this bulletin is being prepared the courses to be offered in 1967-1968 have not been finally determined nor has the character of the major program been established. In general it may be said that the approach to music will stress the importance of the art in contemporary culture and a liberal arts education. No credit will be given for instruction in the techniques of singing or playing an instrument, though the

department will arrange for such instruction for students who wish to maintain or advance their skills. On the other hand credit can be earned by participation in certain music ensembles wherein the ability to perform is a means to the study of the literature of music. (See the discussion of 130 series of courses below.) The undergraduate music courses are not pre-professional or professional in nature, and students planning to pursue careers in music should look forward to obtaining their intensive vocational training at the graduate level.

Students planning to major in music should be able to read music and play the piano to the extent of demonstrating that reading ability. They should be able to demonstrate basic aural skills through the processes of sight singing and aural dictation. Those judged to be deficient in elementary musicianship will be required to repair that deficiency. Accordingly, Music 3 will be available to all entering music majors so judged.

Once admitted to the music major program, students are expected to participate for no fewer than three terms in a performing ensemble for which credit is given. (See the 130 series below.)

Three courses listed on page 171 will be offered in 1967-1968 to students electing to satisfy the Humanities and Fine Arts requirement of John Muir College by studying music.

A considerably wider range of courses in music will be available in 1967-1968 determined and taught by a distinguished core faculty. The program will develop new and, in some cases, experimental courses in music learning. The program will insist that the study of music can not be separated from the making of music and those aspects of music learning that have been separated from each other in the traditional curriculum (performance, composing, analysis and history among others) will be integrated inside the individual course offerings. The aim of the music program is to develop in every student according to his motivating interests a well-rounded, experienced and knowledgeable musicianship.

### Psychology

Students majoring in Psychology are expected to develop a broad knowledge of contemporary psychology, as well as special skills in selected areas. Each student will be expected to conduct a senior research project. Those interested in areas of psychology requiring more advanced technical knowledge than that provided in the General Education requirements are advised to take Mathematics 130, or its equivalent in their sophomore year, or later. Students of John Muir College who plan to major in Psychology may take any one of the three sequences offered for fulfillment of the Mathematics requirement (Mathematics 1-2-3, or 4-5-6, or 7-8-9 [see pages 169 and 170 above]) depending on their preparation. In addition, Psychology majors normally will be expected to take an additional three quarters of Mathematics. These courses should be arranged in consultation with the Department of Psychology.

A Psychology major will be expected to take 15 courses in Psychology and related subjects. Psychology 101, 102, and 103; Psychology 104 and 105 are required. In addition, students majoring in Psychology are required to take at least two courses from among Psychology 130-139 and one course from Psychology 140-149. The selection of these three courses will be determined in

consultation with the departmental adviser. The following sequences are indicated as examples of possible choices: 130, 132, 143; 131, 133, 141 and/or 142; 133, 134, 140. Seniors will take two course equivalents in individual research. Selected students in the senior year will be permitted to take two basic seminars from the graduate offerings in the Department (Psychology 202-219). All students will take at least three electives from the following list of courses: Linguistics 100, 101, 102; Mathematics 100, 101, 102, 131, 132; Philosophy 10, 12, 110.

## CURRICULUM

### Junior Year

**Fall Quarter:**
Psychology 101
Elective
Elective
Elective

**Winter Quarter:**
Psychology 102
Psychology 104
Elective
Elective

**Spring Quarter:**
Psychology 103
Psychology 105
Elective
Elective

### Senior Year

**Fall Quarter:**
Psychology 130-139 (2 courses)
Elective in Psychology or Graduate seminar
Elective

**Winter Quarter:**
Psychology 140-149 (1 course)
Psychology 199
Elective
Elective

**Spring Quarter:**
Psychology 199
Psychology 198
Elective in Psychology or Graduate seminar
Elective

## COURSES

### Lower Division

Psychology 10: Developmental Psychology. An introduction to the psychological development of the human organism with special reference to cognitive development in the child. Three hours lecture per week.

Psychology 11: Human Learning. An introduction to basic principles of human learning and information processing. Three hours lecture per week.

