General Interest Courses for Upper Division Students

**Agricultural Economics** 23, World Agriculture; 112A–112B, Rural Sociology; 143, Regional Resources Development; 175, Economics of Natural Resources.


**Botany** 115, Plants and Man; 125, The California Flora.

**Business Administration** 110, Legal Environment of Business; 111, Social and Political Environment of Business; 117, Law, Government and Economic Enterprise; 125, Administrative Accounting; 137; Economics of Insurance; 150, Organizational Behavior; 154, Industrial Relations; 180, Introduction to Real Estate and Urban Land Economics.

**City and Regional Planning** 110, Introduction to City Planning; 111, Introduction to Housing; 122, The Black Ghetto in Urban Structure.

**Civil Engineering** 118, Engineering Geology; 143, Applied Ecology; 144, Environmental and Sanitary Engineering; 145, Chemistry of Waters.


Education 110, Learning and the Learner; 130, The School in America; 170, Introduction to Adult Education; 192, Social Foundations of Education; 193, Psychological Foundations of Education; 194, Philosophical and Humanistic Foundations of Education; 197, Field Studies; 198, Directed Group Study for Undergraduates; 199, Supervised Independent Study and Research for Undergraduates.


Entomological Sciences 100, Natural History of the Insects; 105, Insect Ecology.

Environmental Design 169, History of the Environment; (170–177, Open to non-majors on space available basis.) 170, Architecture and Urbanism of Antiquity and the Middle Ages; 171, Architecture and Urbanism from the Renaissance to the Modern Period; 175, Great Cities; 177, Survey of Urban Design.


Geography 100A–100B, Principles of Cultural Geography; 103, The Relations between Nature and Culture; *110, Location Theory; 111, Systems of Cities and

NOTE: For key to footnote symbols, see page 86.
<table>
<thead>
<tr>
<th>Course</th>
<th>Program/Region/Location</th>
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<tbody>
<tr>
<td>Regional Development; 112, Historical Geography of Transportation; 113, Information Circulation and Innovation Diffusion; 120, Pre-Industrial Urban Geography; 121, Urban Geography in the Industrial Age; 125, Social Geography; 130A, Natural Resources and Population; 130B, Open Land as a Natural Resource; 135, Energy as a Resource; 140, Analysis of Landforms; 144, Principles of Meteorology and Climatology; 150, California; 153, Canada; 171, The Humid Tropics; and all of the foreign-area regional survey courses in the 150 and 160 series.</td>
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<tr>
<td><strong>Geology</strong> 2, Environment of Man; 106, Mineral Resources; 110, California.</td>
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<tr>
<td><strong>German</strong> 125, Introduction to Germanic Folklore; 133A–133B, German Cultural History and Political Institutions; 140, Introduction to the Linguistic Study of German; 160, Issues and Problems in German Literary and Cultural History.</td>
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</tr>
<tr>
<td><strong>Italian</strong> 103A–103B, Introduction to Italian Literature; 109A–109B–109C, Dante’s <em>Divina Commedia</em>; 110A–110B, Italian Literature of the Thirteenth and Fourteenth Centuries; 111, Italian Literature of the Fifteenth Century; 112A–112B, Italian Literature of the Sixteenth Century; 114, Italian Literature of the Eighteenth Century; 115A–115B, Italian Literature from 1800 to 1850; 116, Italian Literature from 1850 to 1900; 117A–117B, Italian Literature of the Twentieth Century; 130, Dante’s <em>Divine Comedy</em>; 131, The Language of Dante; 140, Petrarch; 141, The Language of Petrarch; 150, Machiavelli; 151, The Language of Machiavelli; 160, Italian Culture during the Fascist Period (1922–45); 161, The Language of Futurism; 180, Pirandello; 181, The Language of Pirandello.</td>
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<tr>
<td><strong>Landscape Architecture</strong> 10 and 10L, Ecological Analysis; 130, Survey of Landscape Architecture; 170, History and Literature of Landscape Architecture.</td>
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<tr>
<td><strong>Linguistics</strong> 110, Introduction to Phonetics and Phonology; 120, Introduction to Syntax and Semantics; 145, Comparative and Historical Linguistics; 153, Language and Society; 154, Language and Cognition; 175, American Indian Languages.</td>
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<tr>
<td><strong>Materials Science and Engineering</strong> 130, Materials Engineering; 141, Particulate Materials.</td>
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</tbody>
</table>

**NOTE:** For key to footnote symbols, see page 86.


**Music** 127A–127B, History of Music; 128A, Opera; 128C, Contemporary Music; 128D, J. S. Bach; 128F, Symphonic Literature of the Nineteenth Century; 128I, Ibero-American Music; 128K, Afro-American Music; 128L, The Music of Black Africa; 141, University Symphony Orchestra; 142, University Chamber Band; 143, University Concert Band; 144, University Chorus; 145, Repertory Chorus; 146, Chamber Music Ensemble; 147, Contemporary Chamber Music Ensemble; 149, Collegium Musicum.


**Nuclear Engineering** 165, Introduction to Nuclear Engineering.

**Nutritional Sciences** 30, Introductory Food Microbiology; 100, Economics of Food and Nutrients; 110, Food Toxicology; 140, Nutrition; 160, Human Nutrition.

**Optometry** Optometry 100; History of Optometry; Optometry 128, Introduction to Pathology; Physiological Optics 101, Anatomy of Eye and Orbit; Physiological Optics 102, Dioptics of the Eye; Physiological Optics 125, Vegetative Functions of the Eye; Physiological Optics 129, Motility of the Eye; Physiological Optics 132, Visual Stimuli; Physiological Optics 151, Monocular Sensory Processes of Vision; Physiological Optics 160, Binocular Vision and Space Perception.


**Plant Pathology** 114, Plant Diseases and the Protection of Plant Resources.


Scandinavian 107, The Plays of Ibsen; 108, Strindberg and His Writings; 109, Scandinavian Drama of the Twentieth Century; 120A–120B, The Novel in Scandinavia; 123, Medieval Scandinavia; 125, Old Icelandic Literature; 141A–141B, Introduction to Swedish Literature; 143A–143B, Introduction to Norwegian Literature; 144A–144B, Introduction to Danish Literature; 160, Scandinavian Mythology; 165, Scandinavian Folklore; 171, Contemporary Swedish Literature, 175A–175B, Kierkegaard.


Soils and Plant Nutrition Soil Science 120, Soil and Water Conservation.

South and Southeast Asian Languages and Literatures 15A–15B–15C, Introduction to Indian Civilization; 121, Early Indian Literature; 122, Medieval Indian Devotional Literature; 123, The Indian Story; 124, Modern Indian Literature; 125, Tamil Literature in Translation; 126, Folk Religions of India; 127, Brahmanism and Hinduism; 129, Sufism in India; 130, Structure of Modern Indo-Aryan Languages; 131, Indian Buddhism; 132, Origin and Development of Hindi and Urdu; 134, Linguistic Patterns of Nepal; 135, Civilizations and Peoples of Nepal; 140, Hindu Mythology; 160, Jainism and Other Heterodox Systems; 175, Classical Indian Civilization; 193A–193B, South Asian Archaeology; IDS 155, Philosophies of India.


KEY TO FOOTNOTE SYMBOLS

The following footnote symbols are used in the departmental faculty rosters and course listings:

Faculty Roster
† On leave, Fall, Winter, Spring
†' On leave, Fall
†' On leave, Winter
†' On leave, Spring
†' On leave, Fall and Winter
†' On leave, Winter and Spring
‖ Recalled to active service

Course listings
* Not to be given, 1973–74
† To be given if a sufficient number of students enroll
‖' To be given even-numbered years
‖" To be given odd-numbered years
§' Approved for one year only
§" Approved for two years only
Courses and Curricula

Prerequisites for courses should be noted carefully, although they are sometimes waived at the discretion of the instructor.

Courses with double numbers (for example, English 1A–1B) are two-quarter sequences beginning in the quarters indicated. Courses with triple numbers (for example, Mathematics 1A–1B–1C) are three-quarter sequences normally beginning in the fall quarter. Except as noted, each course in a sequence is normally prerequisite to one following, and a student may normally receive credit for completion of the first \( \frac{1}{4} \), \( \frac{1}{2} \), or \( \frac{3}{4} \) of a sequence. Course numbers preceded by the letter H are special honors courses, subject to such general restrictions as may be imposed by the department.

The number in parentheses following the course title indicates the credit value; the abbreviation in parentheses indicates the quarter in which the course is offered: (F) fall, (W) winter, (Sp) spring.

Course numbers are assigned as follows:

1–99 Lower division courses, including courses designated by a letter. Open to freshmen and sophomores; not acceptable for upper division credit.

100–198 Upper division courses. Ordinarily open to students who have completed at least one lower division course in the given subject, or two years of college work.

199 Supervised independent study and research courses for undergraduates (upper division), which may be graded only Passed or Not Passed. The student must obtain the prior consent of the instructor who is to supervise the study, his major adviser, and the chairman of the department in which the study is to be conducted (or his equivalent). This approval must be based upon a written proposal submitted to the chairman. The instructor shall indicate his consent in writing—for example, by initialing the student's study list adjacent to the 199 entry. The applicant shall show that his background is adequate for the proposed study, and he must have completed at least 90 units of undergraduate work. The total units in any one quarter in 199 courses may not exceed 5. On the advice of the instructor or instructors concerned, the dean of a student's college or school may recommend exceptions to the limitations listed.

200–299 Graduate courses. Adequate preparation, subject to instructor's approval, is normally 18 upper division units of work basic to the subject matter of the course.

300–399 Professional courses for teachers or prospective teachers.

400–499 Professional courses which, like teaching courses, are acceptable toward academic degrees only within the limitations prescribed by the various colleges or schools or the Graduate Division.

601 Special study for graduate students in preparing for the master's examination.

602 Special study for graduate students in preparing for the Ph.D. qualifying examination.

AEROSPACE STUDIES

(Note Department Office, 47 Harmon Gymnasium)

Professor:
Glenn E. Wasson, M.A., Col., USAF

Assistant Professors:
Richard H. Steckler, M.S., Major, USAF
Francis T. Fitzpatrick, M.A., Captain, USAF
James A. Paul, M.A., Captain, USAF

NOTE: For key to footnote symbols, see page 86.
The Department of Aerospace Studies offers students in all academic categories the opportunity to qualify for commission in the United States Air Force while completing degree requirements within the University. Entering freshmen enroll in the General Military Course and complete the lower division Aerospace Studies program concurrently with their freshman and sophomore years. Such students are enrolled in the "four-year program" and as such are eligible to compete for the College Scholarship Program. Those entering freshmen who desire consideration for full four-year College Scholarships should consult their high school counselors at the beginning of their final year in high school. Maximum student involvement is provided through participation in cadet projects, field trips, local orientation flights, flights to Air Force installations to witness significant events, and administration of corps training.

For those students who do not or cannot enroll in the lower division General Military Course during their first two years, a "two-year program" is offered. This program provides the transfer student and graduate student, as well as others who have not completed the General Military Course, the opportunity to compete for selection in the two-year AFROTC program. Students contemplating application for the two-year program must have two years of academic studies remaining in the University following the summer in which they intend to complete Aerospace Studies 422. Application for this program should be made as early as possible in the academic year preceding the summer training period.

A scholarship program is open for competition among qualified students. These scholarships are awarded at all academic levels affording the student an opportunity to compete at each year of his program. Tuition, all fees, and a book allowance, as well as $100 monthly living allowance, are paid to all recipients.

Students qualified for and desirous of flying training as an Air Force officer will be provided flying training without charge, leading to the award of the Federal Aviation Administration rating of Private Pilot during their final year of the AFROTC program.

Selection for Upper Division is based upon aptitude and interest in becoming an Air Force officer, and potential for leadership and command. It is also subject to the approval of the Chairman of the Department. The Air Force provides uniforms, texts, and $100 per month for all students regularly enrolled in the Professional Officer Course. For further details on enrollment, service commitments, deferment, enrollment procedures for students transferring from a four-year ROTC program at another school, etc., please contact the Department staff.

Lower Division (General Course)

**1A–1B–1C. World Political Military Systems. (1–1–1)**

One 1-hour lecture/seminar and one hour of laboratory per week. Introductory course exploring the structure of world political and military systems; causes of past and present world conflict; factors of national power; national objectives, national policies, and strategy; organization and role of the military instrument of national power.

Mr. Paul (F, W, Sp)

**21A–21B–21C. The Developmental Growth of Air Power. (1–1–1)**

One 1-hour lecture/seminar meeting and one hour of laboratory per week. Prerequisite: courses 1A, 1B, 1C, or equivalent. An examination of the development and various employment concepts of air power over the past sixty years. Factors which have prompted research and technological change are stressed, especially those elements in air power history affecting the strategic concept.

Mr. Paul (F, W, Sp)

422. Officer Basic Military Training. (6)

Study of world military systems and basic leadership training, conducted each summer for six weeks at an active Air Force base. Course is required for students entering the Advanced Course, Aerospace Studies, who have not completed the 1A, 1B, 1C and 21A, 21B, 21C.

AFROTC Staff

Upper Division (Advanced Course)


Three hours of lecture and one hour of laboratory per week. Prerequisite: courses 1A, 1B, 1C and 21A, 21B, 21C or course 422 or equivalent. An examination of American civil-military relations and the environment in which defense policy is formulated. Emphasis will focus on the role of the military in American society and the impact of social, political, and economic developments and constraints on national security forces.

Mr. Fitzpatrick (F, W, Sp)
141A–141B–141C. Aerospace Management.  
(3–3–3)  
Two 1½-hour lectures and seminar meetings and one hour of laboratory per week. Prerequisite: courses 131A–131B–131C. Principles of management and organization, problems in human relations and human behavior, logical and creative thinking with emphasis on problem solving and effective reporting of solutions, leadership theories and practices, public administration, comparative legal systems (civilian–military), and military sociology.  
Mr. Wasson (F, W, Sp)

432. Officer Advanced Military Training. (3)  
Four weeks advanced officer training conducted at an active Air Force base for four year program advanced cadets. Normally attended between sophomore and junior years. Studies and laboratories emphasize leadership training, problem solving, military sociology, and civil–military applications of recent technical developments.  
AFROTC Staff

AFRO-AMERICAN STUDIES PROGRAM  
See Ethnic Studies.

AGRICULTURAL CHEMISTRY  
(Administered by an Interdepartmental Group)  
Professor:  
David L. Brink, Ph.D.  
Graduate Adviser: Mr. Brink, 145 Mulford Hall.  
Work in agricultural chemistry is available only at the graduate level. It is desirable that students have the equivalent of the bachelor’s degree in chemistry from the University of California. Minor deficiencies may be removed by taking suitable courses after admission.  
Study leading to the Ph.D. degree is offered by an interdepartmental group of agricultural chemists who are engaged in research. This field is open to students interested in the application of chemistry to agricultural problems. Courses may be taken in various departments in the College of Agricultural Sciences, the Department of Biochemistry in the College of Letters and Science, the College of Chemistry, and the School of Forestry and Conservation. Graduate research is directed by a member of the group whose activities most closely coincide with the interests of the student. The following special fields are represented: insecticide chemistry and insect biochemistry in the Department of Entomological Sciences; soil chemistry and plant nutrition in the Department of Soils and Plant Nutrition; forest products chemistry in the School of Forestry and Conservation; food chemistry and animal nutrition in the Department of Nutritional Sciences. In addition to his major field of specialization, each predoctoral student must take such courses in chemistry, biochemistry, and allied sciences as may be necessary to enable him to pass a qualifying examination in agricultural chemistry. For further details, consult the adviser.

Graduate Course  
299. Research in Agricultural Chemistry. (1–12)  
Agricultural Chemistry Group.  
(Mr. Brink in charge) (F, W, Sp)

AGRICULTURAL ECONOMICS  
(Department Office, 207 Giannini Hall)  
Professors:  
James N. Boles, Ph.D. (Vice Chairman)  
David A. Clarke, Jr., Ph.D. (Chairman)  
Sidney S. Hoos, Ph.D.  
George M. Kuznets, Ph.D.  
Ivan M. Lee, Ph.D.  

NOTE: For key to footnote symbols, see page 86.
Loy L. Sammet, Ph.D.  
Siegfried V. Wanstrup, Dr.Agr.  
Murray R. Benedict, Ph.D. (Emeritus)  
Henry E. Erdman, Ph.D. (Emeritus)  
George L. Mehren, Ph.D. (Emeritus)  
David Weeks, Ph.D. (Emeritus)  
Harry R. Wellman, Ph.D. (Emeritus)  

Associate Professor.  
Andrew Schmitz, Ph.D.  

Assistant Professors:  
Jurg H. Bieri, Ph.D.  

Alain Choppin de Janvry, Ph.D.  
E. Philip Leveen, Ph.D.  
Ronald G. Lorentson, Ph.D.  
Richard B. Norgaard, Ph.D.  

Professor:  
Davis McEntire, Ph.D.  

Lecturers:  
Richard H. Courtney, Ph.D.  
Jerome B. Siebert, Ph.D.  
Eric Thor, Ph.D.  
L. T. Wallace, Ph.D.  

Undergraduate Major Advisers: Mr. Bieri, Mr. Courtney, Mr. McEntire.  
Graduate Advisers: Mr. Boles, Mr. de Janvry, Mr. Lee.  

Agricultural Economics is one of the majors under the Agricultural Sciences Curriculum in the College of Agricultural Sciences (see page 67), and is offered by the Department of Agricultural Economics. It consists of courses meeting general educational requirements and work in the major, including core courses taken by all students, and courses in one of five options, covering a particular area of specialization within the major. The options are: (1) agricultural business management, (2) agriculture in economic development, (3) marketing and trade, (4) natural resources economics, and (5) quantitative methods.  

Undergraduate Major Requirements  

**Humanities and Social Sciences**, 32 units as follows: English, rhetoric, or comparative literature (8); principles of economics (8); additional social sciences (16).  

**Physical Sciences and Mathematics**, 19 units as follows: mathematics (6)—3 units of calculus; 3 additional units of calculus or linear algebra; statistics (5); physical sciences (8).  

**Biological and Agricultural Sciences**, 16 units as follows: Of the 16 units required, at least 8 are to be in agricultural sciences.  

**Major Field**, 51 units as follows: A. Core requirements, 24 units, consisting of: accounting (4); economic analysis in agriculture (10); analysis of agricultural economics data (5); agricultural policy (5). B. Options, 27 units. One of the following options to be selected: 1. agricultural business management; 2. agriculture in economic development; 3. marketing and trade; 4. natural resources economics; 5. quantitative methods. In each option there are two required agricultural economics courses, plus four additional courses in the field of study—two of which must be selected from a restricted list.  

**Additional courses**, 62 units.  
**Total units**, 180.  

Certain courses may be required in satisfaction of the above. The undergraduate adviser will provide this information and any other details about the major.  

All students must maintain at least a C average in all upper division courses taken in agricultural economics. Those who do not maintain such an average may be required to withdraw from the major at any time.  

Graduate Programs  

Admission for graduate study in agricultural economics depends upon several criteria. The applicant must hold a valid degree (comparable to the bachelor’s degree from the University of California) from a recognized institution and have a scholastic
record that meets the University standards. While he need not have a B.S. degree in agricultural economics, he should have a broad preparation embracing the physical, biological, and social sciences. Courses in economic theory, statistical analysis, and mathematics through calculus are essential. Students who have not completed these requirements but are otherwise well qualified may be permitted to remove these deficiencies after admission.

Programs leading to the M.S. and Ph.D. degrees are offered. They provide for basic preparation in economic theory, quantitative analysis, and agricultural policy, along with opportunity for additional development in a field of emphasis selected by the student. Fields commonly chosen include agricultural statistics, marketing and trade, natural resources economics, policy, and agricultural economic development. Work in still other fields of special interest may be arranged. For further details, consult the graduate adviser.

120. Agricultural Policy. (5)
Three 1½-hour lectures per week. Prerequisite: Economics IA and IB. Analytical and historical treatment of economic problems, governmental policies and programs affecting American agriculture.
Mr. Loeven (W)

123. Agriculture in Economic Development. (5)
Three 1½-hour lectures per week. Prerequisite: course 100A and consent of instructor. Development of the agricultural sector; production, marketing, and institutional phases; the role of agriculture in development and the impact of development on agriculture; the transformation of traditional agriculture.
Mr. de Janvry (W)

130. Agricultural Marketing. (4)
Two 1½-hour lectures per week. Prerequisite: Economics IA. Nature and function, organizational structure, and operation of agricultural markets. Prices, costs, and margins. Market information, regulation, and controls. Cooperative marketing.
Mr. Courtney (F)

141. Management Operations. (5)
Three 1½-hour lectures per week. Prerequisite: course 100A and consent of instructor. Application of managerial economic theory; economic and institutional aspects of organization and management; planning, decision-making, and control processes.
Mr. Boles (Sp)

143. Regional Resources Development. (4)
Two 1½-hour lectures per week. Prerequisite: course 100A. Application of economic theory relating to rent, location, and interregional trade as they bear upon resource development and allocation; economic and institutional problems of land development and use; problems of regional planning for water resources development; transportation systems; the role of government in regional planning and development.
Mr. Lorentson (Sp)

156. Agricultural Economic Measurements. (4)
Two 1½-hour lectures per week. Prerequisites: courses 100A, 100B, and 106. Sources, collection of data, and analysis of selected measurements, including prices, employment, wages, production, and national income.
(—W)

160. Economic Analysis in Agricultural Marketing. (5)
Three 1½-hour lectures per week. Prerequisite: courses 100A, 100B, and 106. The marketing firm in its economic context; location of agricultural production, processing, and trade; demand analysis,
economic analysis of market organization; government in marketing; the marketing system and the general economy. — (Sp)

175. Economics of Natural Resources. (5)
Three 1 1/2-hour lectures per week. Economic issues in public policy decisions affecting natural resources: economic evaluation of projects and programs; tenure of resources; development; conservation; taxation; location; analytical techniques; public policy formation and execution. Mr. Norgaard (F)

197. Field Study in Agricultural Economics. (1-5)
Prerequisite: consent of the instructor. Supervised experience in off-campus organizations relevant to specific aspects of agricultural economics. Regular individual meetings with faculty sponsor and written reports required. Mr. Bieri (F, W, Sp)

198. Directed Group Study. (1-5)
Selected topics in agricultural economics for advanced undergraduates.
The Staff (Mr. Bieri in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (Mr. Bieri in charge) (F, W, Sp)

Graduate Courses

200A-200B. Economics of Agricultural Production and Consumption. (5-5)
Three 1 1/2-hour lectures per week. Theory of the firm and industry, with particular reference to production; market structures, single and multiple products, uncertainty; theory of demand and consumption; and location theory and interregional trade. Sequence, beginning (F).

200A, — (F); 200B, — (Sp)

210A-210B-210C. Quantitative Methods in Agricultural Economics. (5-2-2)
210A. Three 1 1/2-hour lectures per week.
210B. Two 1 1/2-hour lectures per week.
210C. Two 1 1/2-hour lectures per week.
Measurement of economic aggregates; statistical estimation of economic relations; models and studies of intersectoral relations; recursive and independent equation systems; total economy, sector, and commodity models.

210A, Mr. Boles (W); 210B, Mr. Kuznets (F);
210C, Mr. Bieri (W)

220A-220B-220C. Agricultural Policy. (3-3-3)
Two 1 1/2-hour lectures per week. Growth trends and cyclical variation in agriculture and in the national economy; comparative income level and distribution; production trends, variations, and projections; changing organization and structure of agriculture in relation to the general economy; political economy of agricultural policy; defining problems and policy objectives; economic analysis of policy objectives, program alternatives for their achievement, and program results. Sequence, beginning. (F).

220A, Mr. Lee (F); 220B, Mr. Lee (W); 220C, Mr. Levene (Sp)

222. National and World Policies for Agriculture. (3)
One 2-hour lecture per week. National systems of policy formation, objectives, and programs; interrelations of national policies; instruments and institutions for reconciliations of conflicting national interests and objectives. — (Sp)

223. Seminar in Economic Development and Agriculture. (3)
One 2-hour lecture per week. The role of agriculture in economic development of selected foreign countries with emphasis on institutional conditions and government programs. Mr. de Janvry (W)

230A-230B-230C. Agricultural Marketing Research. (3-3-3)
Two 1 1/2-hour lectures per week. A seminar on the literature, current research problems, and methods of analysis in agricultural marketing. Sequence, beginning (F).

230A, — (F); 230B, Mr. Clarke (W); 230C, Mr. Clarke (Sp)

240A-240B-240C. Farm Management Research. (3-3-3)
Two 1 1/2-hour lectures per week. A seminar on the literature, current research problems, and methods of analysis in farm management. Sequence, beginning (F).

240A, — (F); 240B, — (W); 240C, — (Sp)

270A-270B-270C. Natural Resources Economics Research. (2-3; 2-3; 2-3)
One 2-hour lecture per week. Degree candidates in agricultural economics who are specializing in natural resource economics are expected to take 3 units. Also open to other qualified students in all departments, who may elect either the 2- or 3-unit basis. Seminar in the literature, current research, and methods of analysis in natural resource economics with emphasis on public policy and application of economics to special problems of public policy in natural resources. Sequence, beginning (F).

270A, Mr. Norgaard (F); 270B, Mr. Wallace (W); 270C, Mr. Lorentson (Sp)

290. Problems in Agricultural Economics Research. (3)
Two 1 1/2-hour lectures per week. Identification and statement of research problems; formation of hypotheses; selection and employment of research methods; aggregation of research findings; derivation of policy implications. — (Sp)

298. Special Study for Graduate Students. (1-6)
Any properly qualified graduate student who wishes to pursue a special field of study may do so if his proposed program of study is acceptable to the member of the staff with whom he works.
The Staff (—— in charge) (F, W, Sp)

299. Individual Research. (1-9)
The Staff (Mr. Clarke in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. — (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for
qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. ——— (F, W, Sp)

IDS 10A–10B–10C. Man and His Environment—
Crises and Conflicts. (5–5–5)
See Interdepartmental Studies for the complete
description of this course.

AGRICULTURAL SCIENCE

The undergraduate major in agricultural science is a combined offering of the teaching departments in the College of Agricultural Sciences. It is designed not only to accommodate students who wish to have a less specialized B.S. degree but also to provide a broad foundation for graduate study in various fields. It also serves those students who are interested in plant pathology, as well as those who have not yet chosen a specific area of study.

Undergraduate Major Requirements

Humanities and Social Sciences, 32 units as follows: economics (5); English, rhetoric, or comparative literature (8); restricted electives (anthropology, classics, foreign languages, geography, history, philosophy, psychology, sociology, or additional English or rhetoric) (19).

Physical Sciences and Mathematics, 38 units as follows: chemistry, including organic (20); mathematics (3); statistics (3); physics (12).

Biological and Agricultural Sciences, 36 units as follows: agricultural science (4); microbiology (4); biology (12); physiology (4); ecology (4); botany and/or zoology (8).

Major Field, 30 units as follows: one introductory course in each of five of the following subject areas: agricultural economics, entomology, genetics, nutritional sciences, plant pathology, soil science, or plant nutrition. Two additional courses in one of the above selected areas in the major field.

Additional courses, 44 units.

Total units, 180.

Certain courses may be required in satisfaction of the above. Inquire at the Dean’s Office, College of Agricultural Sciences, 101 Giannini Hall, for information concerning advisers.

ANATOMY

For courses in Anatomy, see Physiology-Anatomy.