Psychology 12: Human Communication. An overview of the human organism as an information processing system. Three hours lecture per week.

### Upper Division

Psychology 101: Experimental Psychology. An introduction to the investigation of animal and human behavior. Emphasis is given to the problems in animal and human learning, perception, and information processing. Two hours lecture, four hours laboratory.

Psychology 102: Experimental Psychology. A continuation of Psychology 101. Two hours lecture, four hours laboratory.

Psychology 103: Experimental Psychology. A continuation of Psychology 102.

Psychology 104: Quantitative Method in psychological investigation. Three hours lecture.

Psychology 105: Quantitative Methods. A continuation of Psychology 104. Three hours lecture.

Psychology 130: Physiological Psychology. The role of physiological mechanism with particular reference to the central nervous system. Three hours lecture. Prerequisite: Psychology 101, 102, 103.

Psychology 131: Developmental Psychology. The investigation of learning, thinking, and emotion as a function of normal development. Three hours lecture.

Psychology 132: Emotion and Motivation. Current theories and data. Three hours lecture.

Psychology 133: Thought and judgment. An introduction to complex thought processes in man. Three hours lecture.

Psychology 134: Social Psychology. A survey of social variables that affect individual behavior. Three hours lecture.

Psychology 140: Psychophysics. An introduction to the problem and methods of Psychophysics. Two hours lecture, two hours laboratory.

Psychology 141: Verbal Behavior. Problems in the acquisition and use of language and verbal behavior. Two hours lecture, two hours laboratory.

Psychology 142: Perception. A presentation of current knowledge in visual and auditory perception. Two hours lecture, two hours laboratory.

Psychology 143: Learning and Performance. Basic learning phenomena with special reference to classical and operant conditioning. Two hours lecture, two hours laboratory.

Psychology 198: Senior Seminar. A seminar in selected advanced topics of current research interest. Two hours lecture.

Psychology 199: Individual Project. Independent research or reading on a selected problem under supervision of a faculty member.

*Note:* Unless otherwise indicated, Psychology 101, 102, 103, and Psychology 104 and 105 are prerequisites for all other Upper Division courses.

### Sociology

A Department of Sociology is being formed. Courses available in 1967-1968 will be announced later.

### Visual Arts

The Visual Arts Department has been formed, but as this bulletin is being prepared the courses to be offered in 1967-1968 have not been fully determined. It appears unlikely that the staff will be large enough to permit offering a major for Revelle College students during that year. However, students entering John Muir College as freshmen can anticipate that a fully formed major program will be available to them by the time they are juniors. There will also be more courses in the history of the visual arts.

The approach to the visual arts will stress their importance in contemporary culture and a liberal arts education. The undergraduate courses are not preprofessional or professional in nature, and students planning to pursue careers in the visual arts should look forward to obtaining their intensive vocational training at the graduate level.

The courses to be offered in 1967-1968 will include Art 1A, 1B and 1C described above on page 168, which may be taken to satisfy the Humanities and Fine Arts requirement of John Muir College, and probably the following:

Art 2: Basic drawing. Freehand drawing problems using pencil, pen, and other instruments to develop accurate observation and skill in representation. Three two-hour meetings a week with four additional hours of unsupervised drawing.

Art 10: Life Drawing. Drawing from the figure. Three two-hour meetings a week with four hours of additional unsupervised drawing. Prerequisite: Art 2.

Art 11A: Elements of Painting. Basic instruction in painting in oils, acrylic pigments, and other media. Still life problems. Two two-hour meetings a week with six hours of additional studio work or reading. Prerequisite: Art 2.

Art 11B: Intermediate Painting. A continuation of Art 11A. Two two-hour meetings a week with six hours of additional studio work or reading. Prerequisite: Art 11A.

Art 12A: Elements of Sculpture. Basic instruction in sculpture with studio exercises using clay, wood, metal, plaster, and other materials. Two two-hour meetings a week with six hours of additional studio work or reading. Prerequisite: Art 2.

Art 12B: Intermediate Sculpture. A continuation of Art 12A. Two two-hour meetings a week with six hours of additional studio work or reading. Prerequisite: Art 12A.