ANCIENT HISTORY AND MEDITERRANEAN ARCHAEOLOGY

Professors:
Paul J. Alexander, Ph.D. (History)
Darrell A. Amyx, Ph.D. (History of Art)
John K. Anderson, M.A. (Classical Archaeology)
George F. Dales, Jr., Ph.D. (Near Eastern Archaeology)
David Daube, Dr.Jur., Ph.D., D.C.L., LL.D. (Law)
Erich S. Gruen, Ph.D. (History)
Anne D. Kilmer, Ph.D. (Assyriology)
Spiro K. Kostof, Ph.D. (Architectural History)
W. Kendrick Pritchett, Ph.D. (Greek)
Raphael Sealey, M.A. (History)
Ronald S. Stroud, Ph.D. (Classics)

Associate Professors:
Peter Garnsey, D.Phil. (Latin)
Crawford H. Grenewalt, Ph.D. (Classical Archaeology)
Leonard H. Lesko, Ph.D. (Egyptology)
Jacob Milgrom, D.H.L. (Hebrew)
Ruggero Stefanini, Dottore in Lettere (Anatolian Studies)

NOTE: For key to footnote symbols, see page 86.
The Major
There is no undergraduate major.

The Graduate Program
The program is interdisciplinary in nature, administered by a faculty group drawn from several departments. Both M.A. and Ph.D. degrees are offered. Fields of emphasis include Near Eastern History, Greek History, Roman History, Classical Art and Archaeology, Near Eastern Art and Archaeology, Ancient Law, Epigraphy, and Papyrology. Candidates for degrees will offer a combination of three of these fields or similar fields, one as a major subject, two as minor subjects. The program is open to students with the B.A. in a relevant area who have completed at least one year of undergraduate study in Ancient History or Archaeology. Applicants must have had sufficient training to undertake advanced work in at least one ancient language.

M.A. Requirements
The M.A. in the area of archaeological and art specializations requires 30 quarter units and a thesis. The M.A. in the purely historical area requires 36 quarter units, to be followed by an examination, both oral and written, in the major subject. All M.A. candidates are expected to pass at least one modern language examination before the degree is awarded.

Ph.D. Requirements
There are no specific course requirements. Students are expected to take considerable seminar work in at least two of the Departments represented in the program. Each candidate must pass examinations in two modern languages and two ancient languages appropriate to his fields of study. He is then eligible for the Ph.D. qualifying examinations, both written and oral, which test competence in his major and minor subjects. Upon successful completion of these requirements, the student proceeds to research and writing of a dissertation under the guidance of a three-man committee. The dissertation must be approved by the committee and be in a final form before the student is recommended for the Ph.D. degree.

For further information, inquiries should be addressed to the Graduate Group in Ancient History and Mediterranean Archaeology, in care of the Dean of the Graduate Division.

ANTHROPOLOGY

(Department Office, 232 Kroeber Hall)

Professors:
William R. Bascom, Ph.D.
Burton Benedict, Ph.D.
Gerald D. Berreman, Ph.D.
J. Desmond Clark,‡ Ph.D.
Elizabeth Colson,‡ Ph.D.
George A. DeVos, Ph.D.
May N. Diaz, Ph.D.
Alan Dundes, Ph.D.
George M. Foster,‡ Ph.D.
John J. Gumperz, Ph.D.
Eugene A. Hammel,‡ Ph.D.
Robert F. Heizer, Ph.D., Sc.D.
F. Clark Howell,‡ Ph.D.
Paul Kay, Ph.D.
David G. Mandelbaum, Ph.D.
Laura Nader,‡ Ph.D.
John H. Rowe, Ph.D.
William A. Shack,‡ Ph.D.
Sherwood L. Washburn, Ph.D.
Ronald L. Olsen, Ph.D. (Emeritus)

Associate Professors:
James N. Anderson,‡ Ph.D.
Brent Berlin, Ph.D.
Phyllis Dolhinow, Ph.D.
Nelson H. H. Graburn,‡ Ph.D.
John A. Graham,‡ Ph.D.

NOTE: For key to footnote symbols, see page 66.
The Department of Anthropology offers students the opportunity to study man from the broadest historical and geographical perspective. Courses in the department offer knowledge of the physical nature of man as well as the social and cultural aspects of his behavior. Lower division courses are intended to give a general understanding of human evolution, prehistory, and the nature of human cultures, while upper division courses elaborate particular themes.

The anthropology major is designed to serve two purposes: to provide a general education in anthropology for students who are pursuing a liberal education; and to provide preparation for graduate work for students who wish to become professional anthropologists. A student who does not intend to do graduate work in anthropology may plan his program with considerable freedom, taking care only to fulfill the requirements listed below. A student who plans to go on to graduate study, either at Berkeley or at another institution, should plan his undergraduate program to meet graduate admission requirements. Each student should select a combination of courses to form a unified plan of study that meets his special intellectual interests.

The collections and research facilities of the Robert H. Lowie Museum of Anthropology are available for study in archaeology, ethnography, physical anthropology, and related subjects by graduate and undergraduate students and by visiting scholars; the museum’s exhibition hall is used for instructional and educational purposes, particularly in connection with class work. Those interested may address the Director, 103 Kroeber Hall.

The Major

Anthropology 1, 2, 3, 4; and one course from three of the following five groups: Group I—all courses in Physical Anthropology; Group II—all courses in Archaeology; Group III—all courses in Social and Cultural Anthropology; Group IV—all courses in Language, Culture and Society; Group V—all Area Courses. Also required are 25 elective upper division units to total 40 units of upper division courses in anthropology. These elective units may be taken from any of the groups I–VI; however not more than 12 units of courses 191, 196, 197, and 199 combined will be accepted toward fulfilling major requirements.

Substitutions may be permitted among these additional elective courses of not more than 10 units in allied subjects approved by the department. Students applying for admission to the major are required to have completed three of the four lower division course requirements (Anthropology 1, 2, 3, 4).

Honors Program The Department of Anthropology provides several specialized programs leading to the A.B. degree with honors. Students admitted to the honors program will include in their program H198A–H198B–H198C, Senior Honors. Undergraduate students, both majors and nonmajors, seeking information or advice about their programs or about courses should inquire in Room 213 Kroeber Hall.

Preparation for Graduate Study

Admission to graduate studies at Berkeley does not presuppose an A.B. in Anthropology. The graduate program is oriented toward the doctorate, and only candidates
The program for the Ph.D. degree normally takes five years and is divided into three steps, as follows:

**Step I.** This segment normally takes one year, during which the student begins to narrow down his interests to particular topical and geographical fields of specialization.

**Step II.** During this period, which normally lasts from one to two years, the student attends seminars, carries out individual research projects related to his fields of specialization, and prepares for the Ph.D. oral qualifying examination. With the successful passing of this examination, the student is advanced to candidacy for the Ph.D. degree.

**Step III.** The student undertakes research for his Ph.D. dissertation under supervision of a three-man committee in charge of research and dissertation. With some exceptions, the dissertation is based on the results of original field research, which normally requires a minimum of one year. The writing of the dissertation customarily requires an additional year. On completion of the research and approval of the dissertation by the committee, the student is awarded the Ph.D. degree.

For further information, please address correspondence to the Graduate Adviser, Department of Anthropology, University of California, Berkeley, California 94720.

**Courses and Seminars**

Courses and seminars are listed below. Instructor listings, quarterly offerings, and schedule changes are available in 213 Kroeber Hall.

**Letters and Science List:** for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

**Lower Division Courses**

1. **Introduction to Physical Anthropology. (5)**
   Three 1-hour lectures and one 1-hour section meeting per week. Facts and problems of human evolution, fossil man, race and race differences.
   Mrs. Dolhinow, Miss Sawyer (W); Mr. Washburn (Sp)

2. **Introduction to Archaeology. (5)**
   Three 1-hour lectures and one 1-hour section meeting per week. Prehistory and cultural growth.
   Mr. Isaac (W)

3. **Introduction to Social and Cultural Anthropology. (5)**
   Three 1-hour lectures and one 1-hour section meeting per week. Structure and dynamics of culture.
   Mr. Potter (F); Mr. Berreman (Sp)

4. **Introduction to Linguistic Anthropology. (5)**
   Two and a half hours of lecture and two hours of sections per week. Language in its interrelationships with man's biology, his culture and his society.
   Mr. Berlin, Mr. Kay (F)

5. **Human Evolution. (5)**
   Three hours of lecture and one hour of discussion per week. Limited to freshmen. Reading and papers on the problems and meaning of human evolution. Why the understanding of evolution should be a part of every person's education. Mr. Washburn (F)

*45. **Freshman Seminars. (2)**
   One 2-hour meeting per week. Prerequisite: appropriate lower division lecture course (Anthropology 1, 2, or 3 or 4) completed or being taken concurrently. Limited to 12 freshman students per section. Discussion, substantial reading and written papers developing the salient problems which guide anthropological work.

**Upper Division Courses**

General prerequisite: junior standing or courses 1, 2, 3, 4.

Undergraduate seminars: Certain upper division lecture courses are followed in the next quarter by an undergraduate seminar which provides an opportunity for more advanced work in the subject matter of the lecture course. Enrollment in these seminars is restricted to students who have received a grade
of B or better in the antecedent lecture course and/or who have the instructor’s permission. The undergraduate seminars are given as sections of Anthropology 195.

Class meetings: Unless otherwise noted, lecture courses meet for three lecture hours and one consultation hour per week. Enrollment may be limited.

Group I. Physical Anthropology and Primatology

100. Fossil Man. (5)

Prerequisite: course 1 or equivalent. Origin and relationships of the extinct forms of mankind.  Mr. Howell (W)

102. Human Variation in an Evolutionary Perspective. (5)

Three hours of lecture and one hour of laboratory per week. Prerequisite: course 1 or equivalent. Human variation in both a racial and nonracial context; basic genetics (both molecular and population); theories of racial origins; selective bases of human variations.  Mr. Howell (W)

104L. Physical Anthropology Laboratory. (2)

Two 2-hour meetings per week. Prerequisite: course 100, or 102, or 108 (may be taken concurrently). Enrollment limited to twelve students; primarily for majors in anthropology and the life sciences. Descriptive and analytical techniques and methods applicable to the study of intra- and intergroup resemblances and differences.  Mr. Howell (W)  (F)

108. Primate Evolution. (5)

Prerequisite: course 1 or equivalent. A consideration of the major groups of primates with emphasis on the evolution of behavior.  Mr. Howell (W)

108L. Primate Evolution Laboratory. (2)

Four hours of lecture and laboratory sessions per week. Prerequisite: course 108 (preferably taken concurrently). Enrollment limited to twelve students; primarily for majors in anthropology and the life sciences.  Mr. Washburn (W)

109. Experimental Anthropology. (5)

Prerequisite: two lower division anthropology courses from the group 1, 2, 3. The course will illustrate the use of the combination of experimental and evolutionary approaches in understanding problems such as adaptation, learning, and social life. Emphasis will change from year to year.  Mr. Washburn (W)  (F)

110. Primate Social Behavior. (5)

Three hours of lecture per week. Prerequisite: course 1 or equivalent. Survey of the social behavior and organization of monkeys and apes; their relevance to the evolution of human behavior and social groups.  Mr. Howell (W)  (F)

110L. Primate Social Behavior Laboratory. (2)

Four hours of lecture and laboratory sessions per week. Prerequisite: course 110. Enrollment limited to twelve students; primarily for majors in anthropology and the life sciences.  Mr. Howell (W)  (F)

111. Problems in Primate Social Behavior. (4)

Three hours of lecture and one consultation hour per week. Prerequisite: course 110. Relationships between habitat and social structure of primate groups, socialization, dominance, and communication.  Mrs. Dolhinow (Sp)

117. Theory and Method in Physical Anthropology. (4)

Three hours lecture and one hour of consultation per week. Prerequisite: two courses in physical anthropology. History of physical anthropology with emphasis on important figures and schools of thought. Contributions of related fields will be stressed and computer science emphasized.  Mr. Washburn (W)  (F)

Group II. Archaeology, Prehistory, and Culture History

120. Culture Growth. (5)

Three hours of lecture per week. Prerequisite: course 2 or consent of instructor. Archaeological theory and cultural process, illustrated by the origin and development of civilization in the Old World and the New.  Mr. Rowe (Sp)

122. Archaeology of North America. (5)

Three hours of lecture per week. Prerequisite: course 2 or consent of instructor. Prehistory of North American Indians; prehistoric culture areas; relations with historic Indians.  Mr. Rowe (Sp)

124. Ancient Civilization of Mexico and Central America. (4)

Three hours of lecture per week. A study of the development, form, and history of pre-Columbian Indian civilization, surveying the achievements of the Maya, the Aztec, and their neighbors.  Mr. Graham (Sp)

125. The World of the Ancient Maya. (4)

Three hours of lecture per week. A comprehensive study of the development and culture history of the longest sustained tradition of aboriginal New World civilization.  Mr. Graham (Sp)

126. Peoples of the Andes. (5)

Three hours of lecture per week. Prerequisite: course 2 or consent of instructor. Inca culture and its antecedents; a survey from the earliest times to the present.  Mr. Rowe (W)

127. The Olmec World. (5)

Prerequisite: course 2 or consent of the instructor. Intensive study of the culture, sites, and chronology of the Preclassic Olmec civilization.  Mr. Heizer (Sp)


Prerequisite: upper division standing or consent of instructor. Any quarter of this course may be taken independently, and no quarter is prerequisite to any other.

128A: Africa.  Mr. Clark (F)
128B: Europe and Asia in the Pleistocene.  Mr. Isaac (Sp)
128C: Post-Pleistocene cultural phenomena of Europe and Asia.
128L. Old World Prehistory Laboratory. (5)

Five hours of class meetings and directed study per week. Prerequisite: upper division standing or consent of instructor. May be repeated without duplication of credit with consent of instructor. Descriptive and analytical methods used in classification and discussion of prehistoric cultures of the Old World.

Mr. Clark (F)

130. Invention and Technology. (5)

Three hours of lecture per week. Prerequisite: upper division standing or consent of instructor. Origin, history, and spread of fundamental inventions; illustrative material from the Lowe Museum of Anthropology.

Mr. Clark (Sp)

131. Science and Archaeology. (5)

Prerequisite: course 2. A survey of the application of techniques deriving from the physical and life sciences to the interpretation of archaeological materials.

132. Archaeology and Society. (5)

Three hours of lecture per week. Prerequisite: course 2 or consent of instructor. Archaeological research methods and their uses in the study of man's past.

Mr. Heizer (W)

133. Field Course in Archaeological Method. (5)

One hour of lecture and one 8-hour (Saturday) field course meeting per week. Prerequisite: course 2 or the consent of instructor. Enrollment limited to eighteen students, admitted by the consent of the instructor; may be repeated without duplication of credit. Advanced field investigation, and guidance in preparation of materials for publication.

134. Archaeological Method. (5)

One 3-hour laboratory meeting with three hours of independent laboratory work required per week. Prerequisite: course 133 or consent of the instructor. With consent of the instructor, may be repeated without duplication of credit. Advanced field investigation, and guidance in preparation of materials for publication.

*135. Field Practice in Archaeology. (15)

Forty hours of lab per week. Prerequisite: consent of instructor. Practical experience in the field study of archaeological sites and materials. Depending upon study area selected, coverage may include reconnaissance, mapping, recording, and excavation. May be repeated for credit. Limited enrollment.

136. History and Theory of Archaeology. (5)

Three hours of seminar and one hour of tutorial per week. Prerequisite: senior standing or consent of the instructor. A critical review of the historical background and philosophical premises of past and current anthropological theory with respect to the concepts of time and change.

140. The Nature of Culture: An Introduction to Cultural Anthropology. (5)

Not open for credit to students who have taken course 2. Advanced level introduction to cultural anthropology for nonmajors.

Mr. Dundes (F)

141. Comparative Society. (5)

Prerequisite: course 3 or 140 or consent of the instructor. Theories of social structure, functional interrelationships of social institutions. Primary emphasis on non-Western societies.

Mr. Gumperz (W)

142. Kinship and Social Structure. (5)

Prerequisite: course 141. Comparison of kinship and family types throughout the world; techniques of kinships and structural analysis.

Mr. Kay (W)

143. Plural Societies. (5)

Three hours of lecture per week. Prerequisite: course 3 or consent of instructor. A critical examination of the theories of plural societies with ethnographic examples from various parts of the world.

Mr. Benedict (F)

144. Social and Cultural Change. (5)

Three hours of lecture per week. Prerequisite: course 3 or consent of instructor. Theories of social and cultural change: social evolution, diffusion, acculturation, pattern dynamics, innovation, structural-functional approach to change. Illustrative materials from anthropological sources.

(Sp)

145. Urban Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 or consent of instructor. A consideration of anthropological concepts and methods for the study of the urbanization process in towns and cities.

146. Comparative Peasant Society. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. A comparative study of peasant society as a social type contrasted with primitive and industrial society.

Mrs. Diaz (F)

147. Anthropology and Development. (5)

Three hours of lecture per week. Prerequisite: course 3. Critical examination of the relationships of applied to theoretical anthropology.

148. Man's Ecological Relationships. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Survey of theories, methods, and applications of the ecological perspective to cultural and physical attributes of human populations.

149. Culture and Personality. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Relationships of cultural, social, and personality factors in human behavior; personality in representative societies; techniques for studying culture-personality relations.

Mr. Phillips (W)

152. Anthropology in Modern Life. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Anthropological theory and data applied to problems in such fields as medicine, agriculture, education, and international technical-aid programs.

Mr. Foster (F)

155. Economic Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Economic behavior in nonindustrial societies; its social and cultural setting, and its modern changes.

156. Politics and Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Anthropological
157. Law and Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Comparative survey of the ethnography of law; methods and concepts relevant to the comparative analysis of the forms and functions of law. Miss Nader (F)

158. Religion and Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. A consideration of the interplay between religious beliefs and institutions and other aspects of culture. Miss Nader (F)

159. The Forms of Folklore. (5)

Three hours of lecture per week. Prerequisite: upper division standing. A worldwide survey of the major and minor forms of folklore with special emphasis upon proverbs, riddles, superstitions, games, songs, and narratives. Mr. Dundes (W)

160. Narrative Folklore. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. The study of folktales, myths, legends, and other forms of verbal art; methods and theories of folklore. Mr. Bascom (F)

162. Art and Culture. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Anthropological theory and method applied to the problems of education in traditional and modern cultures. Mr. Ogbu (W)

166. Advanced Survey of Social and Cultural Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 and senior standing or consent of instructor. Intended primarily for major students. Historical survey of anthropological theories, methods, and findings. Miss Colson (Sp)


Three hours of lecture per week. Prerequisite: course 3 or consent of instructor. An introduction to the definition of research problems and design techniques for collection, analysis, and presentation of data. Mr. Geoghegan (W); Mr. Gumperz (Sp)

Group IV. Language, Culture and Society


Three hours of lecture per week. Prerequisite: course 4 or equivalent. 165A is not prerequisite to 165B; 165B is not prerequisite to 165C.

165A: Language in culture; the design of language, language and cognition, language and evolution, linguistic change and culture change. Mr. Geoghegan (Sp)

165B: Language in society; social and linguistic aspects of verbal behavior, speech communities, language and social stratification, language, nation, and state.

165C: Language and the individual; theories of linguistic performance, acquisition of linguistic competence and of performance styles, language and individual thought, hypersemanticalized language, relation of natural to formal languages. Mr. Kay (F)

Group V. Area Courses

170A–170B. China. (5)

Chinese culture and society with emphasis on the village level.

170A. Pre-Communist China.

170B. Communist China.

171. Japan. (5)

Ethnological treatment of historic and modern Japanese culture. Mr. DeVos (W)

172. American Culture. (5)

Three hours of lecture plus two hours tutorial per week. This course will be concerned with the relationship between anthropological theory and research and the study of American culture and society. A consideration of the holistic approach developed by Anthropology in the study of small-scale societies and its usefulness in the study of a complex modern society like the United States.

175. North American Indians. (5)

Historical survey of the cultures of the native peoples of the United States and Canada.

176. Indians of California. (5)

Survey of the cultures of the native people of California. Tribal divisions, arts, customs, archaeology. Mr. Heizer (F)

178. Native Peoples of South America. (5)

Archaeology, ethnohistory and ethnography. Mr. Berlin (W)

179. Contemporary Latin America. (5)

Emphasis on Iberian-Indian assimilation, African influences, development of folk-peasant societies, and the concept of "national" cultures.

180. Mexico and Central America. (5)

Ethnology of Indian and mestizo cultures with special emphasis on comparative organization, belief systems, law, economics, kinship, language and communication.

182. Circumpolar Regions. (5)

A survey of Arctic cultures. Mr. Graburn (F)

183. European Peasant Societies. (5)

Representative groups considered in modern and historical perspective, stressing especially rural-urban relationships and the dynamics of change.

184. Afro-American Ethnography. (5)

Three hours of lecture and one hour of consultation per week. A comparative survey of societal structuring and cultural dynamics of Afro-American peoples living in the Caribbean, North, Central and South America, considered in both historical and contemporary perspective.
185. The Near East. (5)
Cultures of the contemporary Near East, with special emphasis upon Arab populations.

186. Africa South of the Sahara. (5)
Traditional cultures and social institutions of Sub-Saharan Africa.
Mr. Ogbu (F)

§187. Ethiopia and the Horn of Africa. (5)
Three hours of lecture and two hours tutorial per week. Prerequisite: course 3 or 186. Main ethnic groups and traditional systems of social, economic, and political organization of the indigenous peoples of the region, with some reference to changes produced by modernization.
Mr. Shack (Sp)

188A–188B. South Asia. (5–5)
188A: Development of cultural traditions.
Mr. Mandelbaum (F)
188B: Social organization and social trends.
Mr. Mandelbaum (W)

189A–189B. Southeast Asia. (5–5)
Three hours lecture and one hour discussion per week. 189A is not prerequisite to 189B. Peoples and cultures of Southeast Asia.
189A. Mainland: emphasis on Burma, Thailand, and Viet Nam.
Mr. Phillips (Sp)
189B. Insular: emphasis on Indonesia, Malaysia, and the Philippines.

Group VI. General Courses

191. Experimental Courses.

§191U. Comparative Health Systems. (4)
Three hours of lecture per week. Prerequisite: course 3. Cross-cultural view of medical practices; definitions of health and illness.

195. Undergraduate Seminars. (5)
One 2-hour meeting and two consultation hours per week. Prerequisite: grade of B or better in an upper division course for which an associated seminar is scheduled, and/or consent of instructor. Enrollment limited. May be repeated without duplication of credit.
Some, but not all, lecture courses will be followed, usually in the next quarter, by a seminar providing an opportunity for advanced study of the subject matter, emphasizing reading and discussion.
Mr. Washburn, Mr. Heizer (W); Mr. Gumperz, Mr. Heizer (Sp)

196. Fieldwork. (3–15)
Prerequisite: consent of instructor. Individual field experience in anthropological research under the sponsorship of a faculty member with conferences to be arranged and written reports required. May be repeated up to a maximum of 15 units only.
The Staff (F, W, Sp)

197. Field Study in Anthropology. (1–5)
Individual conferences to be arranged. Prerequisite: consent of instructor. Supervised experience relevant to specific aspects of anthropology in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required.
The Staff (F, W, Sp)

H198A–H198B–H198C. Senior Honors. (5–5–5)
Open only to seniors in Anthropology who are seeking an A.B. degree with honors. Systematic readings in the history of anthropology and in significant modern developments within the field, collection and analysis of research materials, and the preparation of an honors thesis, in close consultation with individual members of the staff. Group and individual tutorials. Credit and grade will be awarded upon completion of full sequence. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (2–5)
Individual conferences to be arranged. Enrollment restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.
The Staff (F, W, Sp)

Graduate Seminars

Seminars normally entail at least 8–10 hours per week of library, museum, or laboratory work.

General prerequisite: consent of the instructor.
Except where noted, all seminars meet formally two hours per week.

200. Physical Anthropology Seminars. (4)
a. Human evolution; b. genetic anthropology; c. primate behavior. Mr. Sarich, Mr. Washburn (F); Mr. Howell (W); Mrs. Dolhinow (Sp)

220. Archaeology Seminars. (4)
a. Western North America; b. Mesoamerica; c. archaeology and ethnology of South America; d. African prehistory; e. African protohistoric archaeology; f. European and Near Eastern prehistory; g. method. Mr. Graham, Mr. Rowe (F); Mr. Graham (W); Mr. Clark, Mr. Graham, Mr. Howell (Sp)

One 2-hour lecture and two 2-hour section meetings per week. Required of all graduate students doing their principal work in social/cultural anthropology. Advanced survey of the major theoretical and empirical areas of social/cultural anthropology. Sequence beginning (F).
Mr. Mandelbaum, Mr. DeVos

250. Seminars in Social and Cultural Anthropology. (4)
Two hours of seminar per week. Prerequisite: consent of the instructor. Several one-quarter seminars will be offered from the following list; consult departmental listings for accurate course information:
a. culture and personality; b. deviancy; c. applied anthropology; d. economic anthropology; e. politics; f. religion; g. linguistic anthropology; h. art and culture; i. recent developments; j. ethnological field method; k. theory of research and analytical methods; l. social stratification; m. urban anthropology; n. ecological anthropology; o. social anthropology theory; p. kinship.
Mr. Graburn (F); Mr. Kay (Sp)

251–252. Two-Quarter Seminars in Social and Cultural Anthropology. (4–4)
Two hours of seminar per week. Prerequisite: consent of instructor. The following seminars extend over two consecutive quarters. Credit and grade will be
assigned upon completion of the full sequence. Consult departmental listings for accurate course information: a. comparative social institutions; b. social interaction; c. change; d. acculturation; e. peasant societies; f. urban cultures; g. culture structure; h. law; i. analysis of field data; j. education and culture; k. anthropology today.

Sequence beginning (F): Mr. Berreman, Mr. Ogbu

Sequence beginning (W): Mr. Shack, Mr. Benedict

255A-255B-255C. Medical Anthropology. (4-4-4)
Three hours of lecture per week. Prerequisite: background in behavioral or health science. Credit and grade awarded upon completion of full sequence. Anthropological theory, data, and methodology and its relationship to health sciences. Lectures, readings, and supervised field research.

Sequence beginning (F): Mr. Foster, Mrs. Newman

260. Folklore Seminars. (4)

a. Problems of folklore; b. psychology and folklore; c. North American Indian folklore; d. additional seminars on special topics to be announced.

270. Seminar. (4)
Two hours of lecture per week. Additional topics in various fields of anthropology. The specific topics will be announced at the beginning of each quarter.

Miss Colson (F); Miss Sawyer, Mr. Potter (W); Mr. Howell, Mr. Phillips (Sp)

271-272. Two Quarter Seminar. (4-4)
Two hours of lecture per week. Additional topics in various fields of anthropology extending over two consecutive quarters. Credit and grade will be assigned upon completion of the full sequence. The specific topics will be announced at the beginning of each quarter.

Sequence beginning (F): Mr. Kay, Mr. Gumperz;
Sequence beginning (W): Mrs. Diaz, Miss Colson, Mr. Berlin

280. Area Studies Seminars. (4)

a. Contemporary Latin America; b. Africa south of the Sahara; c. South Asia; d. China; e. Japan;

f. Southeast Asia; g. Oceania; h. additional seminars on special topics to be announced.

Mr. Mandelbaum, Mr. DeVos (Sp)

290. Research Training. (6)
The Staff

295. History and Theory of Anthropology. (4)
Two hours of lecture per week. Prerequisite: consent of instructor.

Mr. Rowe (Sp)

296A-296B. Supervised Research. (4-9; 4)
296A. Practice in original field research under staff supervision.
296B. Analysis and write-up of field materials.

The Staff

298. Direct Reading. (2-6)
Prerequisite: consent of instructor. Individual conferences to be arranged. Intended to provide directed reading in subject matter not covered in available seminar offerings.

The Staff

301. Professional Training: Teaching. (6)
The Staff

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with an adviser. Intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff

Anthropology Seminar. (No credit)
Meetings for the presentation of original work by faculty, graduate students, and visiting anthropologists. Graduate students are expected to attend.