Art 110A: Advanced Drawing and Painting, I. The various courses in advanced drawing and painting differ in content, use of materials, and type of subject matter, depending upon the individual aims of the instructors in charge. Some of the artists will be distinguished visitors from outside the university. The course will consist of four hours of supervised work each week with much additional time spent in the studio without supervision. Prerequisite: Art 11B. *With the consent of the instructor may be repeated.*

Art 110B: Advanced Drawing and Painting, II. Similar to Art 110A. *With consent of the instructor may be repeated.*

Art 110C: Advanced Drawing and Painting, III. Similar to Art 110A and 110B. *With consent of the instructor may be repeated.*

Art 111A: Advanced Sculpture. The various courses in advanced sculpture differ in content, subject matter, and materials: Clay, cast bronze, welded metals, stone, and so forth. The nature of the courses is determined by the artists in charge, who may be distinguished visitors from outside the university. The course will consist of four hours of supervised work each week with much additional time spent in the studio without supervision. Prerequisite: Art 12B. *With the consent of the instructor may be repeated.*

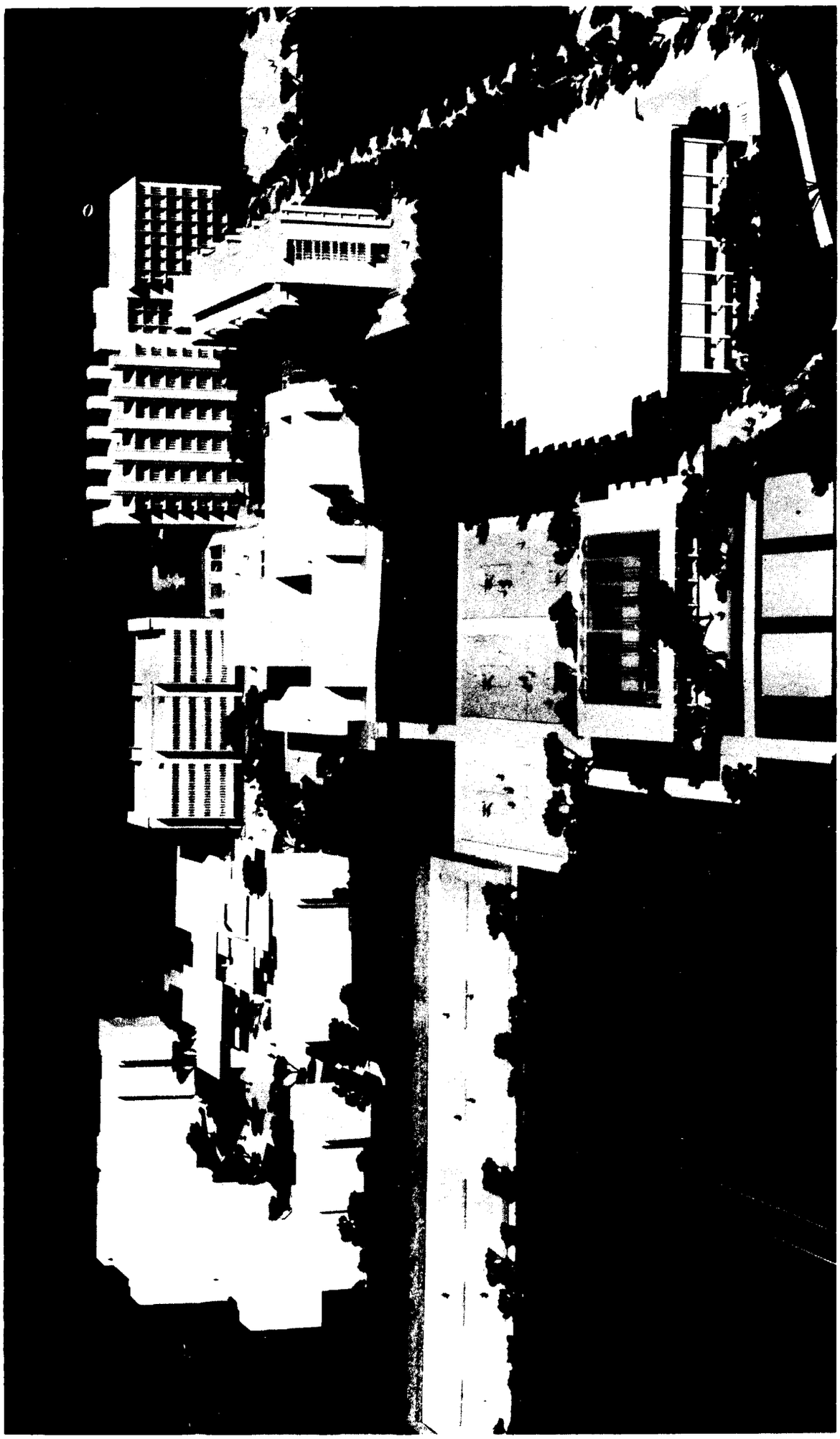
Art 111B: Advanced Sculpture, II: Similar to Art 111A. *With the consent of the instructor may be repeated.*

Art 111C: Advanced Sculpture, III. Similar to Art 111A and 111B. *With the consent of the instructor may be repeated.*

Art 138: Art of the Nineteenth Century. European painting from the French Revolution to the beginning of the Twentieth Century. Special attention is given to the Impressionists and Post-Impressionists. Three meetings a week.

Art 139: Modern Art. From Cubism through Abstract Expressionism. Three meetings a week.

Art 199: Special Studies in the Visual Arts. Independent reading, research, or creative work under the direction of a faculty member.



Architects model of John Muir College scheduled for occupancy beginning 1968

# General Information for Students

## STUDENT ACTIVITIES

University students learn not only from their work in the classroom but also by participation in organized extracurricular activities. Through participation the student has much opportunity for character growth and personality development. At UCSD you will find various student groups and activities covering a wide range of interests and offering experience in student government, community services, social clubs, and intramural athletics.

The University sponsors many student groups usually affiliated with one or more of the academic departments but the largest number of activities will, in the future development of UCSD, fall under the direction of the Associated Students of the University of California, San Diego – ASUCSD.

No matter what the student's interests and abilities may be, he should have no trouble in finding a group with which to work and relax in spare time. The University strongly believes that extracurricular activities should be an integral part of college life and that they are beneficial in obtaining a well-rounded education.

## FEES AND EXPENSES

The exact cost for a student to attend the University of California, San Diego, will vary according to personal tastes and financial resources of the individual. Generally the total expense for three quarters or a college year will average about $1,710 for residents of California and $2,700 for nonresidents.

It is possible to live simply and to participate moderately in the life of the student community on a limited budget. The best that the University authorities can do to assist the student in planning his budget is to indicate certain and probable expenses.

### Incidental Fee

The incidental fee is $73.00 each quarter for graduates and undergraduates. This fee, which must be paid at the time of registration, covers certain expenses for use of library books, for recreational facilities and equipment, for registration and graduation, for all laboratory and course fees, and for such consultation, medical advice, and hospital care or dispensary treatment as can be furnished by the Student Health Service or furnished by health and accident insurance purchased by the University. No part of this fee is refunded to students who do not make use of these privileges. For undergraduate students, there is an additional Associated Students' fee of $2.50 each quarter.

## Reduced Incidental Fee

One-half of the established incidental fee may be paid by:

1. Graduate students whose research or study requires them to remain outside the State of California throughout the quarter. Authorization for this privilege is secured from the Vice Chancellor-Graduate Studies.
2. Graduate students who are full-time non-academic employees of the University as provided for in Personnel Rules, Rule 19, June 1, 1958. Authorization for this privilege is secured from the Personnel Manager.

## Miscellaneous Expenses

Books and stationery for a student average about $40.00 per quarter. Exact information on these items may be obtained by writing directly to the school or department. Students who fail to pass the required examination in Subject A must pay a fee of $45.00 for the course in Subject A.

## Parking Fee

A parking fee is required of students who park cars on the campus.