The Staff

[ART AND HISTORY OF ART]

Practice of Art
(Department Office, 238 Kroeber Hall)

Professors:

Elmer N. Bischoff, M.A.
Sidney Gordin
Karl A. Kasten, M.A.
Erle Loran, M.F.A. (hon.)
James McCray, M.A.
Richard O'Hanlon
Harold Paris
Felix Ruvolo
David Simpson, M.A. (Co-Chairman)
Peter H. Vouklos, M.F.A.
John C. Haley, (Emeritus)

NOTE: For key to footnote symbols, see page 86.
MAJOR PROGRAM

Lower Division  Art 2A, 2B, 3, 14A, one of the following: Art 4, 14B (note that 2A is prerequisite to 2B; 2A–2B are prerequisite to 3 and 4, 14A is prerequisite to 14B), and two of the following: History of Art 6A, 6B, 7, 8, 9A, 9B.

Upper Division  28 units of Art, 10 units of History of Art, and Art 120 or Art 121. Art 100 is required for undergraduate transfer students who have not taken Art 2A at Berkeley.

It is a requirement for the major that the student complete at least 12 units of upper division art courses under three instructors of the regular staff.

Honors Program in the Practice of Art  Qualified students (with a minimum grade point average of 3.0, both overall, and in upper division courses in the Practice of Art) who wish to enter the honors program in the Practice of Art should consult with their major advisers at the beginning of the senior year to formulate a Senior Honors Project and to enroll in the honors course (H195A–H195B–H195C).

The Honors Program will consist of a period of independent study under course H195A–H195B–H195C which will culminate in the submission of a body of work called the "Honors Project," upon which the student's performance will be graded. This program must be taken for a minimum of two quarters and a maximum of three quarters, comprising a minimum of 8 units and a maximum of 12 units.

GRADUATE PROGRAMS

The Department of Art offers programs of graduate study leading to the M.A. degree and the M.F.A. degree in Practice of Art.

Further information concerning these programs may be obtained from the department office, 238 Kroeber Hall.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

2A. Form in Drawing. (4)
Three 3-hour studio classes per week. Introduction to the basic elements of form and their interrelationship. The Staff (F, W, Sp)

2B. Form in Color. (4)
Three 3-hour studio classes per week. Prerequisite: course 2A. Introduction to color and its relationship to the other elements of form. The Staff (F, W, Sp)

3. Composition in Life Drawing. (4)
Three 3-hour studio classes per week. Prerequisite: course 2A–2B. Introduction to the elements of form and their relationship to the human figure. The Staff (F, W, Sp)

4. Materials of Painting. (4)
Three 3-hour studio classes per week. Prerequisite: course 2A–2B. An exploration of the techniques and methods of painting. Mr. Allen, Mr. Ballaine, Mr. Kasten (F, W, Sp)

14A–14B. Introduction to Sculpture. (4–4)
Three 3-hour studio classes per week. 14A is prerequisite to 14B. The Staff (F, W, Sp)

Upper Division Courses

100. Advanced Drawing and Composition. (4)
Required for undergraduate transfer students in practice of art who have not had Art 2A. Should be taken during first quarter in residence. The Staff

102. Advanced Drawing and Painting. (4)
102B, 102C, Mr. McCray; 102D, Mr. Ruvolo; 102E, Mr. Kasten; 102F, Mr. Hartman; 102G, Mr. Bischoff; 102H, Mr. Allen; 102J, Mr. Miyasaki; 102K, Mr. Simpson; 102M, Mr. Ballaine; 102V, visitors.
103. The Human Figure in Drawing, (4)
Principles of space drawing and composition using recognizable form. Mr. Bischoff, Mr. Kasten, Mr. McCray, Mr. Buvolo

105. Mural Composition, (4)
Prerequisite: as above and upper division standing. Emphasis on wall painting offering work in a variety of media on an individual project basis. Mr. McCray

106. Practice in the Graphic Arts: Emphasis on Etching, (4) Mr. Kasten, Mr. Miyasaki, Visitors

107. Practice in the Graphic Arts: Emphasis on Lithography, (4) Mr. Miyasaki

114. Advanced Sculpture, (4)
114A, Mr. O’Hanlon; 114B, Mr. Gordin; 114C, Mr. Paris; 114D, Mr. Voulkos; 114E, Mr. Melchert; 114F, Mr. Hudson; 114V, visitors.

115. Advanced Sculpture: Emphasis on the Human Figure, (4)
(Open to advanced architecture and landscape architecture majors who have had Art 14A.) The Staff

120. Painting Analysis, (4)
Three hours of lecture per week. Prerequisite: course 2A, 2B, and ten units of Art History. A survey course analyzing ideas in art with emphasis on painting. Primarily for art majors. Mr. Simpson (F)

121. Sculpture Analysis, (4)
Three hours of lecture per week. Prerequisite: course 2A, 14A, and ten units of Art History. A survey course analyzing ideas in art with emphasis on sculpture. Primarily for art majors. Mr. Gordin (Sp)

Special Study Courses
H195A-H195B-H195C, Special Study for Honors Candidates in the Practice of Art, (4-4-4)
(Formerly numbered H196A-H196B-H196C)
Individual hours to be arranged. Prerequisite: senior standing and qualifying scholarship record (minimum 3.0 overall GPA and 3.0 GPA in upper division courses in the Practice of Art). May be taken for two or three quarters. Credit and grade will be awarded on completion of the sequence. The Staff (F, W, Sp)

199Y. Supervised Independent Study and Research in Practice of Art, (1-5)
Enrollment is restricted by regulations listed on page 87. Additional limitations: restricted to honors seniors for selected projects. Staff approval required. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses
General prerequisite for graduate courses in the Practice of Art is at least a B average in the undergraduate major in art. Students may not enroll in more than two sections of the following courses per quarter: 202, 212.

202. Graduate Seminar in Art: Emphasis on Two-Dimensional Media, (4)
Three hours of seminar per week. Emphasis on original works; group discussion and criticism. Ancillary topics of a contemporary and historical nature will be introduced. May be repeated for credit. The Staff

212. Graduate Seminar in Art: Emphasis on Three-Dimensional Media (4)
Three hours of seminar per week. Emphasis on original works; group discussion and criticism. Ancillary topics of a contemporary and historical nature will be introduced. May be repeated for credit. The Staff

294. Seminar, (4)
One 2-3 hour meeting per week. Studio work emphasizing various aspects of form. Group criticism. Intended for specially qualified M.F.A. candidates; will not satisfy the M.A. Seminar requirements. May be repeated for credit. The Staff

295. Individual Study for Graduate Students, (1-12)
Individual study intended to provide opportunity for qualified students to prepare themselves for the M.F.A. Comprehensive Project. The Staff

298. Special Study for Graduate Students, (1-4)
Staff approval required. The Staff

History of Art
(Office, 417 Doe Library)

Professors:
Darrell A. Amyx, † Ph.D.
Jean V. Bony, Agrégé
James Cahill, Ph.D.
Herschel B. Chipp, Ph.D.
L. D. Ettlinger, D. Phil.
Walter W. Horn, Ph.D.
Peter H. Selz, Ph.D., D.F.A. (hon.)

Associate Professors:
Svetlana Alpers (Mrs. Paul J.), Ph.D.
Jacques de Caso, † Ph.D.
David H. Wright, Ph.D.

Assistant Professors:
Loren Partridge, Ph.D.
Joanna Williams (Mrs. Clyde), † Ph.D.

Lecturer:
Alfred Frankenstein, Ph.B., D.F.A. (hon.c.)
MAJOR PROGRAM

Lower Division Two of the following: History of Art 6A, 6B, 7, 8, 9A, 9B. Also Art 2A and either Art 2B or 14A. One of the following: History 4A, 4B, 4C, 4D. Students planning graduate study in History of Art are urged to develop a reading knowledge of German and French or Italian as early as possible.

Upper Division Seven upper division courses in four of the designated areas of the History of Art (see below), including at least one course in either the Ancient or Renaissance-Baroque area, plus History of Art 102; or six upper division courses in three of the designated areas of the History of Art (see below), including at least one course in either the Ancient or Renaissance-Baroque area, plus one course in a related history or literature, studio art, or another course if approved by petition in advance to the major adviser, plus History of Art 102.

(Designated areas of the History of Art: Oriental, Ancient, Medieval, Renaissance-Baroque, Modern.)

Note: It is recommended that an appropriate lecture course be taken as a background for the particular section of History of Art 102 selected. Additional sections of History of Art 102 may be substituted for required upper division lecture courses, if space is available.

Restrictions: Only one 199 of 5 units may be offered as part of the upper division course requirement.

Honors Program in the History of Art Students with a grade-point average of 3.0 or better (overall and in upper division work in the History of Art) may be admitted to the Honors Program. Candidates for Honors in the History of Art are required to undertake an honors project (for which 5 units of credit are given under History of Art H195) in their senior year. The project may be an extension of the student’s work in History of Art 102 or may deal with another area already familiar to him. Application forms which require the signature of the Chairman of the Honors Program and of the thesis director are available in the History of Art office. History of Art H195 does not count toward the upper division unit requirements for the major. Should the Honors project cover more than one quarter, 199Z will cover the first quarter and H195 will cover the second quarter.

GRADUATE PROGRAMS

The Department of Art and History of Art offers programs of graduate study leading to the M.A. and Ph.D. degrees in the History of Art.

Further information concerning these programs may be obtained from the department office, 417 Library.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

Three to four hours of lecture per week, one hour of section per week, and additional directed study.

6A–6B. History of Ancient Mediterranean Art. (5–5)
(Formerly numbered 1A)
From the Stone Age to the Period of Constantine. 6A, The Stone Age in Europe and the Near East; Egyptian Art; Art of the Ancient Near and Middle East.

6B. Aegean, Greek, Etruscan, and Roman Art. Either part may be taken separately.

7. Introduction to the History of Art: Painting. (5)
(Formerly numbered 1B)
Medieval, Renaissance, and Modern.
Mrs. Alpers (F), ——— (W), ——— (Sp)

8. Introduction to the History of Art: Architecture and Sculpture. (5)
(Formerly numbered 1C)
Medieval, Renaissance, and Modern.
Mr. Partridge (F)
9A–9B. History of Asian Art. (5–5)
(Formerly numbered 1D–1E)
9A. The Art of India and Southeast Asia. Mrs. Williams (W)
9B. The Art of China and Japan.

Upper Division Courses

Open to nonmajors. General prerequisite: upper division standing or consent of the instructor. Unless otherwise stated, the “A” part of a sequence is not prerequisite to the “B” part. No part A, B or C is prerequisite to another.

All History of Art courses involve three to four hours of lecture per week and additional directed study.

*128. Tribal Art. (5)
Three hours of lecture per week. An analysis of the style of the art of black Africa, the South Pacific and North America, developed according to art-historical principles. — (F)

130A–130B. Early Chinese Art. (5–5)
*130A. Chinese art from the Prehistoric period through the Chou Dynasty. (F)
*130B. Chinese art from the Han Dynasty through the T’ang Dynasty. (W)

131A–131B. Later Chinese Art. (5–5)
131A. Chinese art of the Sung and Yian Dynasties. Mr. Cahill (F)
131B. Chinese art of the Ming and Ch’ing Dynasties. Mr. Cahill (W)

134A–134B. The Art of Japan. (5–5)
(Formerly numbered 134)
134A. Japanese art through the late 13th century. Mr. Cahill (F)
134B. Japanese art from the 14th century through the present. Mr. Cahill (Sp)

Three hours of lecture per week and additional directed study.
136A. Indus Valley through 550 A.D., primarily Buddhist sculpture. Mr. Cahill (F)
136B. 500–1350 A.D., primarily the Hindu temple and its sculpture. Mr. Cahill (W)
136C. 1350 A.D. to the present, primarily Muslim and Rajput miniature painting. Mrs. Williams (Sp)

137. The Art of Southeast Asia. (5)
Three hours of lecture per week. Prerequisite: upper division standing or consent of the instructor. The art of Cambodia, Thailand, Burma, and Indonesia focussing on the period from 400 to 1500 A.D. Sculpture and architecture will be considered as a balance of Indian and indigenous elements. Mrs. Williams

*138. Borobudur, (5)
Three hours of lecture per week. Prerequisite: course 136A or 137, consent of the instructor. Advanced course on the style, sources, and iconography of the Javanese Buddhist monument. To be offered in conjunction with an Oriental language course on the religious content of Borobudur. Mrs. Williams (Sp)

140A–140B–140C. Greek Art. (5–5–5)
Prerequisite: course 1A.
140A. Greek Art, Geometric and Archaic. 1100–480 B.C.
140B. Greek Art of the Classical Period. 480–323 B.C.
140C. Greek Art of the Hellenistic Period. 323–30 B.C. — (Sp)

*141. Aegean Art. (5)
Prerequisite: course 1A. The art of Crete and Greece in the Bronze Age, with attention to connections with neighboring cultures.

144A–144B. Etruscan and Roman Art. (5–5)
Three hours of lecture and one hour of discussion per week. Prerequisite: upper division standing and consent of the instructor. The first part (144A) will treat Italic and Etruscan art as background to Roman art, and carry Republican art to the accession of Augustus. The second part will deal with art under the Empire, particularly in Rome itself.

145. Roman Art. (5)
The art of Rome and of the Roman Empire, from its sources in the Republican era to the Age of Constantine the Great. Mr. Wright (F)

*150A–150B–150C. Medieval Art. (5–5–5)
Three hours of lecture per week. No prerequisite, but it is helpful to have some background in medieval history and in Christian theology. A survey emphasizing the media and regions most important in each period.
150A. c. 300 to 1500 A.D. Mr. Wright (F)
150B. c. 750 to 1100 A.D. Mr. Wright (W)
150C. c. 1100 to 1400 A.D. Mr. Wright (Sp)

Any quarter may be taken separately; for students taking two or three quarters in succession, credit and grade will be assigned upon completion of the sequence. Research papers will normally extend through two successive quarters.

151. Early Christian and Early Byzantine Art. (5)
Three hours of lecture per week. Mediterranean roots of medieval art. Mr. Horn (F)

152. Germanic and Celtic Art. (5)
Northern roots of medieval art. Mr. Horn (W)

153. Carolingian and Ottonian Art. (5)
Two early formative stages of medieval art. Mr. Horn (Sp)

154A–154B. Late Roman and Byzantine Art. (5–5)
Three hours of lecture per week. Prerequisite: a knowledge of history and of Christian theology equivalent to History 114A–114B (which may be audited simultaneously.) Reading knowledge of at least one useful language (normally German, Italian, French or Russian).
*154A: The tradition of Roman Imperial art from the third century to the eighth century.
*154B: Byzantine art from the ninth century to the fifteenth century, and its influence in Western Europe. Research projects will normally extend through the two quarters and credit and grade will be assigned upon completion of the sequence. Either half may be taken separately with special consent of the instructor. Mr. Wright
Three hours of lecture per week.

157A. Romanesque Architecture.  Mr. Bony (F)
157B. Gothic Architecture.  Mr. Bony (W)
157C. Romanesque Sculpture.  Mr. Bony (Sp)
157D. Gothic Sculpture.  Mr. Bony (Sp)

Development of sculpture in western Europe between late-10th and mid-12th century: Traditions and inventions in 11th century sculpture; the great Romanesque workshops, ca. 1090 to 1130; late Romanesque developments (with particular emphasis on Saint-Denis).

160A–160B. Italian Renaissance Art. (5–5)
160A. The Fifteenth Century.  ———— (F)
160B. The Sixteenth Century.  Mr. Partridge (W)

161. The Trecento. (5)
Italian painting and sculpture, 1260–1400.  Mr. Etlinger (F)

*163. Michelangelo and Raphael. (5)
Prerequisite: course 160B and consent of the instructor. Intensive study of the work of these two artists and their milieu.  ———— (Sp)

*165. Italian Renaissance Architecture. (5)

166. Northern Renaissance Art. (5)
Art in Northern Europe from Van Eyck to Brueghel.  ———— (F)

170A–170B. Baroque Art. (5–5)
170A. Southern Baroque Art.  Mr. Eyck to Rubens
170B. Northern Baroque Art.  From Rembrandt to Vermeer

175. Rubens and Rembrandt. (5)
The works of the two leading painters of the time in the north will be contrasted and used to introduce the major concerns of northern artists of the time.  Mrs. Alpers (W)

180A–180B. Modern Art. (5–5)
180A. Rococo to Impressionism.  Mr. de Caso (F)
180B. Cezanne to Modern America.  Mr. Chipp (W)

*180C. Impressionism and Post-Impressionism. (5)
Prerequisite: course 180A or 180E and permission of the instructor. From Manet’s early landscapes to Art Nouveau.  Mr. Chipp (Sp)

180D. Rodin. (5)
(Formerly numbered 183)
A study of the art of Rodin from 1870 to 1914, with references to the sculpture and art of the Symbolist and Art Nouveau periods. Monuments and other works considered with involvement in architecture, draughtsmanship, and artistic criticism.  Mr. de Caso (Sp)

180E. European Painting in the Early Industrial Age (1780–1890). (5)
Three hours of lecture and one hour of discussion per week. The self-portrait as a manifesto of views and aims. The themes of painting during the period. The impact of the Industrial Revolution on art. Artists withdrawing from the problems of the age. The relationship of art to social and intellectual history.  Mr. Etlinger (Sp)

185. Picasso and Cubism. (5)
Prerequisite: course 180B and consent of instructor. Limited to 25 students. The development of Cubism in painting and sculpture. Mr. Chipp (W)

186. Twentieth-Century Sculpture. (5)
Sculpture from Rodin to the present. Mr. Selz (Sp)

189A–189B. American Art. (5–5)
189A. The Eighteenth and Nineteenth Centuries.  Mr. Frankenstein (Sp)
189B. The Twentieth Century.

189C. American and Bay Area Architecture. (5)
Three hours of lecture and one 2-hour field trip (not including travel time) per week. The lectures will trace the major trends in the history of American architecture from the colonial period to the present. In the field trips, individual buildings and the urban development of the bay area will be studied and related to the nationwide developments.  Mr. Partridge (F)

Restricted Courses

102. Undergraduate Seminar: Problems in the Research and Interpretation in the Several Areas of the History of Art. (5)
Designed primarily for Juniors and Seniors whose major is History of Art, but also open to other students with the consent of the individual instructor. Enrollment limited to 25. Concentration on specific problems or works in a particular area of art history. Assigned readings, discussion, and a substantial paper will introduce the student to, and allow him to employ, the methodology and techniques of art historical research.

102A. Oriental.
102B. Ancient.
102C. Medieval.
102D. Renaissance/Baroque.
102E. Modern.  The Staff (F, W, Sp)

Special Study Courses

H195. Special Study for Honors Candidates in the History of Art. (1–5)
Prerequisite: senior standing and qualifying scholarship record (minimum 3.0 overall, and 3.0 in upper division courses in the History of Art).  The Staff (F, W, Sp)

199Z. Supervised Independent Study and Research in History of Art. (1–5)
(Formerly numbered 199)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.  The Staff (F, W, Sp)

Graduate Courses

General Prerequisite: graduate standing and consent of the instructor, including courses in the history of art and reading knowledge of languages as may be required.
Graduate seminars in the History of Art are normally extended through two successive quarters, meeting for two hours each week, counted as a work load of 3 units each quarter. Credit and grade will be given only upon completion of the full sequence. On rare occasions a seminar may meet intensively, for four hours each week, and be completed in one quarter, counting for 6 units. History of Art 225 is not considered a seminar.

*225. Introduction to Research in the History of Art. (5)
A sequence of readings, discussions, museum trips, and reports designed for beginning graduate students.

230A–230B. Seminar in Chinese Art. (3–3)
(F through W)

236A–236B. Seminar in the Art of India. (3–3)
Mrs. Williams (F, W)

240A–240B. Seminar in Ancient Art. (3–3)
Mr. Amyx (F through W)

244A–244B. Seminar in Roman Art. (3–3)
A graduate seminar sequence of the type already established in the Department, intended to provide instruction in the area of the title. Content may change from year to year, and the course may be repeated without duplication of credit.

251A–251B. Seminar in Early Christian and Medieval Art. (3–3)
Mr. Horn (W through Sp)

254A–254B. Seminar in Early Medieval Art. (3–3)
Mr. Wright (F through W)

257A–257B. Seminar in Romanesque and Gothic Art. (3–3)
Mr. Bony (W through Sp)

260A–260B. Mr. Ettlenger (F through W)
260C–260D. Mr. Partridge (W through Sp)

*266A–266B. Seminar in Northern Renaissance Art. (3–3)
(W through Sp)

270A–270B. Seminar in Baroque Art. (3–3)
Mrs. Alpers (W through Sp)

281A–281B. Seminar in Nineteenth-Century Art. (3–3)
Mr. de Caso (F through W)

Mr. Chipp (W through Sp)

286A–286B. Seminar in Twentieth-Century Painting and Sculpture. (3–3)
Mr. Selz (F through W)

299. Special Study for Graduate Students in the History of Art. (1–6)
The Staff (F, W, Sp)

601. Individual Study for Master’s Students in the History of Art. (1–8)
Individual study for the comprehensive or language requirements in consultation with the graduate adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Enrollment is on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students in the History of Art. (1–8)
Individual study, in consultation with the graduate adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. degree. Units may not be used to meet either unit or residence requirements for the doctoral degree. Enrollment is on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

See Interdepartmental Studies for the complete description of this course.

IDS 137. The Age of Charlemagne: Tradition and Innovation. (5)
See Interdepartmental Studies for the complete description of this course.

IDS 138. Michelangelo and His Age, 1475–1564. (5)
See Interdepartmental Studies for the complete description of this course.

**ART GALLERIES**

The University Art Museum, opened in 1970, will play an active role in instruction and research, giving students an opportunity for experience in connoisseurship, organization of exhibitions, and conservation. The Worth Ryder Art Gallery, in Kroeger Hall, provides a continuous program of contemporary painting and sculpture exhibitions.

**Medieval Studies**

Students interested in graduate programs in Medieval Studies are referred to the Committee for Medieval Studies Advisory to the Dean of the Graduate Division.
**ARTS**

Arts courses are described under Interdisciplinary and General Studies, Division of (DIGS).

**ASTRONOMY**

(Department Office, 601 Campbell Hall)

**Professors:**
- Ivan R. King, Ph.D.
- John G. Phillips, Ph.D., *Chairman*
- Hyron Spinrad, Ph.D.
- Harold F. Weaver, Ph.D.
- William J. Welch, Ph.D.
- Sturla Einarsson, Ph.D. (*Emeritus*)
- Carl E. Heiles, Ph.D.
- Leonard V. Kuhi, Ph.D.
- Leland E. Cunningham, Ph.D. (*Emeritus*)

**Assistant Professor:**
- Jonathan Arons, Ph.D.
- Joseph I. Silk, Ph.D.

**Associate Professors:**
- C. Stuart Bowyer, Ph.D.
- John E. Gaustad, Ph.D.

**Lecturers:**
- David D. Cudaback, Ph.D.
- Nannielou H. Dieter, Ph.D.

**Departmental Major Advisers:** Mr. King, Mr. Kuhi.
**Graduate Adviser:** Mr. Phillips, Mr. Silk.

The Department of Astronomy offers undergraduate and graduate instruction in a wide variety of fields, including theoretical and observational astrophysics; infrared, X-ray and radio astronomy; galactic structure and dynamics of stellar systems; high-energy astrophysics and cosmology, and spectroscopy. There is a considerable amount of research and teaching related to astronomy done in other units at Berkeley, including the Space Sciences Laboratory and the Physics Department. Various professors in the Chemistry, Mathematics, Statistics, and Electrical Engineering Departments have an active interest in astronomy, and are available for consultation.

A variety of instruments is available to students and staff, including a 30-inch telescope at Leuschner Observatory (near the campus), a 120-inch telescope at Lick Observatory, and an 85-foot radio telescope at Hat Creek Observatory. Laboratories are available for the development of radio, infrared, and X-ray instruments, and for the precise measurement of optical images and spectra.

**The Major**

During a student's first two undergraduate years he must, in addition to fulfilling certain specific requirements of the College of Letters and Science, pursue studies that will prepare him for future work in astronomy. Specifically, the department requires that during his first two years each student takes courses that will provide a thorough understanding of:

1. *Basic principles of physics*: mechanics, properties of matter, electricity and magnetism, heat, wave-motion, sound and light. (Physics 4A, 4B, 4C, 4D, 4E)
2. *Basic mathematics*: analytic geometry, differential and integral calculus. (Math. 1A, 1B, 1C or 11A, 11B, followed by Math. 11C, 12A, 12B or 51A, 51B, 51C)

In addition, each student is urged to take foreign language courses that will enable him to gain a reading knowledge of any one (and preferably two) of the three languages, German, Russian and French.

The last two years, leading to the A.B. degree in astronomy, are spent in more intensive work, primarily in the fields of astronomy, mathematics and physics. The

**NOTE:** For key to footnote symbols, see page 86.
A specific plan of study to be followed by each student is to be worked out in consultation with the departmental adviser for the major, and must include at least 36 units of upper division work in astronomy and allied fields.

A. All astronomy majors are required to take Astronomy 127A–B–C–D.

B. The remainder of the student's courses will generally be chosen from the following list:

- Mathematical Methods in Physics (Physics 104)
- Analytic Mechanics (Physics 105A–105B)
- Electromagnetism and Optics (Physics 110A–110B–110C)
- Modern Physics and Advanced Electrical Laboratory (Physics 111A–111B–111C)
- Introduction to Statistical and Thermal Physics (Physics 112)
- Introductory Nuclear Physics (Physics 124)
- Nuclear Physics (Physics 129A–129B)
- Quantum Mechanics and Its Applications to Atomic Physics (Physics 137A–137B–137C)
- Introduction to Plasma Physics (Physics 142)
- Introduction to Linear Algebra (Math. 111)
- Advanced Calculus for the Applied Sciences (Math. 120A–120B–120C)
- Mathematical Tools for the Physical Sciences (Math. 121A–121B)
- Numerical Analysis (Math. 128A–128B)
- Physics of the Earth (Geology and Geophysics 122A–122B)
- Introduction to the Theory of Probability and Statistics (Stat. 100A–100B–100C)

Students of marked ability may well take certain graduate courses in astronomy during the senior year.

**Honors Program** For honors in Astronomy a student must fulfill the following requirements: (1) a grade-point average of at least 3.5 in all courses in Astronomy and related fields; (2) in Astronomy 127 A–B–C–D, a minimum of two A's and two B's or three A's and one C; (3) an individual project of research or study, involving at least 3 units of Astronomy H195. The student's project is chosen in consultation with his major adviser, and his written report is judged by the major adviser and one other faculty member.

**Graduate Programs**

The graduate program is aimed at the Ph.D degree. Entering students need not have majored in astronomy, although some astronomical background is desirable. A strong background in physics is essential, however. In order to facilitate reading of research papers in German, Russian, and French as part of their graduate work, entering students are urged to study at least one of these languages as undergraduates.

In addition to the qualifying examination on the thesis topic required by the University, the Department requires students to pass a preliminary examination in two parts. The first part tests breadth of knowledge of general astronomy, and the second part tests depth of knowledge of three specialized research areas chosen by the student from a list of about ten. Students choose, with the aid of their adviser, courses in the Department which are useful in preparing for the preliminary and qualifying examinations. In addition, a tentative regulation currently under discussion would require that students pass a modest number of graduate courses taken outside the Department. A tutorial program is designed to maintain regular contact with the faculty. The program normally takes four to five years. Additional information on the program is available upon request to the Department.
The requirements for the M.A. degree are 36 units in graduate or upper division undergraduate courses (18 of them in graduate courses) and the first part of the preliminary examination.