## Tuition

Tuition is free to every student who has been a legal resident of the State of California for a period of more than one year immediately preceding the opening day of the quarter during which he proposes to enroll. Every student who has not been a legal resident of the state for said period is classified as a nonresident and is subject to payment of a nonresident tuition fee. A student entering the University for the first time should read carefully the rules governing the determination of residence as quoted below so that he may be prepared in the event of nonresident classification to pay the required tuition fee. Every entering student and every student returning to the University after an absence is required to make a statement as to residence on the day of registration upon a form that will be provided for that purpose and his status with respect to residence will be determined soon after registration by the Attorney in Residence Matters.

The eligibility of a student to register as a resident may be determined only by the Attorney in Residence Matters. If the student is in doubt about his residence status, he may communicate with the Attorney in Residence Matters at 590 University Hall, University of California, Berkeley 94720.

Students classified as nonresidents are required to pay a tuition fee of $327 each quarter. This fee is in addition to the incidental fee. (Exemption from payment of the nonresident tuition fee may be granted to an unmarried minor whose parent is in the active military service of the United States and is stationed in California on the opening day of the quarter during which the minor proposes to attend the University or to an unmarried minor child or spouse of a member of the University faculty.) Graduate students may have part or all of the nonresident tuition fee waived under certain conditions set forth in the section titled *Waiver of the Nonresident Tuition Fee.*

## Nonresident Fee For Reduced Programs

For the undergraduate student enrolled in less than three courses, the nonresident tuition fee is $112 per course or the proportionate part for a fractional course. For graduate students the nonresident tuition is $327 per quarter regardless of the number of courses undertaken. There is no reduction in incidental, or ASUCSD fees.

## Waiver of the Nonresident Tuition Fee

The following policy with regard to tuition waivers is subject to revision in the event that adequate funds are not available.

Graduate students who are admitted without deficiencies, who have proved that their scholarship is distinguished, and who are carrying full programs toward the fulfillment of requirements for higher academic or professional degrees, may apply for waiver of the nonresident tuition fee.

The waiver is granted only on the basis of distinguished scholarship as a recognition of academic excellence. It is not granted on the basis of need and is not to be considered a grant-in-aid. The privilege may be revoked at any time at the discretion of the Vice Chancellor-Graduate Studies if, in his judgment, a student fails to maintain distinguished scholarship or if he fails to make satisfactory progress toward a degree.

Students who wish to obtain this privilege should apply for the waiver at the time of application for admission to the Graduate Division. If the application for fee waiver is approved, the student will be notified by mail, time permitting; otherwise, he should inquire at the Office of the Registrar prior to his registration. Students will be charged the full fees at the time of registration unless they have followed this procedure and have received a notice that the fee has been waived prior to their registration date. Re-entering and continuing students should also observe these time limits and procedures if they are applying for waivers. No assurance can be given students who apply for waivers during the registration period that action will be taken prior to their registration date. They must be prepared to register on time and to pay the full fees. If their waiver requests are approved after they have registered, a refund of the nonresident tuition fee will be arranged. Students are also reminded that the waiver is granted for only one quarter at a time and that new application has to be made for it each quarter. Students exempted from payment of the nonresident tuition fee are still required to pay the incidental fee.

Subject to funding restrictions, the nonresident tuition fee may be waived for all graduate students who have been appointed to a Teaching Assistantship, a Teaching Fellowship or a University Fellowship under the jurisdiction of the Graduate Council and paid from intramural funds.

The nonresident tuition fee may not be waived for graduate students registering for thesis only or for students taking a reduced program because of employment or health. Authorization for waiver of the nonresident fee on the basis of scholarship is secured from the Vice Chancellor-Graduate Studies.

## Waiver of the Nonresident Tuition Fee for Foreign Students

The following policy with regard to tuition waivers for foreign students is subject to revision in the event that adequate funds are not available.

Nonresident students who enter the University from institutions of higher learning outside the United States are required to pay full tuition fees for the year in the amount of $980, payable at $327 each quarter. At the end of the first year of residence, students who achieve a distinguished academic record in a full program of study leading to a higher degree may petition to have their nonresident tuition fee remitted. Subsequent remission of the nonresident tuition fee is granted on a quarterly basis and a petition for remission must be made for it each quarter. The incidental fee is never remitted. Authorization for waiver of the nonresident fee for foreign students on the basis of scholarship is secured from the Vice Chancellor-Graduate Studies.

# SCHOLARSHIPS AND LOANS

## Scholarships

Undergraduate scholarship awards are made annually to students whose eligibility is based on academic achievement, character and promise and, except for the Regents Scholarships, on financial need. The amount of the stipend in each case is based on need, which is determined according to criteria established by the College Scholarship Service. Information and application forms for the next academic year are available in the Office of the Dean of Student Affairs in November, and must be filed not later than the following February 15.

## Fellowships

Graduate Fellowships are available in certain departments and will be announced from time to time.

Among these are the Kennecott Copper Corporation and Lockheed Leadership Fund Fellowships in Oceanography; the Department of Health, Education and Welfare National Defense Education Act Fellowships; both the Cooperative and Regular Graduate Fellowships of the National Science Foundation; the U.S. Bureau of Commercial Fisheries Fellowships in Oceanography and Marine Biology; the U.S. Public Health Service Fellowships and The Regents Fellowships. National Science Foundation and National Aeronautics and Space Administration Traineeships are available in the fields of aerospace and mechanical engineering sciences, applied electrophysics, biology, chemistry, earth sciences, marine biology, mathematics, oceanography, philosophy, physics and psychology.

All departments on the campus encourage applications for post-doctoral appointments. Opportunities for such appointments vary from time to time.

## Research Assistantships

There are a limited number of Research Assistantships for properly qualified students, with stipends beginning at $243 monthly for half-time service to an individual or a department. An assistant must be in regular graduate status, in full-time residence and in good scholarship standing. Application may be made to the departments but does not constitute an application for admission, which is a separate process.

## Teaching Assistantships

There are a limited number of Teaching Assistantships for properly qualified students, with stipends beginning at $305 monthly for half-time service to an individual or a department. A teaching assistant must be in regular graduate status, in full-time residence and in good scholarship standing. Application may be made to the departments but does not constitute an application for admission, which is a separate process.

## Loans

All loans for both graduate and undergraduate students are initiated in the Office of Dean of Student Affairs. A few individuals and organizations have made contributions to student loan funds. These are administered by the University according to the wishes of the donors and are not usually available during the first quarter of residence. Regularly enrolled students or applicants for admission to the University, who are United States citizens or permanent residents of the United States, are eligible to apply for National Defense Education Act student loans. The maximum loan that any undergraduate student may obtain is $1,000 for one academic year, and the total that any undergraduate student may borrow under this program is $5,000. A recent amendment of the National Defense Student Loan Program provides that graduate and professional students may now borrow a total of $2,500 per academic year and a maximum of $10,000 during their entire academic career. However, where demand exceeds funds available on any campus, loans may be granted on a competitive basis and their size restricted. Special consideration is given to students with a superior academic background regardless of major.

## Veterans Affairs

Information regarding educational benefits available from the State of California (CVEI) may be obtained from the State Department of Veteran Affairs, P.O. Box 1559, Sacramento, California 95807; or by writing either to room 225, 542 South Broadway, Los Angeles, California 90013 or 515 Van Ness Avenue, San Francisco, California 94102.

Students wishing to enroll under the provisions of Public Law 634 (War Orphans Education Act) should obtain from the United States Veterans Administration a Certificate for Education and Training, which should be filed with the Office of the Dean of Student Affairs. These students must be prepared to pay all fees and educational costs at the time of registration as education and training allowances are paid by the Veterans Administration and the first monthly payment will normally be received 60 to 75 days after enrollment in the institution.

Information on Selective Service and draft status may be had from the Office of the Dean of Student Affairs.

## Employment

Many students who attend the University expect to earn a part of their expenses. However, the undergraduate curricula are organized on the assumption that a student will give most of his time and attention to college studies. Any outside employment should be taken with full realization of academic responsibilities. The importance of planning one's time cannot be overemphasized.