Lower Division Courses

1. Introduction to General Astronomy. (4)
   Four 1-hour lectures and one 1-hour discussion section per week. General facts and principles of the science of astronomy. Not intended for advanced physical science majors. Mr. Kuhi, Mr. Phillips (F); Mr. Weaver, Mr. Spinrad (W); Mr. Gaustad, Mr. Heiles (Sp)

98. Undergraduate Seminar in Astronomy. (1)
   One hour of lecture per week. Prerequisite: course 1 (which must be taken concurrently) and consent of instructor. This course is based on a discussion section limited to 15 students and conducted by a professor. Topics include instrumentation for and recent advances in astronomical research.
   Mr. Kuhi, Mr. Phillips (F); Mr. Weaver, Mr. Spinrad (W); Mr. Heiles, Mr. Gaustad (Sp)

Upper Division Courses

   Three 1-hour lectures and one 1-hour discussion section per week. Prerequisite: Physics 4E; Mathematics 2C or 12B. Introduction to the principal fields of modern astrophysical research. Intended primarily for majors in the physical sciences and engineering.
   Mr. Phillips (W); Mr. Arons (Sp)

   Prerequisite: Physics 4A, 4B, 4C, 4D, 4E; Mathematics 2C or 12B.
   127A–127B. Three 1-hour lectures per week.
   127A: Spherical astronomy, instrumentation, celestial mechanics, solar system. Prerequisite: Physics 4A, 4B, 4C, 4D, 4E; Mathematics 2C or 12B. 127A: Spherical astronomy, instrumentation, celestial mechanics, solar system. Prerequisite: Physics 4A, 4B, 4C, 4D, 4E; Mathematics 2C or 12B. 127B: Stellar magnitudes, colors, spectra, and motions; populations and distributions; variable stars; structure of the Milky Way and other galaxies; cosmology. Sequence beginning (F) Mr. King (F, W)
   127C–127D. Three 1/2-hour lectures per week. 127C: Introductory astrophysics, spectrographs, photometry, stellar atmospheres, curve-of growth, spectroscopic binaries. 127D: Eclipsing binaries, stellar structure and evolution, interstellar matter. Sequence beginning (F) Mr. Gaustad (F, W)

H195. Special Study for Honors Candidates. (2–5)
   The Staff (F, W, Sp, Su)

199. Supervised Independent Study and Research for Undergraduates. (2–5)
   Enrollment is restricted by regulations on page 87. Prerequisite: course 127A–127B. Must be taken on a passed or not passed basis.
   The Staff (F, W, Sp, Su)

Graduate Courses

215A–215B. Orbit Theory and Practice. (5–5)
   Three 1-hour lectures and two 1-hour discussion sections per week. Prerequisite: courses 127A–127B–127C–127D and Physics 105A–105B (may be taken concurrently), or consent of instructor. May be taken by qualified seniors. Various orbit methods, reduction of observations, special perturbations, introduction to general perturbations. Sequence beginning (W)

216. Introduction to Nonstellar Astrophysics. (4)
   Five 1-hour lectures per week. A survey of non-stellar astronomical phenomena, meant as an introduction to the special topics treated in 226, 236, 246 and 256. The basic radiation physics and observational techniques, with applications to interstellar dust clouds, shock waves, radio sources, and quasars.
   Mr. Arons (F)

   Four 1-hour lectures per week. Theory of stellar atmospheres and interpretation of stellar spectra. Radiative transfer; local thermodynamic equilibrium; model atmospheres; continuous spectra of sun and stars. Theory of line formation; stellar spectra and abundances. Special types of stars; stellar envelopes. (Replaces former 217A, E, F, respectively. Not open to students who have taken those courses prior to fall 1968.) Courses 217B and 217C may be taken by students who had courses designated in by those numbers 1966–67 or 1967–68.
   Sequence beginning (W) 217A, Mr. Kuhi (W); 217B, Mr. Spinrad; 217C, Not given

218A–218B–218C. Stellar Systems. (4–4–4)
   Three 1-hour lectures and one 1-hour discussion section per week. Stellar types and populations; star clusters; interstellar material; galactic structure; stellar dynamics; galaxies. Sequence course.
   Mr. Weaver (F); Mr. Shu (W); Mr. King (Sp)

219. Solar System Astrophysics. (5)

   Three 1-hour lectures and two 1-hour discussion sections per week. Prerequisite: Physics 105.
   Sequence beginning (F)

226. X-Ray Astronomy. (3)
   Three hours of lecture per week. Prerequisite: course 216. Experimental evidence for X-ray emission from the Sun, galactic and extragalactic sources. Mechanisms of X-ray emissions. Source models, instrumentation and methods. Connections with related topics in high energy astrophysics.

   Three 1-hour lectures and one 1-hour discussion section per week. Physical processes in stellar interiors: gravitational equilibrium, modes of energy transport, thermonuclear sources of energy. The general facts of stellar evolution as deduced from theory; interpretation of observations. Theory of stellar pulsation. (Not open to students who have taken 227A–227B prior to fall, 1966. Courses 227A and 227B
are not open to students who have taken 217B–217C in 1966–67 or 1967–68.)

228. Cosmology. (3)
Three 1-hour lectures per week. Survey of cosmological models, and topics chosen from the following: Element production, coupling of matter and radiation, and origin of galaxies in Friedmann cosmologies. Observational cosmology, including determination of metric parameters, and properties of intergalactic matter and microwave background.
Mr. Silk (Sp)

236. Radio Astronomy. (4)
Four 1-hour lectures per week. Prerequisite: course 216. Comparison of radio and optical instrumentation and techniques. Detailed application of radiation physics to objects observed in the radio range, including emission nebulae, gas clouds, and relativistic plasmas, with application to current observations. (Not open to students who have taken Astronomy 238.)
Mr. Welch (W)

245. Satellite Theory. (5)
Three 1-hour lectures and two 1-hour discussion sections per week. Prerequisite: consent of instructor. The motion of natural and artificial satellites. Practical determination of their orbits and perturbations.

246. Infrared Astronomy. (3)
Three 1-hour lectures per week. Instrumentation for infrared observations. Principles of molecular spectra; molecule formation. Molecular processes in space, with application to interstellar dust and protostars.

256. Interstellar Gas Dynamics. (4)
Four 1-hour lectures per week. Prerequisite: course 216. Theoretical study of the motion of interstellar matter under the action of gravitational, pressure, and magnetic forces. Steady-state configurations, perturbations, turbulence, and shock waves. Applications to spiral arms, interstellar clouds, spherical explosions, and formation of stars and galaxies. (Not open to students who have taken Astronomy 217D.)
Mr. Shu (Sp)

266. High Energy Astrophysics. (4)
Four hours of lecture per week. Prerequisite: course 216 or consent of instructor. Basic physics of radiation processes in an astrophysical environment. Interaction of energetic particles and photons with matter, including cosmic-ray, x-ray, and gamma-ray production and propagation. Applications to interstellar medium, pulsars, supernovae, intergalactic medium, extragalactic radio sources, and big-bang cosmologies.
Mr. Arons (W)

276. Special Topics in High Energy Astrophysics. (4)
Four hours of lecture per week. Prerequisite: course 266 or consent of instructor. In-depth applications of high energy astrophysics to a wide range of astrophysical environments. These may include such topics as interstellar matter, pulsars, supernovae, supernova remnants, radio galaxies, Seyfert galaxies, intergalactic matter, and quasi-stellar sources. To be given alternate years beginning Fall 1973.
Mr. Silk (F)

(2–10, Su.)
Advanced instruction in observational and reduction techniques making use of the observing facilities of the Leuschner, Hat Creek and Lick Observatories, and the facilities of the Department of Astronomy and the Computer Center.
Mr. Spinrad (Sp)

286. Instrumentation of High-Energy Astronomy. (1)
Three hours of laboratory per week. Prerequisite: course 226 or consent of instructor. Instruction in the design and use of instrumentation employed in the field of high-energy astronomy. Special emphasis will be placed on those types of instrumentation (such as photomultiplier tubes) which are also employed in optical astronomy.

292. Seminar. (2–5)
One 2-hour meeting per week. In addition to the weekly colloquium the department offers seminars in advanced topics, several of which are announced at the beginning of each quarter. A maximum of 10 units may be taken per quarter with a limitation of 5 units in any one section. The Staff (F, W, Sp)

298. Directed Group Study. (1–8)
Prerequisite: must be taken on a passed or not passed basis. Tutorial for groups of two or three students.
The Staff (F, W, Sp)

299. Advanced Study and Research. (2–10)

300. Instruction Techniques in General Astronomy.
(1)
Two hours of lecture per week. Prerequisite: must be taken on a passed/not passed basis. Discussion and practice of teaching techniques as applied to astronomy.
Mr. Gudaback (F)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other doctoral degrees). May not be used for unit or residence requirement for the doctoral degree. Must be taken on a satisfactory or unsatisfactory basis.
The Staff (F, W, Sp)
BACTERIOLOGY AND IMMUNOLOGY

(Department Office, 3573 Life Sciences Building)

Professors:
Phyllis B. Blair, Ph.D.
Alvin J. Clark, Ph.D.
Michael Doudoroff, Ph.D.
Marian E. Koshland, Ph.D.
Hiroshi Nakaudo, M.D., D.Med.Sc.
(Chairman)
Leon Wofsky, Ph.D.

Assistant Professor:
David R. Zusman, Ph.D.

Professor:
H. Hugh Fudenberg, M.D.

Associate Professors:
H. Claudia Henry, Ph.D. (Adjunct)
Janis D. Young, Ph.D. (Adjunct)

Lecturers:
Anne H. Good, M.D., Ph.D.
Mary L. Human, M.A.

Departmental Major Advisers: Mrs. Good, Mrs. Koshland, Mr. Mishell, Mr. Wofsky.
Graduate Adviser: Mrs. Blair.

Students who are interested in the major in bacteriology are urged to consult with the major adviser concerning the specific courses to be taken as a basis for the major.

The Department of Bacteriology and Immunology offers an undergraduate major in bacteriology, and graduate training in both bacteriology and immunology. The undergraduate major, administered according to two plans, provides training in bacteriology at the upper division level, on the basis of a preparation at the lower division level in general biology and physical science. Plan I is strongly recommended for all students who plan to undertake subsequent graduate work. Honor students with a special interest in immunology may arrange an individual major program in this area with the approval of the undergraduate adviser.

The Major

PLAN I

Lower Division Chemistry 1A–1B–1C, 5; Chemistry 8A–8B, or 12A–12B; Mathematics 16A–16B; Physics 6A–6B; Biology 1A–1B.

Upper Division Bacteriology 100A–100B, 101A–101B; Biochemistry 102, 102L, Chemistry 109A. At least 10 additional units chosen from: Bacteriology 103, 202A–202B; Molecular Biology 110A–110B; Zoology 104, 110A–110B, 155; Botany 101, 130A–130B.

PLAN II

Lower Division Chemistry 1A–1B–1C, 5, 8A–8B; Mathematics 16A and either Mathematics 16B or Statistics 2; Physics 6A; Biology 1A–1B, Physics 6B and 6C are recommended.

Upper Division Bacteriology 102–102L; Biochemistry 102, 102L; Public Health 180A–180B. At least 9 additional units chosen from: Bacteriology 103; Molecular Biology 110A–110B or Genetics 100; Public Health 182, 182L; Zoology 104, 156; Zoology 110A–110B or Botany 130A–130B.

Honors Program All honor students majoring in bacteriology are eligible to enroll in the honors program. Students enrolled in the program must take at least 6 units of honors courses (H195 and/or H180), and must pass an oral examination at the end

NOTE: For key to footnote symbols, see page 86.
Preparation for Graduate Study  
For the pursuit of graduate work in either bacteriology or immunology, the undergraduate training outlined under Plan I is preferable. Other courses strongly recommended as basic preparation for future graduate work are: Chemistry 109B; Chemistry 112E (for students who have taken Chemistry 12E); Physics 6C. Useful foreign languages include French, German, Russian and Japanese; German is recommended.

The Graduate Program

The Department offers the M.A. and Ph.D. degrees in bacteriology and immunology. There is no separate M.A. program; the M.A. degree is usually earned as part of the doctoral program. The completion of teaching assignments for a minimum of three quarters is required of all students working for the Ph.D. degree in bacteriology. Information is available from the graduate adviser in 3573 Life Sciences Building.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Upper Division Courses

100A–100B. General Bacteriology. (4–4)
Two 1½-hour lectures and a 1-hour discussion per week. Prerequisites: Biology 1A–1B; Chemistry 5 and 8, or 12; Biochemistry 102. Course 100A is prerequisite to 100B.

100A. An introduction to the biological properties of the bacteria.
Mr. Nikaido (W)

100B. Bacterial physiology and metabolism.
Mr. Zusman, Mr. Doudoroff (Sp)

101A–101B. General Bacteriology Laboratory. (3–3)
101A: Three 3-hour laboratories per week. 101B: Two 4½-hour laboratories per week. Prerequisite: course 100A–100B (may be taken concurrently). Laboratory experiments planned to accompany the lectures in course 100A–100B. Sequence, beginning (W), Mr. Nikaido, Mrs. Human (W); Mr. Zusman, Mr. Doudoroff, Mrs. Human (Sp)

102. An Introduction to General Bacteriology. (4)
Two 1½-hour and one 1-hour lectures per week. Prerequisites: Biology 1A–1B; Chemistry 1C and 8A–8B. Not open to students who have credit in courses 100A–100B.

102L. Bacteriology Laboratory. (4)
One 1-hour lecture per week and two 4-hour laboratories per week. Prerequisite: course 102 (may be taken concurrently) or course 100A. Experimental work to acquaint the student with the techniques of general bacteriology. Planned to accompany lectures in course 102.

Mr. Doudoroff, Mrs. Human (F)

103. Introduction to Immunology and the Biology of Host-Parasite Interactions in Infectious Disease. (4)
Two 1-hour lectures and one 2-hour discussion per week. Prerequisite: Biology 1A–1B; a course in bacteriology is recommended. The nature of the immune response; some aspects of microbial pathogenicity and host resistance. Must be taken on a passed or not passed basis.

Mrs. Koshland (W), Mr. Mishell (Sp)

H180. Research. (3–5)
(Formerly numbered H197)
Open to students in their senior year who are enrolled in the Department of Bacteriology and Immunology honors program. Laboratory research.

The Staff (Mrs. Koshland in charge) (F, W, Sp)

H195. Individual Study. (3–5)
Open to students in their senior year who are enrolled in the Department of Bacteriology and Immunology honors program.

The Staff (Mrs. Koshland in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
(Formerly numbered 195)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (Mrs. Koshland in charge) (F, W, Sp)

Graduate Courses

202A–202B. Immunology. (4–3)
202A. Two 1½-hour lectures per week. Prerequisite: Biochemistry 102 or the equivalent. The immune response; antibody-antigen reactions, structure and function of antibody molecules, the nature of antibody specificity; problems and theories of antibody biosynthesis.

Mr. Wofsy (F)
202B. Two 1/4-hour lectures per week. Cell-mediated immunologic reactions, the allograft reaction; mechanisms of immunologic injury; immunologic disorders; ontogeny and phylogeny of the immune response; antigenic alterations in neoplasia and immunologic surveillance.

Mrs. Blair (W)

202L. Immunology-Immunochemistry Laboratory. (4–8)

Experimental methods of immunology and immunochemistry. Prerequisite: course 202A–202B, or consent of instructor; 202B may be taken concurrently. Laboratory, seminar, and discussion periods to be arranged. Students will select one or more projects involving a variety of techniques. The course may be taken in any of the three quarters; under special circumstances a student may arrange to take the course in more than one quarter and receive credit.

Mrs. Good, Mr. Wofsky, (F, W, Sp)

203. Microbial Metabolism. (3)

Prerequisite: Biochemistry 100B, or consent of instructor. Recommended: an elementary bacteriology course. Covering selected topics on the metabolism of microorganisms, with special emphasis on intermediary metabolism.

(F)

204. The Immunology of Normal and Neoplastic Tissues. (3)

Two 1/2-hour lectures per week. Prerequisite: graduate standing in a biological science or permission of instructor. The allograft reaction; antigens of normal and neoplastic cells; immune interference; immune surveillance in neoplasia. To be taken on a passed/not passed basis.

Mrs. Blair (Sp)

205. The Nature of the Immune Response. (2)

One 3-hour seminar per week. Prerequisite: graduate standing in any biological science, and consent of instructor. An analysis of new developments in research into the molecular and cellular basis of the immune response. To be taken on a passed/not passed basis.

Mr. Mishell (F), Mr. Wofsky (W), Mrs. Koshland (Sp)

206. Immunogenetics. (2)

Prerequisite: course 202A–202B, or consent of instructor. Reading and discussion on current problems of immunogenetics: analysis of complex loci in red blood cell systems and transplantation antigens; genetically controlled antigenic variation in microbes and viruses; genetics of immunoglobulins and antibody synthesis.

Mrs. Koshland, Mr. Fudenberg, Mr. Wang (Sp)

207. Structure and Function of the Procaryotic Cell. (3)

Three hours of lecture per week. Prerequisite: Biochemistry 102 or equivalent. A synthesis of structural and biochemical knowledge about the principal component of procaryotic cells.

Mr. Nikaido (F)

208L. Laboratory Methods in Cellular Immunology. (4–8)

Laboratory, seminar, and discussion periods to be arranged. Prerequisite: course 202A, 202B, and 202L, or consent of instructor. Students will work on a project involving a variety of techniques in cellular immunology. Under special circumstances, a student may arrange to take the course for more than one quarter and receive credit.

Mrs. Good, Mrs. Henry (W, Sp)

212. Seminar in Current Research. (1)

An introduction to the analysis of scientific literature. Required of all first-year graduate students in bacteriology and in immunology. To be taken on a passed/not passed basis.

The Staff (Mrs. Blair in charge) (F, W)

213. Seminar in Advanced Laboratory Methods. (2)

One 3-hour seminar per week. Prerequisite: graduate standing in bacteriology and immunology, and consent of instructor. An introduction to advanced general laboratory methods for first-year graduate students in bacteriology and immunology. To be taken on a passed/not passed basis.

214. Introduction to Research. (4–8)

Prerequisite: Graduate standing in the Department of Bacteriology and Immunology, or the Group in Microbiology or Immunology, and consent of the instructor. An introduction to the research laboratory for first-year graduate students. The student will carry out individual research in the laboratory of one of the members of the staff. To be taken on a passed/not passed basis.

The Staff (Mrs. Blair in charge) (F, W, Sp)

216. Seminar in Tumor Immunology. (1)

Prerequisite: graduate standing in any biological science, and consent of instructor. A critical survey and discussion of current research on the immunology of neoplastic cells. Must be taken on a passed/not passed basis.

Mrs. Blair (F, W, Sp)

280. Research. (1–12)

The Staff (F, W, Sp)

295. Special Topics. (1–3)

Prerequisite: consent of the instructor. From time to time, lecture series are offered on topics of current interest. The Staff (Nikaido in charge) (F, W, Sp)

299. Special Study for Graduate Students. (2–4)

The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1–8)

Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)
BIOCHEMISTRY

(Department Office, 401 Biochemistry Building)

Professors:
Bruce N. Ames, Ph.D.
Clinton E. Ballou, Ph.D.
Horace A. Barker, Ph.D.,
Frederick H. Carpenter, Ph.D.
R. David Cole, Ph.D.
Charles A. Dekker, Ph.D.
Daniel E. Koshland, Jr., Ph.D.
John B. Neilands, Ph.D.
Jesse C. Rabinowitz, Ph.D.
Howard K. Schachman, Ph.D.
Esmond E. Snell, Ph.D.
Allan C. Wilson, Ph.D.

William Z. Hassid, Ph.D. (Emeritus)

Associate Professors:
Michael J. Chamberlin, Ph.D.
Jack F. Kirsch, Ph.D.

Assistant Professors:
Stuart M. Linn, Ph.D.
Gregory Milman, Ph.D.
Edward E. Penhoet, Ph.D.

Professors:
James A. Bassham, Ph.D.
C. Arthur Knight, Ph.D.

Associate Professors:
Michael J. Chamberlin, Ph.D.
Jack F. Kirsch, Ph.D.

Assistant Professors:
Stuart M. Linn, Ph.D.
Gregory Milman, Ph.D.
Edward E. Penhoet, Ph.D.

Graduate Advisers: Mr. Ballou, Mr. Koshland.

The Undergraduate Major

The department offers two programs for the major: Plan I for students expecting to pursue graduate study in biochemistry, and Plan II for those who do not. Students in Plan I may elect the honors program.

The Major

Lower Division
Chemistry 4A–4B–4C (or 1A–1B–1C and 5); Chemistry 12A–12B (or 8A–8B for those expecting to follow upper division Plan II, see below); Mathematics 1A–1B–1C; Physics 6A–6B–6C (or 4A–4B–4C); Biology 1A–1B.

Recommended:
Plan I: Additional courses in biological and physical science; a reading knowledge of one foreign language (German, French, Japanese, Russian).

Upper Division
Plan I: Biochemistry 100A–100B–100C; Biochemistry 101A–101B; Biochemistry 190; Chemistry 109A–109B (or 14 and 110A–110B); Chemistry 112; Related elective (3 units).

Plan II: Biochemistry 100A–100B–100C; Biochemistry 101A–101B; Biochemistry 190; Chemistry 109A–109B; Related electives (8 units).

Recommended:
Plans I and II: additional courses in biochemistry and in allied subjects, chosen in accordance with a plan approved by the departmental adviser.

Honors Program
A student who is enrolled in the major under Plan I and who has a grade-point average of at least 3.0 in courses acceptable in the major may elect the honors program at any time not later than the first quarter of the senior year. In addition to the courses prescribed under the Plan I major, the student in this program will be required to complete 4 units in course 180 and to write a thesis based on the research. Certain graduate biochemistry courses will be open to these students on approval of the instructor and adviser. To remain in the honors program a student must maintain a grade-point average of at least 3.0 in biochemistry courses and in those courses acceptable in the major.

Graduate Study

The department offers the M.A. degree (under either Plan I or Plan II as described in the Graduate Division section of this catalogue), and the Ph.D. degree. All students

NOTE: For key to footnote symbols, see page 86.
working for the Ph.D. degree are required to serve as a teaching assistant for two quarters. For information concerning the requirements for either degree consult a graduate adviser in the department.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Course

20. Current Topics in Biochemistry. (1)
One 1-hour lecture per week. Prerequisite: sophomore standing or consent of the instructor. A course intended primarily to acquaint potential biochemistry majors with developments in this area. Typical topics include: genetic code, regulation of biochemical processes, molecular action of vitamins and hormones, biochemistry of evolution, mechanism of catalysis in living systems, membrane processes. The Staff (Mr. Milman in charge) (W)

Upper Division Courses

100A–100B–100C. General Biochemistry. (3–3–3)
Three 1-hour lectures per week. Prerequisite: Chemistry 8B, 12B or equivalent and a course each in physical chemistry and biology, or consent of the instructor. Designed for biochemistry majors. Lectures on the chemical and physical factors concerned in life processes, including the chemistry, function, degradation, and biosynthesis of major cellular constituents; enzymatic catalysis; energy and metabolism and control of metabolic processes. Sequence, beginning in the fall. Mr. Koshland, Mr. Snell (F); Mr. Ballou, Mr. Bassham (W); Mr. Kirsch, Mr. Penhoet, Mr. Milman (Sp)

101A–101B. General Biochemistry Laboratory. (4–4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Chemistry 5 and course 100A–100B–100C (may be taken concurrently), or consent of the instructor. Laboratory experiments planned to accompany the lectures in course 100A–100B–100C. Sequence, beginning in the fall and in the winter.

101A: Mr. Kirsch, Mr. Wilson (F); Mr. Linn, Mr. Milman (W); 101B: Mr. Neilands, Mr. Ames (W); Mr. Penhoet, Mr. Ballou (Sp)

102. A Survey of the Principles of Biochemistry. (4)
Four 1-hour lectures and one hour of discussion per week. Prerequisite: a course in organic chemistry. Recommended: courses in physical chemistry and biology. Designed for nonbiochemistry majors. Not open for credit to students who have credit in courses 100A–100B–100C or equivalent. Mr. Snell, Mr. Penhoet (F); Mr. Koshland, Mr. Neilands (Sp)

102L. Biochemistry Laboratory. (5)
Two 1-hour lectures and two 4-hour laboratories per week. Prerequisite: Chemistry 5 and course 102 (may be taken concurrently). Not open for credit to students who have credit in course 101A–101B or equivalent. Experimental work to acquaint students with the properties of biological materials, the action of enzymes, and the use of specific techniques for laboratory work in biochemistry. Planned to accompany lectures in course 102. Mr. Barker, Mr. Kirsch, Mr. Barker (F), Mr. Ballou, Mr. Milman (Sp)

150. Biochemistry and Society. (2)
Two 1-hour lectures per week. Prerequisite: course 102, 100A or consent of instructor. This course will offer a biochemical perspective on the technological intrusions which threaten life and will analyze the professional responsibility of the biochemist to society. Must be taken on a passed/not passed basis. The Staff, Mr. Neilands in charge (Sp)

180. Research. (2–4)
Prerequisite: courses 100A and 101A with grade of B or higher and consent of major adviser. Research topics for advanced students under the direction of a member of the staff. The Staff (Mr. Linn in charge) (F, W, Sp)

190. Proseminar. (1)
Prerequisite: courses 100A–100B and 101A–101B. Seminar, for biochemistry majors, based on the biochemical literature. Mr. Penhoet (Sp)

195. Special Topics in Biochemistry. (1)
One hour of lecture per week. Prerequisite: a course in Biochemistry or consent of instructor. A course dealing with topics of current and general interest in biochemistry. May be repeated for credit. Must be taken on a passed/not passed basis. The Staff (Mr. Ballou in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (2–4)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (Mr. Ames in charge) (F, W, Sp)

Graduate Courses

Courses 201 to 214, intended to acquaint graduate students with recent advances in biochemistry, are also open to senior students with honor standing by consent of the instructor.

201A–201B. Advanced Biochemical Laboratory Methods. (4–4)
One 1-hour lecture and three 3-hour laboratories per week. Prerequisite: graduate standing in biochemistry, and consent of the instructor. 201A: Enzyme Chemistry; 201B: Biochemical Genetics. Sequence beginning (W); Mr. Ames, Mr. Chamberlin (Sp)

202. Carbohydrates. (3)
Three 1-hour lectures per week. Prerequisite: Chemistry 112 or equivalent. Selected topics on the chemistry and biochemistry of carbohydrates. Mr. Ballou (F)

204. Biochemistry of Proteins. (3)
Three 1-hour lectures per week. Prerequisite: courses 100A–100B–100C. Chemistry and metabolism of peptides and proteins. Mr. Cole (F)
205. Biochemistry of Nucleic Acids. (3)
Three 1-hour lectures per week. Prerequisite: courses 100A–100B–100C or consent of the instructor. The chemistry and biochemistry of the nucleic acids and their constituents.

Mr. Chamberlin, Mr. Linn (Sp)

206. Physical Biochemistry. (5)
Four and one-half hours of lecture per week. Prerequisite: a year course each of organic and physical chemistry or consent of instructor. Recommended: course 102 or 100A–100B–100C. Application of modern physical concepts and experimental methods to the analysis of the structure, function, and interaction of large molecules of biological interest.

Mr. Schachman (W)

207. Comparative Biochemistry. (2)
Two 1-hour lectures per week. Prerequisite: course 102 or 100A–100B–100C and Biology 1C or equivalent. Recommended: Zoology 108 or Genetics 131. A survey of biochemical differences among the major taxonomic groups of organisms; biochemical methods for classifying organisms and elucidating their phylogenetic relationships; the impact of biochemical studies on our understanding of the mechanics of evolution.

Mr. Wilson (Sp)

213. Enzyme Synthesis and Control. (3)
Three 1-hour lectures per week. Prerequisite: course 102 or 100A–100B–100C, or consent of the instructor. Recommended: Bacteriology 107 or Genetics 131. A survey of biochemical differences among the major taxonomic groups of organisms; biochemical methods for classifying organisms and elucidating their phylogenetic relationships; the impact of biochemical studies on our understanding of the mechanics of evolution.

Mr. Wilson (Sp)

214. Mechanisms of Enzyme Action. (3)
Three 1-hour lectures per week. Prerequisite: course 102 or 100A–100B–100C, physical chemistry and advanced organic chemistry, or consent of the instructor. Current concepts of the mode of action of enzymes. The modes of binding of substrates and allosteric effectors to enzymes and analysis of the thermodynamics and kinetics of these reactions. Catalytic mechanisms utilized by enzymes and correlation of mechanism with 3-dimensional structure.

Mr. Kirsch, Mr. Koshland (Sp)

280. Research. (3–12)
Thesis research for graduate students majoring in biochemistry. Students must enroll for not less than 3 units, except by special permission of the chairman of the department.

The Staff (Mr. Koshland in charge) (F, W, Sp)

285. Research Seminar. (1)
Two hours of lecture per week. Prerequisite: Biochemistry 602 or 280 taken concurrently. Seminar on the presentation and evaluation of results in the area of the students immediate research interests.

The Staff (Mr. Koshland in charge) (F, W, Sp)

290. Seminar. (1)
Graduate student seminar in biochemistry dealing with various topics which differ from year to year. The program for 1972–73 will include several sections each quarter, each emphasizing a different subject. The Staff (Mr. Ballou in charge) (F, W, Sp)

299. Special Study for Graduate Students. (2–4)
Reading and conference for properly qualified graduate students in biochemistry under the direction of a member of the staff. The Staff (Mr. Koshland in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Ballou in charge) (F, W, Sp)

BIOLOGY

Professors:
Herbert G. Baker, Ph.D. (Botany)
Howard A. Bern, Ph.D., (Zoology)
Ralph Emerson, Ph.D. (Botany)
Cedat H. Hand,† Ph.D. (Zoology)
Watson M. Laetsch, Ph.D. (Botany)
William Z. Lidicker, Ph.D. (Zoology)
A. Starker Leopold, Ph.D. (Zoology)
A. Douglas McLaren, Ph.D. (Biology) (Chairman)
Robert Ornduff,† Ph.D. (Botany)
Frank A. Pitelka, Ph.D. (Zoology)
Ralph I. Smith, Ph.D. (Zoology)
Fred H. Wilt, Ph.D. (Zoology)

Associate Professors:
Ned K. Johnson, Ph.D. (Zoology)
Russell L. Jones,† Ph.D. (Botany)

Charles S. Nicoll, Ph.D. (Physiology)
John A. West† Ph.D. (Botany)

Assistant Professors:
David R. Bentley, Ph.D. (Zoology)
Robert K. Colwell, Ph.D. (Zoology)
Michael T. Ghiselin, Ph.D. (Zoology)
Mary L. Pressick, Ph.D. (Zoology)
John A. West† Ph.D. (Botany)
Marshall L. White, Ph.D. (Forestry and Zoology)

Lecturer:
Marvalee H. Wake, Ph.D. (Biology)
Marshall L. White, Ph.D. (Forestry and Zoology)

NOTE: For key to footnote symbols, see page 86.
Field Major in Biological Sciences

**Major Advisers:** Mr. A. D. McLaren, Mrs. M. H. Wake, Head Advisers; Plan A: Mr. H. J. Burki, Mr. P. Duesberg, Mr. G. H. Echols, Mr. J. Gerhart, Mr. J. W. Gofman, Mr. C. A. Knight, Mr. M. E. Maestre, Mr. L. Packer, Mr. G. Stent, Mr. P. Satir, Mr. H. H. Srebnik, Miss M. A. Williams, Mr. R. C. Williams; Plan B: Mr. D. Price, Mr. R. Stebbins; Plan C: Mr. H. G. Baker, Mr. R. Caldwell, Mr. R. Colwell, Mr. R. Emerson, Mr. P. Licht, Mr. R. Schmid; Plan D: Mr. Z. Arnold, Mr. W. Berry, Mr. J. West.

This program, which is offered in the College of Letters and Science, serves the needs of students who can profit from broader training in the biological sciences than is possible in a departmental major. Four plans are offered under the Department of Biology, namely A, specialization in functional biology; B, specialization in systematic biology and morphology; C, specialization in ecology; and D, specialization in the area of marine biology.

**Lower Division Courses** Required of all students in the major: Chemistry 1A–1B (8 units); Chemistry 8A–8B (9 units); Mathematics 16A (4 units); Physics 6A–6B–6C (12 units); Biology 1A–1B (12 units).

**Upper Division Courses** Required of all students in the major: Genetics 100 (5 units), or Molecular Biology 110A (5 units) or Genetics 150A and 150B (6 units); a course in the history or philosophy of biological science (2–5 units) is recommended.

Other courses as follows:

**PLAN A** (specialization in the area of functional biology as evidenced by a study of the physiological and biochemical aspects of living things):

*Option I*—Cellular emphasis: Chemistry 109A–109B (6 units); Biochemistry 102 (4 units); Biochemistry 102L (5 units); Physiology 101 (5 units) or two quarters from among the following: Zoology 104 (4 units); Zoology 110A–110B (3–3 units); Botany 130A (4 units); additional upper division courses in biological science to complete a minimum of 45 units of upper division work in the major.

*Option II*—Organismal emphasis: Biochemistry 102 (4 units); Botany 144 (5 units); Physiology 102A (5 units), or Physiology 123 (4 units), or Zoology 131 (4 units), or Entomological Sciences 103 (2 units) and Entomological Sciences 103L (2 units); Zoology 107A–107B (5–5 units), or Zoology 108 (6 units) and Entomological Sciences 100 (5 units); Zoology 105 (6 units), or Biology 153 (3 units) and Anatomy 151 (4 units). As under Option I, 45 units of upper division work are required.

**PLAN B** (specialization in the area of systematics and evolutionary biology; study of the structure, classification, and evolution of living things): Botany 102 (5 units); Botany 105 (5 units); Botany 110 (5 units), or Botany 125 (4 units); Botany 144 (5 units), or Entomological Sciences 103 (2 units) and Entomological Sciences 103L (2 units), or Physiology 123 (4 units), or Zoology 104 (4 units); Zoology 107A–107B (5–5 units); Zoology 108 (6 units), or Entomological Sciences 100 (5 units); Zoology 109 (4 units), or Genetics 131 (5 units); to complete a minimum of 45 units.

**PLAN C** (specialization in the area of ecology; study of the relations between living things and their environment): Biology 150 (4 units); Botany 102 (5 units), or Botany 101 (4 units) and Botany 104 (10 units) or Botany 120 (5 units), or Botany 125 (4 units); Zoology 107A–107B (5–5 units), or Zoology 157 (10 units), or Interdepartmental Studies 100 (15 units), or Zoology 108 (6 units) and Entomological Sciences 100 (5 units); Physiology 123 (4 units), or Zoology 131 (4 units), or Entomological Sciences...
103 (2 units) and Entomological Sciences 103L (2 units); Entomological Sciences 105 (4 units), or Zoology 140 (3 units), or Botany 154 (2 units); additional upper division courses in biological sciences to complete a minimum of 45 units of upper division work in the major; at least one course in statistics is recommended.

Plan D (specialization in the area of marine biology); Biology 150 (4 units); Biology 160A—160B (3–3 units); Zoology 142 (4 units); Zoology 157 (10 units) or Zoology 108 (6 units); Botany 104 (10 units) or Botany 102 (5 units); one quarter course or summer course (4-unit minimum) at a marine laboratory; additional upper division courses in biological science to complete a minimum of 45 units of upper division work in the major.

Suggested electives: Bacteriology 102 (4 units) and Bacteriology 102L (4 units); Botany 204, 205 (4, 4 units); Civil Engineering 201A (3 units); 201B (3 units); and 201C (3 units); Geology 10 (4 units); Geology 107 (5 units); Geology 110 (4 units); Interdepartmental Studies 100 (15 units); Paleontology 111 (4 units); Paleontology 114 (4 units); Paleontology 115 (4 units); Zoology 106 (4 units) and Zoology 106L (3 units); Zoology 124 (4 units); Zoology 124L, 124M (5, 5 units); Zoology 155 (6 units).

Honors Program The honors program consists of completion of Biology H198, Pre­ seminar in Biology (1 unit), and Biology H195, Special Study for Honors Candidates (3 units), followed by a written report.

Teaching Major in Biological Science

Students majoring in bacteriology, biology, botany, entomological sciences, physiology, zoology, or other biological science areas are eligible for a secondary teaching credential major in biological science. The prospective teacher should consult with the teaching major adviser and with the science supervisor in the School of Education early in his university career so that a program may be planned that meets individual needs. For a list of specific requirements, please refer to the ANNOUNCEMENT OF THE SCHOOL OF EDUCATION. Teaching major advisers: Mr. R. Stebbins and Mrs. M. Wake; teaching minor adviser: Mr. R. Ornduff; science supervisors: Mr. J. D. Miller and Mr. P. Kuerbis.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

1A—1B. General Biology. (6–6)
(Formerly numbered 1A—1B—1C)
Three hours of lecture, three hours of laboratory, and two hours of discussion per week. Prerequisite: Chemistry 1A (semester system) or Chemistry 1A—1B (quarter system); Chemistry 8A—8B recommended concurrently. Biology 1A: The Biological World—Its Evolution. Biology 1B: Cells and Organisms. Intended for students majoring in biological sciences, but open to all qualified students.
Mr. Buchanan, Mr. Laetsch, Miss Pressiek, Mr. Smith, Mrs. Wake (1B, F; 1A, W, 1B, Sp)

2. Topics in Biology. (2)
One hour of lecture per week. Prerequisite: preferentially open to freshmen, consent of instructor required. Reading and discussion of works which provide the foundations for present day biological theory and practice. May be repeated for credit, with consent of instructor. Mrs. Wake in charge (F, W, Sp)
signed for those not specializing in the biological sciences. An introduction to the fungi with special emphasis upon their interactions with man. Topics will include human disease, crop disease, fermentations, antibiotics, edibility, drugs and poisons, waste disposal, composting, storage riots, protein production, chemical conversions, industrial use, etc.

Mr. Emerson (W)

Upper Division Courses

150. General Ecology. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: course 1A–1B or 11A–11B; or Introduction to Biology 1A–1B–1C; or an introductory college level course in each of botany and zoology. An introduction to the principles of ecology, stressing the structure and dynamics of natural communities on both regional and local bases, and the historical and contemporary influences of man.
Mr. Colwell (in charge), Mr. Baker, Mr. Petelka

151. Microbial Ecology. (4)
Two 1½-hour lectures and one 2-hour discussion/demonstration/field work per week. Prerequisite: a course in general biology. Interrelationships of microorganisms and their environments. Physical and chemical properties of soil and aquatic habitats; cycles of elements; activities of bacteria, algae, fungi, protozoa; population dynamics. Limited enrollment.
Mr. McLaren (in charge), Mr. Balamuth, Mr. West (Sp)

153. Development Biology. (3)
Three hours of lecture per week. Prerequisite: course 1A–1B. An introduction to principles of embryonic and postembryonic development of plants and animals, stressing mechanisms of cell regulation, self assembly of macromolecular aggregates, relations of cell growth and division, communications among cells, and cell differentiation.
Mr. Wilt (Sp)

160A–160B. Marine Geobiology. (3–3)
Two hours of lecture and one hour of laboratory per week. Prerequisite: course 1A–1B, 150. The courses include the oceanographic and geological context of marine biology with examples drawn from the geologic record and present seas.
Mr. Berry, Mr. Arnold, Mr. Wilde (W, Sp)

167. Biogeography. (3)
Two 1-hour lectures per week. Prerequisite: senior or graduate standing and consent of instructor. Principles underlying patterns of geographic distribution and dispersal of organisms based on critical analysis of evidence from selected modern groups, with emphasis on the western hemisphere.
Mr. N. K. Johnson (in charge), Mr. R. Ornduff (F)

H-195. Special Study for Honors Candidates. (3)
Prerequisite: H-198. Study, followed by a written report, with any faculty member in the Departments of Biology and Agriculture. May be repeated for credit.
Mr. McLaren (W, Sp)

H-198. Proseminar in Biology. (1)
Prerequisite: upper division standing with an over-all B average, and at least a B average in the major. One 1-hour meeting per week plus individual conferences. Reporting and group discussion on selected topics.
Mr. McLaren (F)

Graduate Courses

221. Comparative Physiology and Endocrinology Seminar. (1)
One hour of lecture per week. Prerequisite: permission of the instructor. Reviews and reports of current research in vertebrate endocrinology and physiology. To be taken on a passed/not passed basis.
Mr. Licht, Mr. Nicoll, Mr. Bern (F, W, Sp)

250. Tropical Biology—an Ecological Approach. (12)
Ten 1-hour lectures and 30 hours of laboratory and field work per week. Prerequisite: graduate status in a biological discipline and a course in general ecology. Evolution and dynamics of tropical biota, their relationships to tropical environments; an intensive field course in Costa Rica offered in cooperation with the Organization for Tropical Studies; travel and subsistence fellowships available from O.T.S. Feb.–Mar.; July–Aug. Biology 250 is sponsored by the Graduate Council.
Mr. Baker, Mr. Colwell

301. Professional Preparation: Teaching of Biology. (1)
One hour of lecture per week. Prerequisite: graduate standing and appointment as a teaching assistant, or consent of instructor. Principles of teaching biology at the college level. Weekly seminars on approaches to biology, teaching methods, evaluation, and analysis of current problems in general biology. To be taken on a passed/not passed basis.
Mrs. Wake (F, W, Sp)

Molecular Biology 10. Introduction to Molecular Biology. (3)
See Molecular Biology for the complete description of this course.

Medical Physics 10. Atomic Radiation and Life. (4)
See Medical Physics for the complete description of this course.

Nutritional Sciences 10. Survey of Nutritional Sciences. (5)
See Nutritional Sciences for the complete description of this course.

Interdepartmental Studies 10A–10B–10C. Man and His Environment—Crisis and Conflict. (5–5–5)
See Interdepartmental Studies for the complete description of this course.

Interdepartmental Studies 100. Problems in Marine Biology. (15)
See Interdepartmental Studies for the complete description of this course.

Interdepartmental Studies 170. Wildlife Biology and Management. (4)
See Interdepartmental Studies for the complete description of this course.

Botany 431. Techniques of Electron Microscopy for Biologists. (3)
See Botany for the complete description of this course.

Anatomy 495. Freeze-Etch Electron Microscopy. (2)
See Physiology-Anatomy for the complete description of this course.
Biostatistics

(Administered by an Interdepartmental Group)

Professors:
David R. Brillinger, (Miller Professor) Ph.D.
Chin Long Chiang, Ph.D. (Co-Chairman)
Joseph L. Hodges, Jr., Ph.D.
Lucien LeCam, Ph.D.
Jeryzy Neyman, Ph.D., D.Sc. (hon.), LL.D. (hon.), Ph.D. (hon.) (Emeritus)
Elizabeth L. Scott, Ph.D. (Co-Chairman)

Jacob Yerushalmy, Ph.D.

Associate Professors:
Kjell A. Doksum, Ph.D.
Michael E. Tarter, Ph.D.

Assistant Professors:
Richard J. Brand, Ph.D.
Steve Selvin, Ph.D. (Acting).

Graduate Advisers: Mr. Brand, Miss Scott, and Mr. Chiang.

The phenomena studied in the health, medical, and biological sciences, as in all sciences, involve chance mechanisms. To understand such mechanisms or their relationship with the phenomena requires competence in probability and statistics, and to apply these concepts to any field of science requires a basic knowledge of the subject matter of the field. Biostatistics is concerned with development of statistical principles and methods and their application to problems in the health, medical, and biological sciences. As a discipline, biostatistics is essential to research and contributes to the understanding in these scientific areas.

Graduate Programs and Degrees
The group in Biostatistics offers two graduate programs: M.A. and Ph.D. These programs are appropriate for students who have either a strong mathematical and statistical background with a great interest in the biomed­ical sciences, or degrees in the biological sciences with a major interest in mathematics and statistics. For further information, consult the graduate advisers, Mr. Brand, Miss Scott, and Mr. Chiang.

The M.A. degree can be obtained under Plan I or Plan II; but students may proceed directly to the Ph.D. program without obtaining the M.A. degree. The Ph.D. dissertation is administered according to Plan B, one foreign language is required.

Preparation for Graduate Study
It is realized that few of the entering students will be prepared in mathematics, statistics, and the subject matter areas. Most prerequisites, however, can be made up during the first year of graduate study. Minimum entrance requirements consist of two full-year courses in calculus, and one-year courses in mathematical statistics or biostatistics, and in biology, zoology, or physiology.

Research Facilities
Graduate students in the group have direct access to a small electronic computer and also have available to them the services of the University Computer Center. A unique facility available to group members is the Child Health and Development Studies conducted by the Division of Biostatistics of the School of Public Health. Financed by the National Institutes of Health, this facility provides opportunities for both practical experience and individual research.

Research in the Statistical Laboratory and cooperation with other departments allow the possibility of unusually broad and effective training in both the theoretical and applied directions. Research activity in the Statistical Laboratory presently includes stochastic models and applications in carcinogenesis, competition of species, cell division, theory of epidemics, and population dynamics.

Courses of Instruction
A wide variety of appropriate courses from a number of departments is available to candidates for either the M.A. or the Ph.D. degrees, giving both programs considerable flexibility. Such flexibility allows each student, in consultation with his major professor and graduate adviser, to arrange his own program. See Public Health and Statistics for some of the course listings.

NOTE: For key to footnote symbols, see page 86.
The Major in Botany is designed to acquaint undergraduates with the fundamental aspects of plant science and to allow sufficient latitude besides for more advanced studies in areas of special interest. Background courses in the physical sciences, particularly chemistry, are taken in the freshman year while the required introductory sequence in Biology (1A–1B) is normally taken in the sophomore year. Prospective majors are urged to consult the departmental major adviser early in their lower division work.

The Major

**Lower Division**  Biology 1A–1B; Chemistry 1A–1B, 8A–8B; two additional quarters of chemistry (from 1C, 5, or 14) or calculus (Mathematics 1A–1B–1C or 16A–16B of 190A–190B) or Physics 6A–6B–6C. Botany 1 recommended.

**Upper Division**  Biochemistry 102; two courses of the following: Botany 101, 102, 105, or 110; two courses of the following: Botany 130, 135, and 140; one course of the following: Botany 120, 124, or 154; plus one additional course from any of the preceding three groups; Genetics 100 or 150A–150B. Additional courses in botany or approved courses in related departments to complete a minimum of 36 upper division units.

**Honors Program**  Qualified students may arrange an individual program of special study in consultation with the major adviser, to begin not later than the first quarter of their senior year. Students in the honors program must pass an oral comprehensive examination.

**Preparation for Graduate Study**  Those students interested in graduate study in botany at Berkeley or elsewhere are strongly advised to gain a background in at least one foreign language, German being especially recommended. Ph.D. candidates at Berkeley are required to pass a reading examination in one foreign language (ordinarily selected from French, German, and Russian) before taking the oral qualifying examination. (Alternative methods for fulfilling this requirement exist; for a detailed statement request information from the graduate adviser.) Students interested in physiological, biochemical, or biophysical botany should take all of the physics, chemistry, and mathematics listed as options under lower division above and also Biochemistry 102L.

**NOTE:** For key to footnote symbols, see page 86.
The Graduate Program

Graduate training leading to the M.A. and Ph.D. is offered in the field of botany as represented by the experience, interests, and competence of the faculty. Students should have had or must complete the required, or equivalent, courses which compose the undergraduate major. They must demonstrate a reading knowledge of one foreign language early in their graduate work, and they are expected to attend a graduate seminar (Botany 290) on the average of every other quarter they are registered. A student's further course work will be planned with an advisory committee during his first quarter and subsequently with his major professor and the graduate adviser.

Students should note that faculty of the Department of Botany are members of several graduate groups described in appropriate bulletins of the Graduate Division. Students may enroll in such group programs with a faculty member of Botany as their major professor.

For further details on the requirements for the M.A. and the Ph.D. degrees, as well as the facilities available for graduate study in botany, please consult the graduate advisers.

The Botanical Garden in Strawberry Canyon provides opportunities for research with living plants, supplies teaching material for classes on campus, and serves as an outdoor laboratory for students; its collections are especially rich in succulents, South American, South African, European, and Australian plants. The combined University and Jepson Herbaria offer a world-wide, floristic, reference-research collection and library which form a foundation for basic research in systematic botany, ecology, phytogeography, and evolution, not only for faculty, staff, and students but also for visiting scholars and for biologists throughout the United States and other countries.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

1. General Botany. (5)
Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: recommended Biology 1A-1B or 11A-11B. An introduction to the plant kingdom, designed for students who intend to major in the plant sciences. Mr. Kaplan (F)

10. Plant Biology. (4)
Open without prerequisite to all students and designed for those not specializing in the biological sciences. Emphasis of the course is placed on the fundamental concepts of biology as illustrated by the structure and function of plants.
One 1-hour lecture, one 1-hour discussion, and one 3-hour audiotutorial study session (to be arranged by students per week. Mr. Jensen (Sp)

*11. An Evolutionary Survey of the Plant Kingdom. (4)
Three 1-hour lectures and one 3-hour laboratory period per week. Open without prerequisite to all students and designed for those not specializing in the biological sciences. Emphasis will be on the structure, life histories, reproductive mechanisms, and relationships of the major groups of plants.

41A. Freshman Seminar. (3)
One 3-hour meeting at night per week. Prerequisite: 11th or 12th grade biology or chemistry. Enrollment restricted to 10 freshmen per section. To explore through reading, dialogue, and laboratory demonstration the development of the instructor's present research program. Mr. Jensen (W)

Upper Division Courses

101. Survey of Mycology. (4)
Two 1-hour lectures and two 3-hour laboratory or field periods per week. Prerequisite: Biology 1A-1B or 11A-11B. Selected aspects of fungi: their structure, reproduction, physiology, ecology and genetics; their role in plant disease, human welfare, and industry. Acceptable in the Botany Major only if combined with course 104 in place of 100.
Mr. Emerson (F)

102. General Phycology. (5)
Two 1½-hour lectures and two 3-hour laboratories per week and two or three half-day trips on weekends. Prerequisite: Biology 1A-1B; course 1 recommended. General biology of fresh-water and marine algae including both phytoplankton and benthous. Emphasis is on morphology, phylogeny, and systems. Laboratories include study of representative types, identification of field-collected specimens, techniques for culture, and simple experiments on development and reproduction. Mr. West (W)
104. Marine Botany. (10)

Full-time study at Bodega Marine Laboratory in the first half of the summer, including lectures, laboratory, field work and special problems, with emphasis upon marine algae. Prerequisite: Biology 1A–1B–1C or Biology 1A–11B.1

105. Principles of Plant Morphology. (5)

Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B; course 1 recommended. An analysis of the structural diversity of multicellular plants, particularly the higher forms, with emphasis on the developmental mechanisms responsible for this variation in form and the significance of this diversity in relation to the environments in which the plants grow. Mr. Kaplan (W)

110. Evolutionary Morphology of Vascular Plants. (5)

Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B; course 1 and 105 recommended. An analysis of the evolution and comparative morphology of vascular plants studied from the viewpoint of both fossil and living representatives. Mr. Schmidt (Sp)

115. Plants and Man. (4)

Three 1-hour lectures and 2 hours of demonstration per week. Prerequisite: a course of high school or college biology or botany, or consent of instructor. Man’s selection and use of plants for his own purposes and the interrelation between the evolution of domesticated plants and the cultural evolution of man. Mr. Baker (F)

120. Taxonomy of Seed Plants. (5)

Two 1-hour lectures and two 3-hour laboratories per week plus field work. Prerequisite: Biology 1A–1B. Lectures on phylogeny and classification of spermatophytes; laboratory and field work illustrating taxonomic principles and methods.

Mr. Constance (in charge), Mr. Strother (W)

124. Field Course in Plant Taxonomy and Ecology. (10)

Full-time study in the first half of the summer at the University of California Field Station at Sagehen Creek, near Truckee, California. Prerequisite: a background in biology. The taxonomic aspects include a brief survey of the flowering plants with practice in identification. The ecological aspects include studies of physiological tolerances of plants and the nature of limiting factors of the environment as they influence patterns of distribution. Acceptable in place of course 120 for the major.2

125. The California Flora. (2)

Two 1-hour lectures per week. Open without prerequisite to all students. Emphasizes the relation of California plants and plant communities to soils, climate, geological history and recent history.

Mr. Ornduff (Sp)

125L. The California Flora, Laboratory. (2)

Two 3-hour laboratories per week. The use of and introduced members of the flora of California. Keys and examination and identification of the native Must be taken concurrently with Botany 125.

Mr. Ornduff (Sp)

130. Plant Cell Biology. (3)

Three 1-hour lectures per week. Prerequisite: Biology 1A–1B. A synthesis of morphological, biochemical, and genetic information on cell function, structure, and development. Mrs. Southworth (F)

130L. Plant Cell Biology, Laboratory. (2)

Two 3-hour laboratories per week. Prerequisite: Biology 1A–1B. Emphasizing the morphological and biochemical aspects of the cell. To accompany course 130. If taken, must be concurrent with course 130. Mrs. Southworth (F)

135. Plant Growth and Development. (5)

Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B. A combined anatomical and physiological study of the factors controlling growth, differentiation, and reproduction in vascular plants. Mr. Jones (Sp)

140. Form and Function in Vascular Plants. (5)

Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B. An analysis of the basic functioning of the adult vegetative plant and the relation of anatomy to problems of maintenance physiology. Mr. Machlis (W)

144. Plant Physiology. (5)

Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B and Chemistry 8A, 8B may be taken concurrently. A study of the physiology of higher plants. Recommended for biology field majors and students working toward the general secondary teaching credential. Not open to students who have taken course 140. Mr. Machlis (F)

154L. Laboratory in Plant Ecology. (2)

Six hours of laboratory per week. Prerequisite: course 154 (may be taken concurrently). Laboratory for course 154 in Plant Ecology. Mr. Baker (W)

190. Seminar for Botany Majors. (2)

One 1-hour lecture per week. An introduction to the field of Botany as represented in the Department. Mr. Constance (F)

3 Arrangements must be made well in advance for a place in the class and for personal accommodations. Inquiries regarding details are to be addressed to: The Director, Bodega Marine Laboratory, P.O. Box 247, Bodega Bay, California 94923.

3 Arrangements must be made well in advance for a place in the class and for personal accommodations. Inquiries regarding details are to be addressed to the Department of Botany, University of California, Berkeley, California 94720.