A few part-time jobs are available to students who can adjust their academic programs to the employers' needs. Usually class schedules must be arranged before referrals for employment can be given.

The Student and Alumni Placement Office, Building 250, Camp Matthews, assists students in finding part-time employment both on and off campus. No charge is made for this service. Personal interviews are necessary, as arrangements cannot be made satisfactorily by correspondence. Those wishing part-time work should register with the Student and Alumni Placement Office upon arrival on the campus.

Career Placement Services are available to terminating students, graduates, and alumni who have matriculated on one of the campuses of the University.

## Living Accommodations

The University strongly encourages all freshmen to live on campus their first year at UCSD. Living accommodations are available at both Revelle and John Muir Colleges. All residence halls are arranged on the suite plan with ten students sharing a common study-living area. Both single and double occupancy rooms are available, with priority for singles given to returning residents. The present room and board rate is $920.00 for three quarters. There is an additional charge of $100 for single accommodations. The housing card accompanying the admissions application should be returned as soon as possible to the Housing Office. Appropriate information will be sent to the applicant upon receipt of the card.

Limited accommodations for single graduate students are also available in the residence halls on a first come, first served basis. Graduate students will be assigned to graduate suites identical to those described above. Further information concerning campus housing may be obtained from the Housing Office.

The Housing Office will assist others in finding suitable accommodations in the surrounding communities of La Jolla, Del Mar or Pacific Beach. There are a limited number of small apartments near the campus, many of which are of the studio-apartment type, large enough for two students to share and in which the student tenants may do their own cooking. There are also some room-and-board opportunities with private landlords. Rates per month may vary from $50.00 for a room to $100.00 and up for an apartment or room and board. Students should call in person at the Housing Office to request assistance for specific off-campus housing.

Residential Apartments for married students exist on the campus. These consist of 19 studio units (which may be available for single students), 56 one-

bedroom and 31 two-bedroom apartments. All of these units are unfurnished except for stove and refrigerator. Coin-operated washers and dryers are supplied in the community building on the apartment grounds. Monthly unfurnished rental prices, including utilities are $80-$90 for the studio, $100 for one-bedroom and $110 for two-bedroom apartments. Information and application blanks may be obtained by calling in person or writing to the Housing Office where a waiting list is maintained.

## Student Health Service

The purpose of the Student Health Service is to assist students in maintaining the best possible physical and mental health for maximum scholastic achievement.

Out patient care is provided for minor illness and injury at the Student Health Center and infirmary beds are available for short term care.

Student Health Service personnel handle the presenting medical problems and at the same time take the opportunity to promote some aspects of health education on an individual basis.

A group medical and hospitalization insurance policy purchased by the University provides consultation with local physicians upon referral by the Student Health Service physicians and hospitalization at nearby Scripps Memorial Hospital.

Limited psychiatric diagnostic service is available at Student Health Center upon referral from Student Health physicians. Psychological counseling is freely available at Student Health Center.

Immunizations are available and students are encouraged to keep their programs up to date.

Each new student, and each student re-entering UCSD after an absence of two or more consecutive quarters, is required to have a physical examination by his physician. The completed physical examination form is to be mailed directly to the Student Health Center by the student's physician prior to the student's registration.

Smallpox vaccination is required within three years. A tuberculin test at the time of the physical examination by the student's own physician is also required.

Foreign students are required to purchase insurance coverage for their dependents who have accompanied them to this area. These policies are available through the Student Health Center.

# OFFICERS OF THE UNIVERSITY

## EX OFFICIO REGENTS

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*Sacramento, California 95814*

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## APPOINTED REGENTS

The term of the appointed Regents is sixteen years, and terms expire March 1 of the years indicated in parentheses.

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## PRINCIPAL OFFICERS OF THE REGENTS

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*Student Health Service*
Robert W. Watson, M.D.
*Accounting Officer*
Joseph A. Pastrone, M.B.A.
*Business Manager*
J. W. Hutchison
*Chief Campus Architect*
Mac A. Cason, B. Arch.
*Assistant to the Chancellor*
*for Planning and Analysis*
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*Manager of Public Affairs*
Cy W. Greaves, B.S.
*Director of University Art Gallery*
Donald Lewallen, M.A.