1 Arrangements must be made well in advance for a place in the class and for personal accommodations. Inquiries regarding details are to be addressed to: The Director, Bodega Marine Laboratory, P.O. Box 247, Bodega Bay, California 94923.
H195. Special Study for Honors Candidates. (1–6)
Prerequisite: restricted to junior and senior botany majors. The Staff (Mr. Kaplan in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–3)
Enrollment is restricted by regulations listed on page 57. Additional limitations: at least one upper division course in Botany and an overall grade-point average of 3.00, must be taken on a passed/not passed basis. Mr. Kaplan in charge (F, W, Sp)

Graduate Courses

201. Biology of the Lower Fungi. (5)
Three 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 100 or equivalent background in mycology. Phycomycetes, Asco- and Basidio- and Hyphomycetes (in part). Given in alternate years.
Mr. Emerson (F)

Three 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 100 or equivalent background in mycology. Myxomycetes, Deuteromycetes (in part), and Basidiomycetes. Given in alternate years.
Mr. Collins (F)

*204. Algology. (6)
Three hours of lecture and two 3-hour laboratories per week. A survey of the algae. Given in alternate years.
Mr. West (W)

210. Pteridology. (5)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: courses 105 and 110. An advanced treatment of the biology of ferns. Given alternate years.
Mr. Smith (Sp)

*220. Advanced Taxonomy. (3)
Three hours of lecture per week. Prerequisite: Botany 120 (Botany 212 is no longer offered). A survey of the literature basic to classification of flowering plants.
Mr. Constance (F)

222. Plant Biosystematics. (3)
Three 1-hour lectures per week. Given in alternate years. Prerequisite: course 120. A study of the biometrical, cytological, and experimental bases of biosystematics, the morphological patterns resulting from various evolutionary processes, and the taxonomic problems they pose.
Mr. Ornduff (W)

224. Evolutionary Ecology. (5)
Two 1-hour lectures and two 3-hour laboratories per week. Given in alternate years. Prerequisite: course 120 and Genetics 100. A study of processes involved in the development and maintenance of ecological adaptations in individuals, populations, and communities.
Mr. Baker (Sp)

232. Plant Histochemistry. (5)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 130 or 212 and Biochemistry 102 or consent of instructor. The principles and practice of microscopic and quantitative histochemistry as applied to plant tissue.
Mr. Jensen (W)

*247. Plant Sex Hormones. (2)
Two 1-hour lectures per week. Prerequisite: course 140A–140B and Biochemistry 102. A study of the occurrence, chemistry, and physiology of hormones controlling sexual reproduction.
Mr. Machlis (Sp)

248. Biochemical and Biophysical Approaches to Plant Physiology. (5)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 140 and Physics 6A–6B/C. The role of advanced research techniques in elucidating physiological processes.
Mr. Park (Sp)

*249A–249B. Advanced Plant Physiology. (4–4–4)
Meetings with the faculty for an evening of discussion every two to three weeks. Prerequisite: courses 110, 140, and consent of instructor in charge. Intensive reading and analysis of the classical and recent literature in the field of plant physiology. Given in alternate years.
Mr. Baker (W)

259. Advanced Plant Ecology. (4)
Four hours of lecture per week. Prerequisite: courses 154 and 224. Intensive reading and analysis of the literature in the field of plant ecology. Designed for candidates for the Ph.D. in the area of plant ecology.
Mr. Baker (W)

290. Seminar. (2)
One 1-hour meeting per week. Advanced study in various fields of botany. Topics will be announced in advance of each quarter. Consent of instructor required. Enrollment in more than one section permitted.
The Staff (F, W, Sp)

299. Research. (1–12)
Graduate student research. The Staff (F, W, Sp)

395. Botanical Teaching. (2)
One 2-hour lecture-discussion session per week. Open to all graduate students in the Department of Botany. The course will cover the aims and methods of teaching botany at the college and university level. All new Teaching Assistants in the department are expected to enroll.
Mr. Jensen (F)

431. Techniques of Electron Microscopy for Biologists. (4)
One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: graduate standing, approval of major professor, and consent of instructor. The purpose of this course is to prepare graduate students in the biological sciences to use electron microscopy in their research.
Mrs. Southworth (W)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or resident requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

Botany Colloquium. (0)
One 1-hour meeting per week. Meetings for the presentation of original work by the faculty, visiting lecturers, and graduate students.
The Staff (F, W, Sp)
BUDDHIST STUDIES

The Group in Buddhist Studies

(Group Office, 246 Dwinelle Hall)

Professors:
Robert N. Bellah, Ph.D. (Sociology and Comparative Studies)
Delmer N. Brown, Ph.D. (History)
James Cahill, Ph.D. (History of Art)
Wolfram Eberhard, Ph.D. (Sociology)
Padmanabha S. Jaini, Ph.D. (South and Southeast Asian Languages and Literatures)
J. Frits Staal, Ph.D. (Philosophy and South and Southeast Asian Languages and Literatures)

Chairman: P. S. Jaini
Graduate Adviser: Robert Goldman

Associate Professors:
James E. Bosson, Ph.D. (Oriental Languages)
Lewis R. Lancaster, M.Th., Ph.D. (Oriental Languages)
Barend A. Van Nooten, Ph.D. (South and Southeast Asian Languages and Literatures)

Assistant Professors:
Robert P. Goldman, Ph.D. (South and Southeast Asian Languages and Literatures)
Wei-Ming Tu, Ph.D. (History)
Joanna Williams, Ph.D. (History of Art)

The Group in Buddhist Studies offers an interdisciplinary program of study and research leading to the Ph.D. degree in Buddhist Studies. The Group, which cooperates closely with the Departments of South and Southeast Asian Languages and Literatures and of Oriental Languages, emphasizes the close ties of religion with the Linguistic background and the surrounding civilizations. Students who wish to join the program may choose either an emphasis on Sanskrit or on an East Asian language, i.e., Chinese or Japanese. For those who choose the Sanskrit emphasis, the required secondary language will be Chinese or Tibetan; for the Chinese/Japanese emphasis, the required secondary language will be Sanskrit.

Preparation
For admission to the graduate program the student shall have completed an M.A. in one of the appropriate Asian languages or have equivalent language preparation. Early in the student's doctoral career, written examinations in two modern languages must be passed. These languages must be relevant to the student's program and have the approval of the graduate adviser.

Further information about the program, including a full statement of the requirements for advancement to candidacy, is available upon request from the Group Office.

BUSINESS ADMINISTRATION

(Department Office, 350 Barrows Hall)

Professors:
David A. Alhadef, Ph.D.
Hector R. Anten, Ph.D.
K. Roland A. Artle, Ecol.Dr.
Frederick E. Balderston, Ph.D.
Wayne S. Boutell, Ph.D., C.P.A.
Louis P. Bucklin, Ph.D.
James M. Carman, Ph.D.
John P. Carter, Ph.D.
Alan R. Cerf, Ph.D., C.P.A.
Earl F. Cheit, Ph.D., J.D.
C. West Churchman, Ph.D.

Michael Conant, Ph.D., J.D.
Leonard A. Doyle, Ph.D., C.P.A.
Joseph W. Garbarino, Ph.D.
Robert C. Goshey, Ph.D.
Nils H. Hakansson, Ph.D., C.P.A.
John C. Harsanyi, Ph.D.
Austin C. Hoggatt, Ph.D.
Richard H. Holton, Ph.D. (Chairman)
Roy W. Jastram, Ph.D.
Van Dusen Kennedy, Ph.D.
Clark Kerr, Ph.D., LL.D.
Choh-Ming Li, Ph.D.

NOTE: For key to footnote symbols, see page 86.
Undergraduate Curriculum

Lower Division

Students preparing for admission to the School of Business Administration may complete required lower division courses in any college or school in the University, or equivalent courses at other institutions. Counselors in the School of Business Administration will assist lower division students in selecting courses prerequisite to the upper division business administration curriculum. Detailed information on required preparation is available in the ANNOUNCEMENT OF THE SCHOOL OF BUSINESS ADMINISTRATION.

Upper Division

Upper division courses which are required in Business Administration are:

100—The Price System and Business Enterprise
101—Business Fluctuations and Forecasting
111—Social and Political Environment of Business
120—Managerial Accounting

For general information concerning the School of Business Administration, please see page 72.
And, at least three of the following courses:

110 — Legal Environment of Business
130 — Financial Management
150 — Organizational Behavior
160 — Marketing
190 — Introduction to Organization and Decision

Beyond these requirements, additional courses within a subject matter field must be taken. Advisers will assist students in the selection of these courses.

The following subject matter fields are available:

- Accounting
- Applied Economics
- Finance
- Management Science
- Marketing
- Organizational Behavior and Industrial Relations
- Production Management
- Real Estate and Urban Land Economics
- Transportation

Preparation for Graduate Study Admissions to the Graduate School of Business Administration requires evidence of superior scholarship and an acceptable bachelor's degree. In evaluating applications, maturity, demonstrated capacity for leadership, and intellectual activity of a higher order are taken into account.

The Graduate Program

Two Master's degrees and the Ph.D. degree are offered. The Master of Business Administration (MBA) requires a minimum residency of six quarters of which the first three quarters are composed of special core courses (BA 101G, 102G, 107G, 108G, 111G, 120G, 121G, 130G, 140G, 150G, and 160G). Students who have a Bachelor's degree in business administration from the University of California or another institution of acceptable standing may petition for advanced standing on the basis of equivalent work and examination in lieu of one or more of the "G" courses. Fields of emphasis for the MBA include: Accounting, Applied Economics, Finance, International Business, Marketing, Operations Management, Organizational Behavior and Industrial Relations, Political, Legal, and Social Environment of Business, Real Estate and Urban Land Economics, and Transportation.

A Master of Science (MS) degree is offered in the field of Management Science. Admission to this program requires prerequisite courses in mathematics, statistics, and computer science. A core of four "G" courses are also required before advanced work in Management Science is begun.

All master's students must maintain a B average in all courses taken since receipt of the Bachelor's degree and must pass a comprehensive examination. All "G" courses are open only to graduate students in the Graduate School of Business Administration.

The Ph.D. program is open to students from any undergraduate or graduate major. A background in quantitative tools is desirable. For residency and other requirements please consult the Announcement of the Graduate School of Business Administration as well as the Announcement of the Graduate Division.

Lower Division Courses

1. Introduction to Accounting, (5)

Two 1½-hour lectures and 3 hours of laboratory per week. Prerequisite: sophomore standing. Required for admission to the School of Business Administration. The identification, measurement, and reporting of the financial effects of economic events on enterprises; the contemporary model and its origins. The Staff (Mr. Moonitz in charge) (F, W, Sp)

*10. General Accounting, (5)

Three 1½-hour meetings per week. Prerequisite: at least sophomore standing in any department of the University. Not open to students obtaining credit for course 1, 120, or 125. An introduction to various aspects of accounting including preparation and interpretation of financial statements and the role of accounting data in the decisions of investors, managers, and other users.
Upper Division Courses

Prerequisites: Economics 1A–1B, Statistics 2 or equivalent, Mathematics 16A–16B or equivalent, and Computer Science 2 or equivalent are required for nearly all upper division courses. Junior standing is required for all upper division courses.

100. The Price System and Business Enterprise. (5)
Four and one-half hours per week. **Prerequisite: Economics 1A–1B, Mathematics 16A–16B, Statistics 2 or equivalent.** Not open to students who have taken Economics 100A. Economic analysis applicable to the problems of business enterprises with emphasis on the determination of the level of prices, outputs, and inputs; effects of the state of the competitive environment on business and government policies.
Mr. Merewitz, Mr. Artle, Mr. Hoggatt (F, W, Sp)

101. Business Fluctuations and Forecasting. (5)
Four and one-half hours per week. **Prerequisite: course 100.** Not open to students who have taken Economics 100B. Analysis of the operation of our enterprise system with emphasis on the factors responsible for economic instability; analysis of public and business policies which are necessary as a result of business fluctuations.
Mr. Doyle, Mr. Merewitz, Mr. B. Roberts (F, W, Sp)

102. Advanced Managerial Economics. (5)
Three 1½-hour lectures per week. **Prerequisite: courses 100 and 101.** Advanced analysis of the theory and practice of decision making in business firms, utilizing the concepts and techniques of managerial economics. The business decisions to be investigated include pricing policies, internal transfer pricing, inventory management.

103. Theory and Models of Economic Forecasting. (5)
Three 1½-hour lectures per week. **Prerequisite: courses 100 and 101 or the equivalent.** Theory and analysis of the long-run and short-run forecasts of economic activity.

110. Legal Environment of Business. (5)
Three 1½-hour lectures per week. An analysis of the law and the legal process, emphasizing the nature and functions of law, legal reasoning and the operation of law within the U.S. federal system, followed by a discussion of the legal problems pertaining to contracts and related topics, business associations, and the impact of law on economic enterprise.
Mr. Katz, Mr. Conant, Mr. M. Smith (F, W, Sp)

111. Social and Political Environment of Business. (5)
Three 1½-hour lectures per week. **Prerequisite: senior standing.** Study of the evolution of American business in the context of its changing political and social environment. Analysis of the origins of the American business creed, the concept of social responsibility of business, and the expanding role of the corporation.
Mr. Kennedy, Mr. Epstein, Mr. Votaw, Mr. Sethi (F, W, Sp)

114. Legal Aspects of Business Transactions. (5)
Three 1½-hour lectures per week. **Prerequisite: course 110.** A review of the legal implication of certain common business transactions and situations, including problems arising in sales, installment buying, inventory financing, obtaining and extending credit, negotiable instruments, and insolvency, with emphasis on the Uniform Commercial Code.
Mr. M. Smith (W)

115. Legal Aspects of Real Estate. (5)
Three 1½-hour lectures per week. **Prerequisite: course 110; recommended, course 180.** The law affecting ownership and use of real property; transfers; titles; development rights and the regulation thereof in the public interest.
Mr. Starr (Sp)

117. Law, Government and Economic Enterprise. (5)
Three 1½-hour lectures per week. An analysis of the impact of law upon American economic enterprise and the role of government participation in the operation of our business community. Discussion of current problems in the fields of unfair competition, securities regulations, pricing and marketing and taxation.
Mr. Conant (F)

120. Managerial Accounting. (5)
Two 1½-hour lectures and three hours of laboratory per week. **Prerequisite: course 1.** The use of accounting systems and their outputs in the process of managing an enterprise. Classification of costs and revenues on several bases for various uses; budgeting and standard cost accounting; analyses of relevant costs and other data for decision-making.
Mr. Vance, Mr. Buckman, Mr. Wheeler (F, W, Sp)

121. Financial Accounting I. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. **Prerequisite: courses 1 and 120 or the equivalent.** Required for those specializing in accounting. Continuation of course 121. Accounting for investments in securities, intangible assets and sources of long-term capital; funds statements, financial analysis.
Mr. Staubus, Mr. Vance (F, W, Sp)

122. Financial Accounting II. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. **Prerequisite: course 121.** Required for those specializing in accounting. Continuation of course 121. Accounting for investments in securities, intangible assets and sources of long-term capital; funds statements, financial analysis.

123. Problems of Financial Reporting. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. **Prerequisite: course 122 or the equivalent.** Accounting for partnerships; consolidated financial statements; adjustments of accounting data using price index; accounting for the financial effects of pension plans, other advanced accounting problems.

124. Cost Accounting. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. **Prerequisite: courses 1 and 120.** Intensive study of basic cost accumulation systems and refinements thereof used to determine costs of products or activities in various types of enterprises.
Mr. Buckman, Mr. Vance (F, W, Sp)

125. Administrative Accounting. (4)
Three 1½-hours of lecture per week. For students interested in administration or management who are not enrolled in the Schools of Business Administration. Students will not receive credit for course 125 and course 1 or 10. Introduction to accounting and its uses in analyzing, planning, and controlling the operations of organizations of all types. (W)
126. Auditing. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: course 121. Completion of course 122 strongly recommended. Concepts and problems in the field of professional verification of financial and related information, including ethical, legal and other professional issues, historical developments, and current concerns.
Mr. Vance, Mr. Boutell (F, W, Sp)

127. Accounting Systems for Management Information. (5)
Four and one-half hours per week. Prerequisite: course 124 or consent of the instructor. The study of accounting systems, including computer-oriented systems, with an emphasis on the information and control functions of the management decision-making process. The COBOL language will be used.
Mr. Boutell (W)

128. Federal Income Taxation. (5)
Three 1½-hour lectures per week. Prerequisite: courses 1 and 120; course 121 recommended. Determination of individual and corporation tax liability; influence of federal taxation on economic activity; tax considerations in business and investment decisions.
Mr. M. Smith (F, W, Sp)

129. Field Study in Accounting. (5)
To be arranged. Prerequisite: course 122 or equivalent or consent of the instructor. A planned program of exposure to actual accounting practice designed to broaden students’ perspective of the concepts and theory of accounting. Assignment to specific corporations, CPA firms, or government agencies for orientation and work experience. Research reports based on the field study required. The Staff (W)

130. Financial Management. (5)
Four and one-half hours per week. Prerequisite: courses 100 and 120. Analysis and management of the flow of funds through an enterprise. Cash management, source and application of funds, term loans, types and sources of long-term capital. Capital budgeting, cost of capital, and financial structure. Introduction to capital markets.
Mr. Morrisey, ——— (F, W, Sp)

132. Money and Capital Markets. (5)
Four and one-half hours per week. Prerequisite: courses 101 and 130. Organization, behavior, and management of financial institutions. Markets for financial assets and the structure of yields. Influence of Federal Reserve System and monetary policy on financial assets and institutions.
Mr. Turner (W, Sp)

133. Investments. (5)
Three 1½-hour lectures per week. Prerequisite: course 130 or by permission of instructor. Sources and demand for investment capital, operations of security markets, determination of investment policy, and procedures for analysis of securities.
Mr. Johnson (F, W, Sp)

137. Economics of Insurance. (5)
Three 1½-hour lectures per week. An introduction to the underlying principles of insurance, followed by a descriptive and analytical study of the practices in the more important branches of the insurance business.
Mr. Goshay (F)

138. Contemporary Problems of Insurance. (5)
Three 1½-hour lectures per week. Prerequisite: course 137. Selected topics of current interest in insurance; specialized topics in life insurance, corporate risk management, and social insurance.

140. Introduction to Production Management. (5)
Two 1½-hour lectures and one 1½-hour laboratory per week. Management problems related to the specification and control of standards with respect to products, processes, equipment, and jobs; elementary models for scheduling, maintenance, and inventory control procedures; relation of these problems to motivation, incentives, and cost control.
Mr. Koenigsberg, Mr. Rogers (F, Sp)

141. Planning of Production Facilities. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: course 140. Economic aspects of the design and establishment of industrial facilities. Special problems of equipment selection and replacement; plant location, scale of operations and layouts; line-balancing and waiting line analysis; systems for maintenance and reliability; applications of linear programming to production planning, material-handling and other ancillary systems.
Mr. Rogers (Sp)

142. Production Control Systems. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: course 140. Development and operation of systems for production control, with special emphasis upon comprehensive problems: inventory management under uncertain demand conditions; special problems of scheduling operations in job shops planning activities in uncertain seasonal and other demand fluctuations; use of CPM, Pert and simulations; distribution analysis and quality control.

(Formerly numbered 175A–175B)
Four and one-half hours per week. Prerequisite: Mathematics 16A–16B and Statistics 20 or equivalent. 145A prerequisite to 145B. The techniques and models of operations research are presented at a relatively low mathematical level with a variety of applications to management problems.
Mr. Koenigsberg (F, W)

146A. Linear Models in Management Science. (5)
(Formerly numbered 176A)
Four and one-half hours per week. Prerequisite: a course in Linear Algebra. Linear input-output systems, feedback, and decision rules. Optimization in linear and non-linear programming; the simplex method, duality and sensitivity analysis. Applications to problems with special structure and non-convex linear models. Illustrations from a variety of fields.
Mr. Grinold (F)

146B. Problems in Decision under Certainty. (5)
(Formerly numbered 176B)
Four and one-half hours per week. Prerequisite: course 146A and Statistics 144A. Static models of decision analysis: value of information and influence of uncertainty on optimal policy. Simple one- or two period models with experimentation: influence of learning on optimal policy. Dynamic policy analysis: implications of following any fixed policy. Dynamic models with policy choice. Illustrations.
Mr. Saigal (W)

146C. Management Science Workshop. (5)
(Formerly numbered 275)
Four and one-half hours per week. Prerequisite: course 146B or consent of instructor. The use and limitations of models in decision making. The role
of the model builder in the decision making process. Each student will prepare a report dealing with a concrete problem.  
Mr. Churchman (Sp)

147. Computers and Modern Organizations: Theory and Application, (5)
(Formerly numbered 177)
Four and one-half hours per week. Prerequisite: A course in programming or familiarity with a computer language. A survey course concerned with the importance of computers in organizations including small groups, universities, firms, government, and society at large. Topics include history of development of computers, characterization of scientific versus business problems, information storage and retrieval, compilers, problem-oriented languages, simulation models, current developments in computer systems.  
Mr. Hoggatt (F)

150. Organizational Behavior, (5)
Four and one-half class hours per week. A general descriptive and analytical study of organizations from the behavioral science point of view. Problems of motivation, leadership, morale, social structure, group networks, communications, hierarchy and control in complex organizations. The interaction between technology and human behavior. Discussion of alternate theoretical models.  
Mrs. K. Roberts, Mr. Strauss, Mr. Pfeffer (F, W, Sp)

151. Management of Human Resources, (5)
Four class hours per week. Prerequisite: Course 150 or permission of the instructor. The designs of systems of rewards, assessment, and manpower development. The interaction of selection, placement, training, personnel evaluation, and career ladders within an on-going organization. Role of the staff manager. Introduction of change. Implications of behavioral research for management problems and policies.  
Mr. Malm (F, Sp)

154. Industrial Relations, (5)
Four class hours per week. Students will not receive credit for both Economics 150 and course 154. An analysis of manual, white collar and professional employee relations. Background and functioning of employee and employer organizations. Wage and manpower policy issues. Collective bargaining, income security and other problems of public policy.  
Mr. Kennedy, Mr. Garbarino (F, W, Sp)

155. The Social Control of the Employment Relationship, (5)
(Formerly numbered 153)
Four and one-half hours per week. Prerequisite: Course 154 or Economics 150. Analysis of the issues arising out of legislative, administrative, and judicial efforts to define the rights, duties, and responsibilities of employers and labor organizations in the field of employment and labor relations. Includes programs to deal with racial, ethnic, sex, and age discrimination as well as the law of union-management relations.  
Mr. Garbarino (Sp)

160. Marketing, (5)
Four and one-half hours per week. Prerequisite: Course 100 or equivalent. The evolution of markets and marketing; market structure, organization and behavior, marketing functions, pricing and price policy; marketing cost and efficiency; public and private regulation.  
Mr. Achabal, Mr. Burnkrant (F, W, Sp)

162. Retailing, (5)
Four and one-half hours per week. Prerequisite: Course 160 or 160G. History and development of retail management types; geographical structure of retail trade, assortments of goods and services; store management; government regulations.  
Mr. Revzan (F)

163. Advertising, (5)
Four and one-half hours per week. Prerequisite: Course 160. Basic concepts and functions of advertising in the economy; consumer motivation; problems in utilizing advertising and measuring its effectiveness.  
Mr. Nicosia, Mr. Burnkrant, (F, W, Sp)

164. Industrial Procurement, (5)
(Formerly numbered 161)
Four and one-half hours per week. Prerequisite: Course 160. The interaction of buyer and seller in a non-ultimate consumer environment. The problems met in purchasing by industrial organizations and governments; major buying policies; vendor selection; quantity and quality determination; and relation of buying price, production cost, and selling price.  
Mr. Nicosia (Sp)

165. Marketing Management, (5)
Four and one-half hours per week. Prerequisite: Course 160. Analysis of marketing functions primarily in manufacturing firms including product selection, pricing and sales administration; development of marketing organization within the firm.  
Mr. Achabal (W, Sp)

166. Wholesaling, (5)
Four and one-half hours per week. Prerequisite: Course 160. The meaning and importance of wholesaling; its place in the marketing structure; functions of wholesaling; the agency structure of wholesaling; internal managerial aspects; government regulations; trends and costs, profits, and efficiency.  
Mr. Revzan (W)

169. Marketing Policies and Problems, (5)
Four and one-half hours per week. Prerequisite: Course 160 or consent of instructor. Analysis of special topics in marketing including geographic market structures, price policy, consumerism and other topics. Course may be repeated for credit.  
Mr. Nicosia (F, Sp)

170. Physical Distribution and Transportation Management, (5)
Three 1½-hour lectures per week. Problems in transportation of persons and physical distribution of goods. Provision of transportation facilities by government and transportation services by professional and private carriers. Analysis of governmental subsidies and regulations.  
Mr. Merewitz (W)

180. Introduction to Real Estate and Urban Land Economics, (5)
Three 1½-hour lectures per week. The nature of real property; market analysis; construction, cycles; mortgage lending; equity investment; real estate administration; metropolitan growth; urban land utilization; real property valuation; public policies.  
Mr. W. Smith, Mr. Roulec (F, W, Sp)
181. Valuation of Real Property. (5)
Three 1 1/2-hour lectures per week. Prerequisite: course 180. Critical examination of appraisal concepts and methods; the role of value estimates in private land-use and real estate investment decisions and in the implementation of public policies affecting urban development. Mr. W. Smith (F, Sp)

183. The Financial Management of Real Estate Resources. (5)
Four and one-half hours per week. Prerequisite: course 180. Real estate debt and equity financing; mortgage market structure; effects of credit on demand; equity investment criteria; public policies in real estate finance and urban development.

Mr. Schaffer (W)

185. Introduction to International Business. (5)
Four and one-half hours per week. Prerequisite: senior standing. A survey involving environmental, economic, political, and social constraints on doing business abroad; effects of overseas business investments on domestic and foreign economies; foreign market analysis and operational strategy of a firm; management problems and development potential of international operations.

Mr. Burns (F, W)

190. Introduction to Organization and Decision. (5)
Four and one-half hours per week. Normative models of rational behavior under uncertainty; games and the analysis of conflict in organizations; computer simulation of organizational behavior; approaches to organization design.

Mr. Maraschak (F, Sp)

198. Directed Study. (1-5)
The Staff (Mr. Epstein in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (Mr. Epstein in charge) (F, W, Sp)

First-Year Courses for Graduate Students

Note: The following first-year courses are open only to graduate students in the Schools of Business Administration. Other students require prior approval from the Director of the Master's Programs in Business Administration.

101G. Economic Analysis for Business Decisions I. (4)
Four hours of meetings per week. Prerequisite: course 107G strongly recommended. Economic analysis applicable to the problems of business and operation of our enterprise system; the determination of prices, inputs and outputs; effects of the state of the competitive environment on business policies.

Mr. Alhadef, Mr. Rosenberg, Mr. Marschak (F, W, Sp)

102G. Economic Analysis for Business Decisions II. (4)
Four and one-half hours of meetings per week. Prerequisite: course 101G. Theories of fiscal and monetary policy, as well as other macroeconomic policies, are a central topic in this course. The issues and the evidence will be discussed during the quarter. Other topics to be covered range from the specifics of the U.S. balance of payments situation today to the broader problems associated with economic growth and decay in the world.

Mr. Maisel, Mr. Doyle, Mr. B. Roberts (F, W, Sp)

107G. Quantitative Analysis For Business Decisions I. (4)
Four and one-half hours per week. Uses of formal models, models of the decision problem, rational choice under uncertainty, linear and nonlinear programming, multistage problems.

Mr. Garman, Mr. B. Roberts (F, Sp)

108G. Quantitative Analysis For Business Decisions II. (4)
Three 1 1/2-hour meetings per week. Prerequisite: course 107G. Continuation of course 107G. The application of statistical methods in managerial and business problems.

Mr. Churchman, Mr. Aaker (F, W)

111G. Political, Social and Legal Environment of Business. (4)
Four and one-half hours of meetings per week. A study of basic ideas, concepts, attitudes, rules and institutions in our society that characterize the legal, political and social framework within which the business system operates.

Mr. Katz, Mr. Epstein, Mr. Votaw (F, W, Sp)

120G. Accounting I—Financial Reporting. (4)
Three 1 1/2-hours of meetings per week. Prerequisite: admission to the Graduate School of Business Administration. A study of accounting measurements for general purpose financial reports. Aimed at the acquisition of a working knowledge and a clear understanding of the contents of published financial statements.

Mr. Wheeler (F, Sp)

121G. Accounting II—Managerial Accounting. (4)
Three 1 1/2-hours of meetings per week. Prerequisite: course 120G or equivalent. An analysis of the ways in which accounting data and accounting procedures may be used to facilitate managerial aims and activities. Cost determination and control using budget and standards.

Mr. Vance, Mr. Wheeler, Mr. Comiskey, Mr. Vance (F, W, Sp)

130G. Financial Policies of Business. (4)
Three hours of meetings per week. Prerequisite: courses 101G and 120G or equivalent. Business finance, with emphasis upon financial problems and policies of corporations; the role of commercial banks, institutional and other investors in supplying funds for corporations.

Mr. Rubinstein (F, W, Sp)

140G. Production Organization and Management. (4)
Three hours of lecture and one 1/2-hour laboratory per week. Prerequisite: courses 107G and 108G. Managerial organization and its application to the production area. Use of analytical and quantitative methods to deal with managerial problems related to the design and standardization of products, processes and jobs. Models to establish and control the efficiency of operations, including programming, scheduling, purchase and handling of materials, selection and maintenance of equipment, and cost control.