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A. A. Benson, Ph.D.
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### Revelle College

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Hugh Bradner, Ph.D. (acting)
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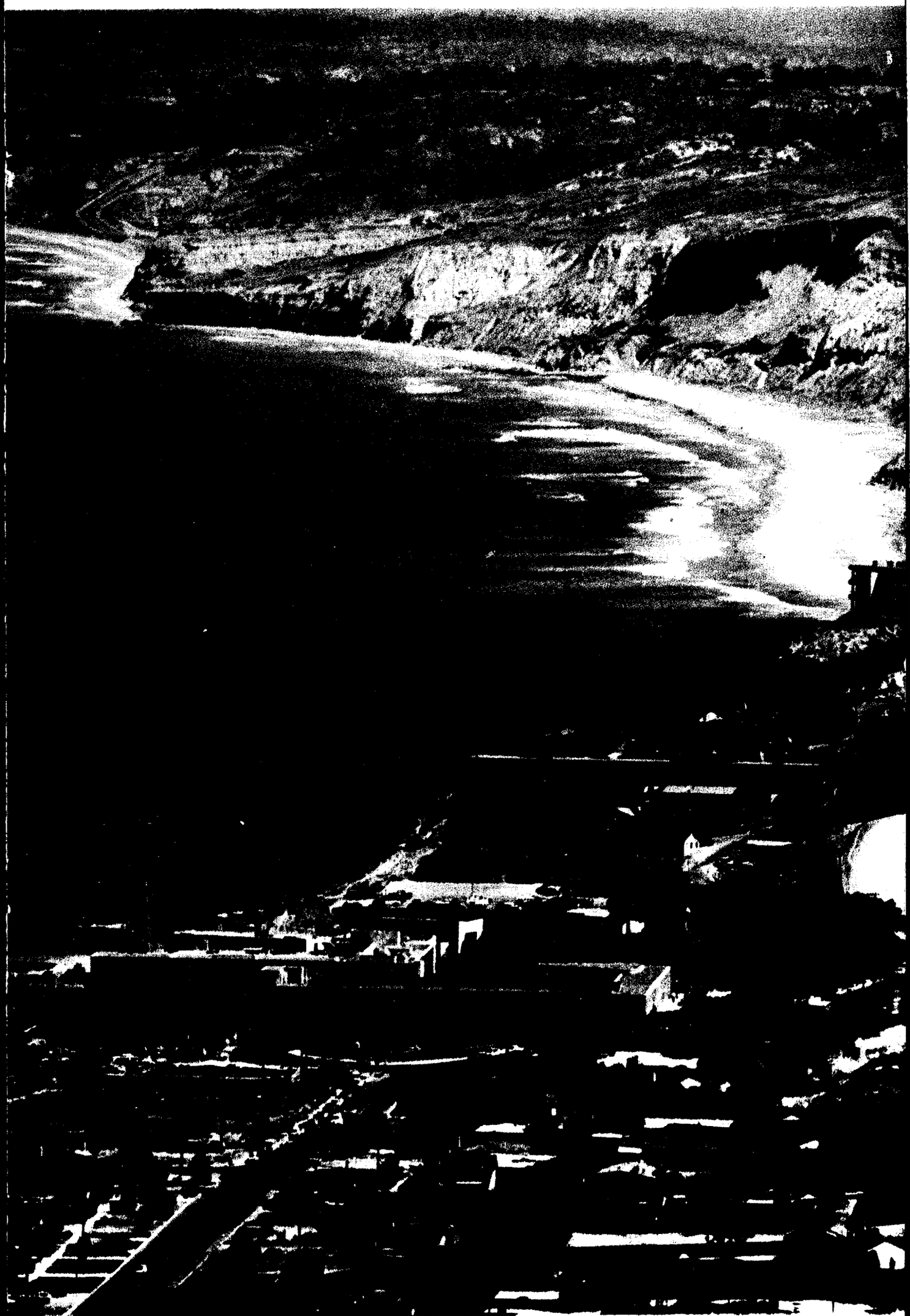

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