Mr. Saigal, Mr. Garman (F, W, Sp)
150G. Organizational Behavior. (4)
Four and one-half hours of meetings per week. A general descriptive and analytical study of organizations from the behavioral science point of view. Problems of motivation, leadership, morale, social structure, group networks, communications, hierarchy and control in complex organizations. The interaction between technology and human behavior. Discussion of alternate theoretical models.
Mr. Malm, Mr. Pfeffer, Mrs. K. Roberts, Mr. Strauss (F, W, Sp)

160G. Marketing Organization and Policies. (4)
Four and one-half hours of meetings per week. Prerequisite: course 101G or equivalent. The evaluation of marketing in the economy; marketing structure, organization and behavior; marketing functions; pricing and price policies; marketing costs and efficiency; public and private regulations.
Mr. Bucklin, Mr. Myers, Mr. Aaker, Mr. Bakderston, Mr. Carman (F, W, Sp)

Graduate Courses
Note: Graduate seminars typically select a topic of current interest each quarter and may be repeated for credit in appropriate cases.

*200A–200B. Economic Analysis for Business

Decisions. (4–4)
200A: 4½ hours of class meetings per week. 200B: three hours of meetings per week. Prerequisite: limited to Ph.D. students.
200A. Examination of such tools as marginal analysis and optimization subject to constraints. From the course the student should gain an understanding of the operation of a price system and also an elementary grasp of the fundamental concepts of equilibrium, efficiency, and equity.
200B. Prerequisite: course 200A. Theories of fiscal and monetary policy, as well as other macroeconomic policies, are a central topic in this course. The issues and the evidence will be discussed during the quarter. Other topics to be covered range from the specifics of the U.S. balance of payments situation today to the broader problems associated with economic growth and decay in the world.

201. Economics of the Firm. (4)
(Formerly numbered 202C)
Four hours of lecture per week. Prerequisite: courses 101G–102G, 107G and 108G or equivalent. A survey of neoclassical, managerial, and behavioral theories of the firm with particular emphasis on technical aspects of production functions, cost functions, investment, research and development, technological change, and joint production.
Mr. Kelso (F)

202. Statistical and Econometric Methods for Business. (4)
(Formerly numbered 201A)
Four hours of lecture per week. Prerequisite: courses 101G–102G, 107G and 108G or equivalent. Theory and use of statistical and econometric methods with special emphasis on practical applications. Topics include regression analysis; special problems in applied regression analysis; simultaneous equations estimation; elements of multi-variate analysis.
Mr. Rosenberg (F)

203. Market Failures and Bounds of the Firms. (4)
(Formerly numbered 202A)
Four hours of lecture per week. Prerequisite: courses 101G–102G, 107G and 108G or equivalent. Efficiency in resource allocation; failures of markets and substitutes for markets; decreasing cost phenomena; public goods and public bads (environmental problems); behavior of firms under regulatory constraints.
Mr. Meyer (W)

204. Applied Economic Modeling and Forecasting. (4)
(Formerly numbered 203B)
Four hours of lecture per week. Prerequisite: courses 101G–102G, 107G and 108G or the equivalent. Use of econometric models for forecasting and analysis. Fundamental concepts for quantitative specification of economic systems. Structural characteristics of national, regional, industry, and enterprise models relevant to forecasting applications. Role of judgment in use of econometric models. Simulation experiments.
Mr. B. Roberts (W)

205. Management in the Public Sector. (4)
(Formerly numbered 202B)
Four hours of lecture per week. Prerequisite: knowledge of computer programming. 206A prerequisite to 206B. Problems and projects in the computer simulation of economic and industrial processes, thinking and learning processes, artificial intelligence and information systems. Credit and grade awarded upon completion of full sequence.
Mr. Hoggatt, Mr. Garman (F, W)

206A–206B. Applications of Digital Computers to Problems in the Social Sciences. (4–4)
Three hours per week. Prerequisite: knowledge of computer programming. 206A prerequisite to 206B. Problems and projects in the computer simulation of economic and industrial processes, thinking and learning processes, artificial intelligence and information systems. Credit and grade awarded upon completion of full sequence.
Mr. Hoggatt, Mr. Garman (F, W)

207. Seminar in Applied Economics. (4)
(Formerly numbered 202)
Four hours of lecture per week. Topics will vary with the interest of the instructor. A description of the topics and objectives of the seminar will be available to prospective students during the winter quarter each year.
Mr. Kelso (Sp)

211. Seminar on the Modern Corporation. (4)
Mr. Votaw (W)

217. The Interaction of Business and Government. (4)
Three hours of meetings per week. Theory of the mixed economy. Methods of interaction between government and business. Sources of business leadership, "inter-penetrated" activities including research and development, space, defense, atomic energy, foreign petroleum operations, basic steel. Relations between government and business in other leading nations.
Mr. Epstein (Sp)

220. Advanced Financial Accounting. (4)
Three hours of lecture and 1½ hour laboratory per week. Prerequisite: course 121G or equivalent.
Not open to students who have taken course 121 or 122. Intensive study of the theory and practice of financial accounting. Asset and liability measurement, income determination and financial reporting.
Mr. Cerf (W, Sp)

221. Accounting Theory I. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 220 or equivalent. The history of accounting to 1900; the development of accounting theory and principles in the twentieth century; a critical examination of basic concepts and measurement methods in accounting.
Mr. Staubs (F, Sp)

222. Accounting Theory II. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 221. The role of capital and income theory in accounting; accounting for the impact of changing price levels; current issues in financial accounting.
Mr. Hakansson, Mr. Moonitz (F, W)

224. Advanced Managerial Accounting. (4)
Two 1 1/2 hour meetings per week. Prerequisite: courses 101G, 121G, and 124 or equivalent. The theory and practice of cost determination and cost analysis in relation to the management control function.
Mr. Wheeler, Mr. Buckman (F, Sp)

225. Seminar in Managerial Accounting. (4)
Two 1 1/2 hour meetings per week. Prerequisite: course 102G and 121G or equivalent. Topics in managerial accounting in relation to management planning and control including some aspects of operations and capital budgeting and long range planning.
Mr. Wheeler (W)

226. Seminar in Auditing. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 126 or equivalent. Historical background of the auditing function; development of auditing standards; application of statistical sampling theory to auditing.
Mr. Vance (W)

227. Control Aspects of Information Systems. (4)
Three hours per week. Prerequisite: courses 126 and 127. Seminar in current professional problems concerning management information systems including auditing and other control aspects of these systems.
Mr. Boutell (Sp)

228. Advanced Topics in Income Taxation. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 128. Professional study of tax accounting practice, corporation tax problems, estate and gift taxation, tax research, tax planning and administrative procedure.
Mr. M. Smith (Sp)

Three hours of meetings per week. Prerequisite: course 102G. Financial policies of the firm, working capital management, fixed asset investment, capital budgeting, cost of capital determination, capital structure, dividend policy and taxation, aspects of financial decisions and merger problems.
Mr. Rubinstein, Mr. Brealey (F, W, Sp)

232. Money Markets and Financial Institutions. (4)
Mr. Alhadeff, ——, Mr. Turner (F, W, Sp)

233. Securities Markets and Investment Policies. (4)
Three hours of meetings per week. Prerequisites: courses 108G and 230 or consent of instructor. Structure and operation of securities markets. Relationships between security prices, business cycles, and money market developments. Consideration of individual and institutional investment policies and principles of security analysis.
Mr. Brealey, Mr. Carter, —— (F, W, Sp)

234. Seminar in Business Finance. (4)
Three hours of meetings per week. Prerequisite: course 230 and consent of instructor.
Mr. Hakansson, Mr. Rubinstein (F, Sp)

235. Seminar in Financial Intermediaries and Money and Capital Markets. (4)
Three hours of meetings per week. Prerequisite: course 232 or permission of instructor.
Mr. Maisel, Mr. Pyle (W, Sp)

236. Seminar in Investments. (4)
Three hours of meetings per week. Prerequisite: course 233.
Mr. Rosenberg, Mr. Brealey (F, Sp)

239. Seminar in Insurance. (4)
Three hours of meetings per week.
Mr. Goshay (Sp)

241. Facilities Planning and Production Control. (4)
Two 2-hour meetings per week. Prerequisite: course 140G or equivalent. Design of production systems, plant location, size and layout decisions, equipment decisions, line balancing models, waiting line applications to production planning problems. Operation of production systems—scheduling of materials, manpower and machines into, through, and out of the production facility.
Mr. Rogers (F)

242. Production Programming. (4)
Two 2-hour meetings per week. Prerequisite: course 241 or consent of the instructor. Programming methods and their application to production management areas of process selection, output determination, facilities design, project planning, and scheduling of operations. While primary emphasis is placed upon analysis of deterministic linear systems, problem-solving approaches for less restricted cases are also considered.
Mr. Rogers (W)

243. Analysis for Production Management. (4)
Two 2-hour meetings per week. Prerequisite: consent of instructor. Students are expected to have some demonstrated competence in mathematical and statistical analysis. Examination of the nature and content of methods of quantitative analysis employed in production management decision making. Probabilistic models and statistical methods are developed for designing inventory systems, executing "statistical" quality control plans, choosing among equipment alternatives, organizing service, maintenance operations, etc.

246A. Construction and Analysis of Nonlinear and Dynamic Models. (4)
(Formerly numbered 277A)
Three hours of meetings per week. Prerequisite: courses 146A–146B–146C and Mathematics 190B–
246B. Applied Probability Models in Management Science. (4)
(Formerly numbered 277B)
Three hours of meetings per week. Prerequisite: courses 246A and Statistics 134A-134B. The power of simple stochastic models with quadratic criteria. Discrete variable problems. Policy analysis using imbedding principles of dynamic programming. Applications, including organizational and economic aspects.
Mr. Grinold (F)

246C. Problem Analysis Seminar. (4)
(Formerly numbered 277C)
Three hours of meetings per week. Prerequisite: courses 246A and 246B or consent of instructor. An in-depth examination of one or more specific problems. Alternate views of the problems. Construction of a realistic decision-oriented model. Use of the computer in modeling and analysis. Typical problems are pesticide usage, delivery of health care, university management, financial planning, etc.
Mr. Saigal (W)

248. Seminar in Production Management. (4)
Two 2-hour meetings per week. Prerequisite: two courses (140G and one other) and consent of instructor. Selected topics from production theory; application of quantitative methods to current production problems. Integration of production planning within the overall objectives of the firm; problems of formulating and executing production policy decisions. Students will work individually or in teams, to prepare case studies which apply production theory to current problems in local industry.

249. Philosophy of Management Science. (4)
(Formerly numbered 276)
Four hours of meetings per week. This seminar is essentially a study of models for measuring the values of objectives and a critical discussion of the problems involved. An emphasis is placed on the basic philosophical issues involved in the evaluation of system performance.
Mr. Churchman (F)

253. Labor-Management Relations in the Public Sector. (4)
Three hours of meetings per week. Analyzes issues created by the expansion of collective bargaining in public and non-profit sectors. Examples: selection of bargaining agents, representation units, bargaining topics and procedures and conflict resolution. Approach is comparative in terms of jurisdiction, federal, state, local; and in education, health and security.
Mr. Garbarino (Sp)

255. Seminar in Manpower Economics and Labor Markets. (4)
Three hours of meetings per week. Prerequisite: one industrial relations course or consent of instructor. Manpower and labor market economics. Dynamics of the labor force, manpower policies, employment and unemployment. Analyses of wage and salary determination and labor market behavior of occupational groups: production and clerical workers, managerial, and professional workers. Problems of wage and income policies of the firm, union and the national economy.
Mr. Garbarino (F)

256. Seminar in Collective Bargaining. (4)
Three class hours per week. Prerequisite: course 154 or the equivalent. Studies of the bargaining process; the legal and factual basis of collective bargaining; the provisions of collective agreements; administration of agreements, including negotiation and arbitration of grievances; processes of disputes settlement; influence of the larger environment.
Mr. Kennedy (W)

257. Seminar in Organizational Behavior. (4)
Three hours of meetings per week. The study of the management and development of human resources. Study and discussion of research findings relating to the effectiveness of organizational behavior, management of professional and work groups in a wide variety of organizations. Deals with questions relating to motivation, leadership, organizational development, compensation, job design, and organizational structure.
Mrs. K. Roberts, Mr. Miles (F, Sp)

259. Special Topics in Organizational Behavior. (4)
Three hours of meetings per week. Prerequisite: courses 150G and 257 or equivalent or consent of instructor. Analysis of recent literature and developments related to such topics as organization development; environmental determinants of organization structure and decision-making behavior; management of professional employees and management in temporary structures; cross-cultural studies of management and organizations.
Mr. Malm (W)

260. Marketing Analysis and Management I. (4)
Three hours of meetings per week. Prerequisite: course 160G or equivalent. Concepts of marketing strategy and planning; macro and micro demand analysis; location problems; buying behavior of household and industrial consumer; promotion management, including advertising and personal selling.
Mr. Myers (F, Sp)

261. Marketing Analysis and Management II. (4)
Three hours of meetings per week. Prerequisite: course 160G or equivalent. Product and price policies; management of the marketing organization; sales management, control and analysis; integration of the marketing program.
Mr. Bucklin, Mr. Rezan

262. Retailing Policies and Problems. (4)
Three hours of meetings per week. Prerequisite: course 260 or equivalent. Case studies of executive determination of organizational structure; nature and scope of policies; merchandising policies; advertising and sales promotion; personnel management; operating policies; accounting and control policies; and general management problems. Study of the nature of competition at the retail level.
Mr. Bucklin (F)

263. Communication Processes in Marketing. (4)
Three hours of meetings per week. Prerequisite: course 260 or equivalent, or consent of instructor. Behavior of household and organizational buyers; communications research; systemic analysis of mass behavior and communication processes.
Mr. Myers (Sp)

264. Industrial Marketing Behavior. (4)
Three hours of meetings per week. Prerequisite: course 160G or the equivalent. The environment of an industrial firm and its interdependence with the firm’s marketing decisions. Models of organizational
decision processes: examination of structural/behavioral characteristics of industrial procurement and selling processes. Applications of basic disciplines (economics/social psychology) and their research methods.

Mr. Nicosia (W)

*266. Marketing Organization. (4)

Three hours of meetings per week. Prerequisite: course 160G or consent of instructor. Meanings and evolutionary aspects of marketing organization; marketing organization at the wholesale and retail levels and of the marketing channel; spatial aspects; general marketing strategy at each level and throughout the channel; specialization and integration in marketing organization; problems of “ordered” marketing.

268. Marketing Research. (4)

Three hours of meetings per week. Prerequisite: course 108G or equivalent. Nature and significance of marketing research, development of marketing research methods; investigation and analysis of specific marketing research problems, including class research problems; presentation of research results; evaluation of the effectiveness of marketing research.

Mr. Carman (W, Sp)

269. Seminar in Marketing. (4)

Three hours of meetings per week. Prerequisite: open to M.B.A. candidates with a minimum of two quarter courses in marketing; other candidates with the express consent of instructor. Seminar treatment of selected topics in marketing including review of the marketing literature; marketing organization; marketing functions; prices and price policies; area structure; cost and efficiency; public and private regulation.

Mr. Grether, Mr. Aaker, Mr. Bucklin (F, W, Sp)

270. Transportation Management. (4)

Three hours of meetings per week. Problems in the management of transportation undertakings. Cost analysis and rate structure. Promotion and restriction by governmental agencies.

Mr. Carter (F)

271. Economic Analysis in Transportation. (4)

Three hours of meetings per week. Public spending on urban transportation, civilian air transport, highways, ports. Cost analysis, pricing. Demand analysis.

Mr. Merewitz (Sp)

274. Seminar in Transportation. (4)

Three hours of meetings per week. A topic of interest will be selected each quarter. Course may be repeated for credit.

Mr. Carter (W)

280. Real Estate and Urban Land Economics. (4)

Two 1½-hour meetings per week. Intensive review of literature in the theory of land utilization, urban growth and real estate market behavior; property rights and valuation; residential and non-residential markets; construction; debt and equity financing; public controls and policies.

Mr. Schaaf (F, W, Sp)


Three hours per week. Prerequisite: course 280 or consent of the instructor. Urban development and the national economy; the interaction of business institutions and public agencies in the performance of urban functions; determinants of land-use patterns; environmental impacts; economic aspects of property rights; unmet housing needs.

Mr. W. Smith, Mr. Artle (W)

284. Seminar in Real Estate and Investment Analysis. (4)

Two 1½-hour meetings per week. Prerequisite: course 280 or consent of the instructor. Analysis of selected problems and special studies; cases in residential and non-residential development and financing, urban redevelopment, real estate taxation, mortgage market developments, equity investment, valuation, and zoning.

Mr. Roulac, Mr. Walters (F, Sp)


Three hours of meetings per week. Tools of international economic theory applicable to problems of international business; commercial and financial policies for the multinational firm in industrial and developing countries.

Mr. Holton, (F, Sp)

286. International Operations Management. (4)

Three hours of meetings per week. Prerequisite: course 285. Internal operation of the multinational firm; supplemented by case studies, designed to develop problem-solving skills, taking into account the different business environments, as well as to identify analytical problems such as location for multinational firms, etc.

Mr. Sethi, (F, Sp)

287. International Financial Management. (4)

Three hours of meetings per week. Prerequisite: course 232 for majors in international business or equivalent money and banking course for others. U. S. balance of payments and investment position; international monetary system and its development; financial management of U.S. firm abroad in protection of earning and assets; capital markets abroad; special accounting, taxation, and pricing problems in operating abroad. Major case problems in establishing and running a business abroad.

(F, W)

289. Seminar in International Business. (4)

Three hours of meetings per week. Prerequisite: course 286 or consent of the instructor. Seminar techniques will be applied to highly topical subjects in the international business field. The subject of the seminar generally varies from quarter to quarter. May be repeated without loss of credit.

Mr. Sethi (W)

290. Organization and Decision. (4)

Four hours of meetings per week. Prerequisite: primarily for students at the master’s level. Problems in the design of organizations, mainly based on normative models of rational individual behavior under uncertainty. Games and the study of conflict in organizations. Relevance of experimentation and computer simulation to organization design.

Mr. Balderston (Sp)

291. Experimental Courses. (4)

Two 1½-hour meetings per week. Courses will vary from year to year and will be announced at the beginning of each quarter.

The Staff (F, W, Sp)

*291M. Application of Cross-Cultural Research Methodology to Problems of International Business. (4)

(Formerly numbered 291F)

Three hours of meetings per week. Prerequisite: graduate standing. Development of substantive con-
cepts and research methodology in dealing with the problems of international business primarily in the areas of organizational behavior, long range planning, consumer behavior, and marketing strategies.

292A-292B-292C. Seminar in Organization Theory. (4-4-4)
Two 2-hour meetings per week.

292A. Prerequisite: restricted to Ph.D. students. An extensive analysis of the development and antecedents of organization theory, including a thorough review of the literature in the field and an introduction to the basic aspects of individual behavior, decision theory, communications, small group analysis, and complex organizations.
Mr. Balderston (F)

292B. Prerequisite: course 292A. The critical analysis of models and research on motivation, leadership and the sociology of complex organizations. Emphasis will be placed on experimental and descriptive studies of organizations.
Mr. Strauss, Mr. Miles (W)

292C. Prerequisite: course 292A and Mathematics 190A-190B-190C or equivalent. The formulation of normative models of individual and group decision-making under conditions of risk and uncertainty. The development of normative and descriptive models of organizations.
Mr. Marschak (Sp)

293. Individually Supervised Study for Graduate Students. (1-6)
Individually supervised study of subjects not available to the student in the regular schedule, approved by faculty adviser as appropriate for the student's program.
The Staff (Mr. Carman in charge) (F, W, Sp)

294. Seminar in Business Policy. (4)
Fifteen 2-hour meetings per quarter. A study of business problems and the formulation of policies to meet these problems from the viewpoint of a top-management executive committee. The objective is to develop skill in the formulation of policy in particular functions and for enterprises as a whole.
Mr. Jastrem (W, Sp)

295. Business Research Methods. (4)
Two 1½-hour meetings per week. Meaning of research and scientific methods. Forms of scientific method applicable to business research. Types of business research problems, and available types of materials. Actual research procedure, and application by student to his Business Administration 299 research project.
Mr. Jastrem (F, W)

296. Special Topics in Business Administration. (4)
Prerequisite: graduate standing. Advanced study in various fields of business administration. Topics will vary from year to year and will be announced at the beginning of each quarter.
The Staff (F, W, Sp)

298. Seminar in Business Administration. (4)
Hours to be arranged. Prerequisite: admission to the Ph.D. program in business administration and permission of instructor. An analysis of important issues in the respective subject areas. Intensive work in preparing and presenting the results of these analyses, with special attention to methods of inquiry applicable to the various subject areas for Ph.D. specialization.
The Staff (F, W, Sp)

299. Individual Research in Business Problems. (1-6)
The Staff (Mr. Carman, Mr. Rogers in charge) (F, W, Sp)

390. Professional Preparation for Teaching Assistants. (1-4)
Special Study under the direction of a staff member with emphasis on the teaching of undergraduate courses in business administration. Must be taken on a passed/not passed basis.
The Staff (Mr. Carman in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Rogers in charge) (F, W, Sp)

602. Individual Study for Doctoral Candidates. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. and other doctoral degrees. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Carman in charge) (F, W, Sp)

IDS 175. A Nontechnical Introduction to Operations Research. (4)
See Interdepartmental Studies for the complete description of this course.

IDS 180. Economic and Biological Feedback Systems. (3)
See Interdepartmental Studies for the complete description of this course.

IDS 209A-209B-209C. Economics of Decision, Information, and Organization. (5-5-4)
See Interdepartmental Studies for the complete description of this course.

IE 100. Cultural Traditions of India. (1-4)
See International Education for the complete description of this course.

IE 200. Cultural Traditions of India. (1-4)
See International Education for the complete description of this course.

IE 400. Modernization in Contemporary India. (1-4)
See International Education for the complete description of this course.

IE 487. Internship in India. (1-5)
See International Education for the complete description of this course.
Preparation for Graduate Study

Students interested in pursuing graduate work in the Department are advised to obtain a strong background in chemistry, physics, and mathematics and to be familiar with the basic concepts of biology. Based on course offerings at Berkeley, the recommended preparation for graduate work in the Department includes: Chemistry-general (1A–1B–1C, and 5), 16 units (or 4A–4B–4C, 15 units); organic (12A–12B–112), 15 units; physical (110A–110B), 6 units; Biochemistry (102, 102L or 100A–100B–100C), 9 units; Physics-general (6A–6B–6C or 4A–4B–4C), 12 units; Mathematics-calculus (16A–16B–16C or 1A–1B–1C), 12 units; Biology-general (1A–1B) 12 units.

Incoming students with incomplete undergraduate preparation will be expected to make up their deficiencies early in their graduate work.

Graduate Study

The Department offers graduate programs leading to the Ph.D. (and M.S.) degree in three graduate curricula: biophysics, comparative biochemistry, and plant physiology (photosynthesis). Current areas of research include: electron transport in photosynthesis; photosynthetic phosphorylation; control mechanisms in photosynthesis; carbon assimilation; nitrogen fixation; chemistry and function of metalloproteins; and physical aspects of photosynthesis. The laboratory techniques of biochemistry and biophysics form the foundation for much of the research work in the Department.

A reading knowledge of one foreign language (which may be chosen from several languages, depending on the student's chosen curriculum) is required before the qualifying oral examination for the Ph.D. degree. In the qualifying examination, the student must demonstrate adequate preparation for research, as well as general knowledge of different areas in his chosen curriculum. For further information, consult the graduate adviser.

Graduate Courses

222. Unifying Concepts of Photosynthesis. (3)
Two 1½-hour lectures per week. Prerequisite: consent of instructor. Carbon assimilation, structure of photosynthetic apparatus, light and dark reactions, with special emphasis on energy conversion, photosynthetic phosphorylation, and photosynthesis in subcellular systems.

Mr. Buchanan, Mr. Arnon, Mr. Knaff, Mr. McSwain, Mr. Malkin (F)

NOTE: For key to footnote symbols, see page 86.
The College of Chemistry offers a major in chemical engineering leading to the B.S. degree. The program equips the student for professional work in development, design, and operation of chemical processes and of process equipment. Students with high scholastic attainment are well prepared to enter graduate programs. The curriculum is accredited by the Engineers Council for Professional Development.

Chemical Engineering Major

The requirements for the degree are: A total of 180 quarter units. Mathematics: 1A, 1B, 1C and one of 51A, 51B, 51C. Physics: 4A, 4B, 4C, 4D, 4E. Chemistry: 1A, 1B, 1C, 5 (or 4A, 4B, 4C); 12A, 12B, 14, 110A, 110B, 111A, 111B. Chemical Engineering: 140, 141A, 141B, 142, 150A, 150B, 151A, 151B, 160. Six additional units of elective courses in chemical engineering; 10 units of advanced technical electives; 20 units of courses in the College of Engineering, approved by the student’s adviser. Satisfaction of the American History and Institutions requirement (see page 25); 27 units in the humanities and social sciences, chosen from a list provided by the College of Chemistry.

Interdisciplinary Options. The chemical engineering electives, the advanced technical electives, and many of the College of Engineering units are quite flexible and may be devoted to exploration of several scientific fields, or may be selected for in-depth study of a single field and its relation to chemical engineering. The options now available for the in-depth alternative are chemistry, applied physics, systems analysis and applied mathematics, materials and molecular engineering, space systems, earth and ocean sciences, environmental balance, applied biology, food resources and processing, business organization and enterprise, and science education. Further information is available from the Department of Chemical Engineering.

Graduate Study

Students interested in graduate study are invited to write to the Department of Chemical Engineering for information.

NOTE: For key to footnote symbols, see page 86.
Upper Division Courses

Stated prerequisites for each course indicate the desirable background level. Students majoring in other engineering or physical science fields should consult the instructor to determine whether they have acquired sufficient preparation.

100. Introduction to Chemical Process Technology. (4)

Four 1-hour class meetings per week. Prerequisite: upper division standing in bacteriology, biochemistry, chemistry, engineering, nutritional science, physics, or wood science, or consent of instructor. Not open for credit to students who have credit in courses 150A-150B or equivalent. Principles of fluid flow, heat transfer and diffusion transport and their application in important natural phenomena and in the processing and purification of materials. Illustrative topics will include selected problems in applied biology, biomedical engineering, food processing, and environmental control. Mr. Wilke (W)

140. Introduction to Chemical Engineering. (3)

Three 1-hour lectures per week. Prerequisite: Chemistry 14 (which may be taken concurrently). The student is advised to attend computer center programming sessions. Material and energy balances. Properties of gases, liquids, solids, and solutions useful in solving industrial problems. Use of thermodynamic concepts. Numerical and graphical calculations. Mr. Hanson (F); Mr. Grens (W); Mr. Vermeulen (Sp)

141A-141B. Chemical Engineering Thermodynamics. (4-4)

Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: course 140 with a grade of C or higher, Chemistry 14. Sequence beginning (F, W)

141A. Thermodynamic principles with applications to flow problems, phase behavior of pure substances, power cycles, refrigeration and gas liquefaction. Calculation of thermodynamic properties of fluids. Mr. Merrill (F); Mr. Newman (W)

141B. Prerequisite: course 141A. Thermodynamics of multicomponent systems. Phase equilibria for mixtures. Chemical equilibria for homogeneous and heterogeneous systems. Estimation methods for thermodynamic properties. Mr. Bromley (W); Mr. Shen (Sp)

142. Chemical Kinetics of Industrial Processes. (4)

Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: Chemistry 14 or 109A-109B or other course involving thermodynamics with chemical applications; Mathematics 51C and previous introduction to chemical kinetics are desirable, but not required. Analysis and prediction of rates of chemical conversion in flow and nonflow processes, including catalytic systems. Mr. Vermeulen (F); Mr. Petersen (Sp)

*145. Industrial Kinetics Laboratory. (3)

Three 3-hour laboratories (including one 1-hour lecture period) per week. Prerequisite: course 142 with a grade of C or higher, course 150A, or consent of instructor. Planning and conducting of bench-scale experiments relating chemical conversion to processing conditions.

146. Principles of Electrochemical Processes. (3)

Three 1-hour lectures per week. Prerequisite: courses 141B and 150B, or senior standing in physical science or engineering. Principles and application of electrochemical equilibria, kinetics, and transport processes. Technical electrolysis and electrochemical energy conversion. Mr. Tobias (F)

150A. Introduction to Transport Processes. (4)

Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: course 140 with a grade of C or higher, Chemistry 14, or consent of instructor. Elementary fluid mechanics, heat transfer, and mass transfer, and their application to chemical engineering problems. Mr. Williams (W); Mr. Goren (Sp)

150B. Mass Transfer and Separation Processes. (4)

Four 1-hour class meetings per week. Prerequisite: course 150A. Application of mass transfer to separation processes. Design principles for equilibrium stage and countercurrent differential contacting operations including gas absorption, distillation, and solvent extraction. Mr. Bromley (F); Mr. King (Sp)

151A—151B. Chemical Engineering Laboratory. (4-4)

Two 4-hour laboratories per week. Prerequisite: course 150A, Chemistry 111A, English 1A or Rhetoric 1A or English for Foreign Students 40 with grade of C or higher. Sequence beginning each quarter.

151A. Experiments in physical measurements, fluid mechanics, heat transfer, and refrigeration. Emphasis on investigation of basic relationships important in engineering. Experimental design, analysis of results, and preparation of engineering reports are stressed. Mr. Pigford (F); Mr. Hanson (W); Mr. Foss (Sp)

151B. Prerequisite: course 150B. Experiments in mass transfer, simultaneous heat and mass transfer, vaporization and condensation, separation techniques, and chemical reactors. Mr. Pigford (F); Mr. Hanson (W); Mr. Foss (Sp)

*155. Particulate Systems. (3)

Three 1-hour lectures per week. Prerequisite: course 150A or knowledge of elementary fluid mechanics. Production and separation of particulate systems in force and flow fields. Dust and mist collection, sedimentation, crystallization, and coagulation processes. Mr. Goren (W)

156. Transport Phenomena. (3)

Three 1-hour lectures per week. Prerequisite: course 150B or senior standing in physical science or engineering. The differential equations of momentum, energy, and mass transfer applied to laminar and turbulent flow and to interphase transfer. Mr. Donaghey, Mr. Williams (F)

158. Polymer Science and Technology. (3)

Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 150A or senior standing in physical science or engineering; one course in organic chemistry. Introduction to the physical and chemical behavior of organic polymers. Properties of solutions, melts, glasses, elastomers, and crystals. Engineering applications, emphasizing processing technology. Experiments in polymerization, characterization, and mechanical properties. Mr. Shen (W)
159. Process Technology of Solid-State Materials and Devices. (3)
(Formerly numbered 191S)
Three 1-hour class meetings per week. Prerequisite: Materials Science and Engineering 130 or graduate standing. Chemical processing and properties of solid-state materials. Crystal growth and purification, Thin film technology. Control of growth defects and morphology—fluence on electrical, magnetic, and optical properties. Application of chemical processing to the manufacture of semiconductors and solid-state devices. Mr. Donaghey (W)

160. Chemical Process Design. (4)
Four 1-hour class meetings per week. Prerequisite: courses 141A–141B, 150A–150B. Design principles for chemical processing equipment. Design of integrated chemical processes with emphasis upon economic considerations.
Mr. Oldershaw, Mr. Lynn (F); Mr. Blue (Sp)

162. Dynamics and Control of Chemical Processes. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: senior standing in engineering or physical sciences. The unsteady behavior of industrial chemical process units; methods and theory of their control. Laboratory testing of process control systems and measurement of process dynamics.
Mr. Foss (W)

165. Selection and Evaluation of Chemical Processes. (3)
Two 1½-hour lectures per week. Prerequisite: courses 141A, 150B. Development and discussion of a series of realistic cases involving the engineering of chemical processes. Selection and synthesis of a process and process elements. Identification and evaluation of process modifications and alternatives.
Mr. Lynn, Mr. Hanson (Sp)

170. Introduction to Biochemical Engineering. (3)
(Formerly numbered 191A)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 150A, 150B or consent of instructor. A review of special methods and theory useful in the design and operation of processes in the biochemical industries with particular emphasis on fermentation systems. Laboratory techniques for batch and continuous cultures.
Mr. Wilke (Sp)

192. Individual Study for Advanced Undergraduates. (2–5)
Prerequisite: a written proposal like that required for course 199, as described on page 87. Independent study on theoretical or computational problems.
The Staff (Mr. King in charge) (F, W, Sp)

194. Research for Advanced Undergraduates. (3–5)
Prerequisite: senior standing and a written proposal like that required for course 199, as described on page 87. Students with honors standing may carry out original research under the direction of one of the members of the staff.
The Staff (Mr. Petersen in charge) (F, W, Sp)

195. Special Topics. (3–4)
Three or four 1-hour lectures per week. Prerequisite: consent of instructor. Lectures on special topics.
The Staff (Mr. King in charge) (F, W, Sp)

196. Special Laboratory Study. (2–5)
Prerequisite: senior standing and a written proposal like that required for course 199, as described on page 87. Special laboratory work for advanced students. The Staff (Mr. King in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulation listed on page 87. Additional limitation: nonlaboratory study only. Must be taken on a passed or not passed basis.
The Staff (Mr. King in charge) (F, W, Sp)

Graduate Courses

230. Theoretical Methods in Chemical Engineering. (3)
Three 1-hour lectures per week. Prerequisite: Mathematics 51B or equivalent; open to senior honor students with consent of the instructor. Mathematical formulation and solution of problems drawn from the fields of heat and mass transfer, fluid mechanics, and reaction kinetics employing vector calculus, ordinary differential equations, Laplace transforms, and partial differential equations.
Mr. Goren (F)

231. Analysis of Chemical Engineering Problems. (3)
Three 1-hour lectures per week. Prerequisite: course 230 or equivalent. Continuation of course 230. Solution of complex chemical engineering problems employing calculus of variations, boundary value problems, integral equations, and approximate methods.
Mr. Goren (W)

232. Computational Methods in Chemical Engineering. (3)
Three 1-hour lectures per week. Prerequisite: course 230. Open to senior honor students with consent of instructor. Introduction to modern computational methods for treatment of problems not amenable to analytic solutions. Application of numerical techniques to chemical engineering calculations with emphasis on computer methods.
Mr. Grens (Sp)

240. Phase Equilibria. (3)
Three 1-hour lectures per week. Prerequisite: graduate standing. Molecular thermodynamics of multicomponent systems with applications to separation operations. Equilibrium properties of pure and mixed fluids.
Mr. Prausnitz (F)

241. Applications of Statistical Mechanics. (2)
Two 1-hour lectures per week. Prerequisite: course 240 and consent of instructor. Principles of statistical mechanics with emphasis on configurational properties of fluids. Introduction to statistical theories of gases, liquids, polymers and surfaces with applications to separation operations.
Mr. Prausnitz (Sp)

243. Cryogenic Engineering. (3)
Three 1-hour lectures per week. Prerequisite: course 141B and 150A or equivalent. Low-temperature refrigeration principles and applications; gas purification, liquefaction and separation; magnetic, thermoelectric and von Ettinghausen cooling; transport properties of materials at low temperatures; cryogenic techniques in chemical processes.
Mr. Lyon (F)
244. Applied Chemical Kinetics. (3)
Three 1-hour lectures per week. Prerequisite: course 142 or equivalent, or consent of instructor. Collison theory and transition state calculations, chain reactions and free radical mechanisms, adsorption phenomena, Langmuir-Hinshelwood kinetics, description of selected systems of industrial importance. Mr. Vermeulen, Mr. Klein (W)

245. Catalysis. (3)
Three 1-hour lectures per week. Prerequisite: course 244 or Chemistry 219A, or consent of instructor. Adsorption and kinetics of surface reactions; catalyst preparation and characterization; poisoning, selectivity and empirical activity patterns in catalysis; surface chemistry, catalytic mechanisms and modern experimental techniques in catalytic research; descriptive examples of industrial catalytic systems. Mr. Merrill (W)

246. Principles of Electrochemical Engineering. (3)
Three 1-hour lectures per week. Prerequisite: courses 141B, 156 and 146. Electrode processes in electrolysis and in galvanic cells. Charge and mass transfer in ionic media. Criteria of scale-up. Mr. Tobias (W)

247. Chemical Reaction Analysis. (3)
Three 1-hour lectures per week. Prerequisite: courses 230 or consent of instructor. Principles of chemical kinetic processes and physical rate processes and how they interact to govern the apparent behavior of chemically reactive systems. Particular emphasis on catalytic reactions. Application to the analysis and design of fixed and fluidized bed reactors. Mr. Petersen (F)

249. Biochemical Engineering. (3)
Three 1-hour lectures per week. Prerequisite: Bacteriology 102; Chemistry 110B, 112E; course 150B; or consent of instructor. Application of chemical engineering principles to the processing of biological and biochemical materials. Design of systems for cultivation of microorganisms and for the separation and purification of biological products. Mr. Wilke (W)

250. Mass Transfer. (3)
Three 1-hour lectures per week. Prerequisite: graduate standing or consent of instructor. Diffusion in gases and liquids. Mechanism and models of mass transfer in laminar and turbulent systems across fixed and free interfaces. Interactions between heat and mass transfer. High transfer rates. Characteristics of chemical reaction. Mixing efficiencies. Mr. Pigford (W)

251. Separation Processes. (3)
Three 1-hour lectures per week. Prerequisite: graduate standing or consent of instructor. Concepts of multistage and countercurrent contacting. Techniques for computation, and analysis of binary and multicomponent systems. Continuous, semicontinuous and batch operation. Mr. King (F)

252. Adsorption Separations in Particulate Beds. (3)
Three 1-hour lectures per week. Prerequisite: course 250 (may be taken concurrently), or 150B with honor standing; Mathematics 51C or course 230, or equivalent. Introduction to ion exchange, adsorption, partition absorption and extraction, and regenerative heat transfer. Fixed-bed performance; axial dispersion; theory of chromatography. Moving beds, semicontinuous agitated systems, membrane processes and fluidized beds. Mr. Vermeulen, Mr. Klein (W)

254. Advanced Transport Phenomena. (3)
Three 1-hour lectures per week. Prerequisite: course 250. Formulation and rigorous analysis of the laws governing the transport of momentum, heat, and mass with special emphasis on chemical engineering applications. Detailed investigation of laminar flows. Mr. Newman (Sp)

258. Chemical Technology of Polymers. (3)
Three 1-hour lectures per week. Prerequisite: course 158 or consent of instructor. Analysis of all steps in the sequence of production of monomers and polymers, processing rheology, optimal selection and recycling of polymeric materials. Chemical principles in the technologies of adhesives, rubbers, plastics, coatings, and fibers. Mr. Shen, Mr. Williams (F)

260. Optimization in Chemical Process Design. (3)
Three 1-hour lectures per week. Prerequisite: courses 230 and 160, or equivalent. Applications of linear and nonlinear mathematical programming to problems of optimum design and operation of chemical processes. Mr. Foss (F)

261. Process Simulation. (3)
Two 1-hour lectures and one 1-hour discussion per week. Prerequisite: course 160 or equivalent. Introduction to simulation by digital computer programs of chemical processes operating in the steady state. Emphasis on decomposition of recycle systems. Practice in simulation of simple units and processes. Mr. Greens (W)

262. Chemical Process Dynamics. (3)
Three 1-hour lectures per week. Prerequisite: course 230 or equivalent. The unsteady behavior of chemical processes interpreted through the interaction of physical and chemical phenomena. Analysis of the distinctive problems of chemical process control. Mr. Foss (F)

265. Design and Engineering of Integrated Chemical Process Systems. (3)
Two 1½-hour lectures per week. Prerequisite: a comprehensive background in chemical engineering. Consideration of specific, realistic cases involving the synthesis, evaluation, selection and optimization of processing alternatives. Qualitative and quantitative studies. Criteria for engineering judgment and economic evaluation. Mr. Lynn, Mr. Hanson (Sp)

295. Special Topics in Chemical Engineering. (1–4)
Prerequisite: open to properly qualified graduate students. Current and advanced study in chemical engineering, primarily for advanced graduate students. Mr. Petersen (W)

295A. Decay of Heterogeneous Catalysts. (2)
Mr. Petersen (W)

295B. Studies in Electrochemical, Hydrodynamic, and Interfacial Phenomena. (2)
Mr. Newman (W, Sp)

295C. Advanced Topics in Transport Phenomena. (2)
Mr. Newman (W, Sp)

295D. Electrochemical Energy Conversion. (2)
Mr. Tobias, Mr. Williams (Sp)

295E. Atmospheric Processes and Weather Modification. (2)
Mr. King, Mr. Vermeulen (W)
298. Seminar in Chemical Engineering. (1–6)

Prerequisite: open to properly qualified graduate students with consent of instructor. Lectures, reports, and discussions on current research in chemical engineering. Several sections are offered each quarter. To be graded on a passed/not passed basis.

The Staff (Mr. King in charge) (F, W, Sp)

299. Research in Chemical Engineering. (1–12)

To be graded on a passed/not passed basis.

The Staff (Mr. King in charge) (F, W, Sp)

300. Professional Preparation: Supervised Teaching of Chemical Engineering. (2)

Two 1-hour lectures per week. Prerequisite: graduate standing, appointment as a teaching assistant, or consent of instructor. Discussion, problem review and development, guidance of large scale laboratory experiments, course development, supervised practice teaching. Must be taken on a passed/not passed basis.

The Staff (Mr. King in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Merrill in charge) (F, W, Sp)

Colloquium and Graduate Seminar. (No credit)

Members of the instructing staff and graduate students meet once a week to discuss investigations presented by invited speakers and Ph.D. candidates in the department.
Isadore Perlman, Ph.D. (Emeritus)

Associate Professors:
Robert A. Harris, Ph.D.
Clayton H. Heathcock, Ph.D. (Vice-Chairman)
William H. Miller, Ph.D.
Herbert L. Strauss, Ph.D.
James C. Wang, Ph.D.

Assistant Professors:
Paul A. Bartlett, Ph.D.
Douglas T. Browne, Ph.D.
William M. Gelbart, Ph.D.
Charles B. Harris, Ph.D.
Ronald R. Herm, Ph.D.
Wayne L. Hubbell, Ph.D.
Luciano G. Moretto, Ph.D.
Alexander Pines, Ph.D.
Kenneth N. Raymond, Ph.D.
Henry F. Schaefer, Ph.D.

Lecturer:
Charles W. Koch, Ph.D.

Choice of College

A student can complete a major in chemistry in either the College of Chemistry (B.S. degree) or the College of Letters and Science (A.B. degree). Both curricula are approved by the American Chemical Society, and either is a satisfactory foundation for a career in chemical industry, for the teaching of chemistry, or, if completed with high academic standing, for graduate work in chemistry.

Chemistry Major in the College of Chemistry

The requirements for a B.S. degree in the College of Chemistry, with a chemistry major are: a total of 180 quarter units. Mathematics: 1A, 1B, 1C and one of 51A, 51B, 51C. Physics 4A, 4B, 4C, 4D, 4E. Chemistry: 1A, 1B, 1C, 5 (or 4A, 4B, 4C); 12A, 12B, 14, 104A, 104B, 110A, 110B, 111A, 111B, 112, and a choice of one of 105, 106, 107, or 123 and IDS 124. In addition to these specified courses, the B.S. chemistry major consists of 25 units of advanced study in chemistry and related fields. These courses permit the student to emphasize chemistry in areas of personal interest; or to specialize in some related field, such as physics, biology, geology, mathematics, metallurgy, materials science, ceramic engineering, nuclear science; or to complete the premedical requirements (Biology 1A–1B and Zoology 105, for example). Without the approval of the adviser or the Dean of the College, these 25 units of advanced scientific courses and a portion of the 27 units of restricted electives (see below) can be used for coherent programs in other interdisciplinary areas.

Satisfaction of the American History and Institutions requirement (see page 25). A reading knowledge of scientific German equivalent to that provided by German 2.

Twenty-seven units in the humanities, and social sciences, chosen from a list provided by the College of Chemistry.

Chemistry Major in the College of Letters and Science

The requirements for the A.B. degree in the College of Letters and Science with a chemistry major are:

A total of 180 quarter units, including the major and College requirements.
Mathematics: 1A, 1B, 1C.
Physics: 4A, 4B, 4C, 4D, 4E.
Chemistry: 1A, 1B, 1C, 5 (or 4A, 4B, 4C); 12A, 12B, 14, 104A, 110A, 110B, 112, and a choice of 105, 106, 107, or 111A–111B. (For students who wish to be certified to the American Chemical Society, this must be 111A–111B.)

Enough additional units in upper division chemistry and allied subjects to make a total of 30.

In addition to the requirements for the major in chemistry, students in the College of Letters and Science must fulfill the requirements in American History and in American Institutions; the College unit requirements (180 units, of which at least
162 units including a minimum of 54 upper division units must be chosen from courses on the Letters and Science List, of which 9 units must be in upper division courses outside the Department of Chemistry); and the breadth requirements. For the list of courses which may be offered in fulfillment of these requirements and for a complete statement of the requirements of the College of Letters and Science, the ANNOUNCEMENT of the COLLEGE OF LETTERS AND SCIENCE must be consulted. For students who wish to be certified to the American Chemical Society, a reading knowledge of scientific German is required.

Honors Program At the discretion of the Committee on Honors a student may be awarded the A.B. with Distinction or Great Distinction in the honors program. Students will not ordinarily be recommended for such awards unless they have engaged in undergraduate research or other advanced work approved by the major adviser.

Letters and Science Major Advisers: Mr. Rapoport, Mr. Sauer.

Field Major in Physical Sciences

Students interested in this major please see Physical Science (page 424) for the description of the major program.

California Teaching Credential (Secondary)

The teaching major in chemistry is identical with the Letters and Science chemistry major. The teaching minor in chemistry consists of 30 units in chemistry, chosen from courses in the Letters and Science chemistry major. For further information, see the ANNOUNCEMENT of the SCHOOL OF EDUCATION.

Graduate Study in Chemistry

Students interested in graduate study are invited to write to the Chairman of the Department of Chemistry for information.

Lower Division Courses

1A—1B—1C. General Chemistry. (4—4—4)
Two 1-hour lectures and two 3-hour laboratories per week, part of the laboratory time being devoted to quiz and discussion. Prerequisite: high school chemistry or consent of instructor. Stoichiometry, ideal gases, equilibrium (solubility, acids and bases), thermochemistry, nuclear chemistry; electrical cells, imperfect gases, atomic structure, chemical bonding; periodic table, descriptive chemistry, transition metals, introductory organic chemistry, qualitative analysis. Three-quarter sequence beginning (F). Mr. Moore

4A—4B—4C. General Chemistry and Quantitative Analysis. (5—5—5)
Three 1-hour lectures and two 3-hour laboratories per week. Prerequisite: high school chemistry (high school physics is also recommended), introductory calculus which may be taken concurrently, and superior performance on an examination given during the week of enrollment. Intended for students of superior facility and preparation in chemistry, but not limited to chemistry majors. Equivalent to courses 1A—1B—1C plus 5 as prerequisite for further courses in chemistry. Covers the principles of general chemistry with a more quantitative emphasis than course 1A—1B—1C, and lays more stress on the applications of thermodynamics and quantum mechanics. Laboratory emphasizes quantitative work. Three-quarter sequence beginning (F). Mr. Moore

5. Quantitative Analysis. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 1C with grade of C or higher. The principles and techniques of volumetric, gravimetric, potentiometric and colorimetric methods of analysis, and ion exchange separation.
Mr. Koch, Mr. Moretto, Mr. Orlemann (F, W, Sp)

8A—8B. Organic Chemistry. (4.5—4.5)
Two 1½-hour lectures and one 4½-hour laboratory per week. Prerequisite: course 1A—1B or 4A—4B. Intended for students not majoring in chemistry and not planning to take additional courses in organic chemistry. A study of the fundamental aspects of organic chemistry, with emphasis on materials of interest to students of the biological sciences. Students with credit in Chemistry 12A and 12B may not receive credit in the corresponding quarters of Chemistry 8. Two-quarter sequence beginning (F) Mr. Calvin; (Sp) Mr. Rapoport

12A—12B—112. Organic Chemistry. (5—5—5)
Two 1½-hour lectures and two 3-hour laboratories per week. Prerequisite: course 1C or 4C, with grade of C or better. For students whose major is
14. Chemical Thermodynamics. (3)

Three 1-hour lectures per week. Prerequisite: course 1C or 4C; Mathematics 1C. Intended for chemistry and physical science majors and other students planning to take courses 110A–110B. Introduction to chemical thermodynamics, colligative properties and chemical equilibria.

Mr. Phillips, Mr. Pigford, Mr. Shen, Mr. Street (F, W, Sp)

Upper Division Courses

104A–104B. Advanced Inorganic Chemistry. (3–3)

Three 1-hour lectures per week. Prerequisite: course 14. (104A, nonmetals; 104B, metals) Two-quarter sequence beginning (F, W).

Mr. Raymond (F); Mr. Jolly (W)

105. Advanced Quantitative Analysis. (5)

Two 1-hour lectures and three 3-hour laboratories per week. Prerequisite: course 5 or 4C, 104A.

Mr. Orlemann (F)

106. Inorganic Synthesis. (5)

Two 1-hour lectures and two 4½-hour laboratories per week. Prerequisite: course 5 or 4C, 104A.

Mr. Jolly (F); Mr. Brewer (W)

107. Inorganic Reactions. (5)

Two 1-hour lectures and three 3-hour laboratories per week. Prerequisite: course 5 or 4C, 104A. Kinetic and thermodynamic studies of some inorganic reactions.

Mr. Brewer (Sp)

109A–109B. Survey of Physical Chemistry.

(3 or 4, 3 or 4)

Two 1-hour lectures and one or two 1-hour discussion periods. Prerequisite: course 1C or 4C, and at least one quarter course in calculus. Intended for students majoring in the biological sciences and not planning to take additional courses in physical chemistry. Students with insecure backgrounds in mathematics and the quantitative aspects of chemistry should enroll in the course for 4 units instead of 3. Those taking the course for 4 units will attend an extra meeting each week where they receive additional drill in problem solving and the applications of calculus in physical chemistry. Two quarter sequence beginning (F, W).

109A. Elementary chemical thermodynamics, macromolecular properties.

109B. Kinetics, molecular structure and spectroscopy.

Mr. Sauer (F); Mr. Tinoco (W)

110A–110B. Physical Chemistry. (3–3)

Three 1-hour lectures per week. Prerequisite: 110A, course 14, Physics 4D; 110B, Physics 4E.

110A. The quantum mechanics of chemical bonding and molecular structure.

110B. Molecular spectroscopy, diffraction phenomena, and chemical kinetics. Statistical mechanics may be introduced in either 110A or 110B. Sequence beginning (F, W, Sp).

Mr. R. A. Harris, Mr. Johnston, Mr. Jura, Mr. Phillips, Mr. Fitzger, Mr. C. B. Harris, Mr. Rasmussen

111A–111B. Physical Chemistry Laboratory. (3–3)

One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 14 with a grade of C or higher, 110A, which may be taken concurrently, or 109B with the consent of instructor. Two-quarter sequence beginning (F, W). Mr. Givin, Mr. Myers, Mr. Somorjai, Mr. Strauss, 111A: (F, W); 111B: (W, Sp)

112. Organic Chemistry. (5)

See Chemistry 12A for description of this course.

112E. Organic Chemistry Lecture Only. (3)

Two 1½-hour lectures per week. Prerequisite: course 12B with grade of C or better. The lecture part of course 112. Intended for students in chemical engineering who wish an additional course in organic chemistry, but open to others with consent of the instructor.

(W, Sp)

H114. Advanced Chemical Thermodynamics. (3)

Three 1-hour lectures per week. Prerequisite: course 110B and honors standing. A rigorous presentation of classical thermodynamics. Equilibria involving real gases and real solutions. Application of tabulated thermodynamic data. Systems involving intensive variables besides pressure and temperature.

Mr. Shirley (F); Mr. Phillips (Sp)

H117. Quantum Mechanics. (3)

Three 1-hour lectures per week. Prerequisite: course 110B and honors standing. Some familiarity with linear algebra and differential equations is desirable. Elementary principles of quantum mechanics with application to atoms and molecules.

Mr. Gelbart (F, Sp)

121. Molecular Structure and Molecular Spectroscopy. (3)

Three 1-hour lectures per week. Prerequisite: course 110B. The interpretation of spectra of polyatomic molecules. The effect of molecular symmetry on infrared and Raman spectra. Radiofrequency spectroscopy: molecular magnetic, quadrupole, electron spin, and microwave spectroscopy.

Mr. Herm (W)

123. Nuclear Chemistry. (3)

Three 1-hour lectures per week. Prerequisite: senior standing.

Mr. Cerny (W)

127. Physical Organic Chemistry. (3)

Two 1½-hour lectures per week. Prerequisite: course 112 and 110B, or consent of instructor. Application of molecular orbital and resonance concepts to bonding, electronic structure, spectra and reactions of organic compounds. Topics discussed include electronic and magnetic resonance spectroscopy and the orbital symmetry reaction rules. A reading knowledge of German is recommended.

Mr. Streitwieser (F)


One 1-hour lecture and three 3-hour laboratories per week. Prerequisite: course 5 or 4C, 112; reading knowledge of German or consent of instructor. Emphasis is on physical methods of identification or organic compounds.

Mr. Dauben (F); Mr. Heathcock (W)
129. Organic Chemistry—Synthetic Methods. (4)
Three 3-hour laboratories per week. Prerequisite: course 128, a reading knowledge of German, and consent of the instructor.
Mr. Dauben (W); Mr. Cason (Sp)

192. Individual Study for Advanced Undergraduates. (1–3)
Any properly qualified student who wishes to pursue a problem of his own choice, through reading or nonlaboratory study, may do so if his proposed project is acceptable to the member of the staff with whom he works.
The Staff (Mr. Orelmann in charge) (F, W, Sp)

H194. Research for Advanced Undergraduates. (2–5)
Prerequisite: honors standing, course 110B, and consent of the instructor. Students who have completed with high credit a satisfactory number of advanced courses may pursue original research under the direction of one of the members of the staff. The Staff (Mr. Orelmann in charge) (F, W, Sp)

195. Special Topics. (3)
Three 1-hour lectures per week. Prerequisite: consent of the instructor. Special topics will be offered from time to time. Examples are: photochemical air pollution, computers in chemistry.
The Staff (Mr. Orelmann in charge) (F, W, Sp)

196. Special Laboratory Study. (2–5)
Prerequisite: course 111B and at least one of courses 105, 106, 107, or 129; consent of the instructor and consent of the adviser. Special laboratory work for advanced undergraduates.
The Staff (Mr. Orelmann in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Additional limitation: non laboratory study only. Must be taken on a passed or not passed basis.
The Staff (Mr. Orelmann in charge) (F, W, Sp)

Graduate Courses

Two 1½-hour lectures per week. Prerequisite: course 112; course 127 should be taken concurrently with 206A, or consent of instructor. The application to synthetic studies of current knowledge of reaction mechanism, molecular structure, and steric factors. Emphasis is on typing of reactions according to mechanism. Three-quarter sequence beginning (F).
Mr. Noyce, Mr. Jensen, Mr. Dauben

207. Organic Chemistry. (3)
Two 1½-hour lectures per week. Prerequisite: course 206C. The chemistry of heterocyclic compounds, with emphasis on those of natural origin.
Mr. Rappoport (W)

*208. Organic Chemistry. (3)
Two 1½-hour lectures per week. Prerequisite: course 206C. Kinetics and mechanism of organic reactions, mechanisms of rearrangements.

*209. Organic Chemistry. (3)
Three 1-hour lectures per week. Prerequisite: course 206C. The chemistry of poly cyclic compounds of biological interest, with emphasis on terpenoids, steroids and related substances.

210. Contemporary Organic Chemistry. (1)
One hour of lecture per week. Prerequisite: graduate standing in Chemistry. Recent significant developments in the theory and practice of organic chemistry. Mr. Rappoport, Mr. Streitweiser (F, W, Sp)

216A–216B. Statistical Mechanics. (3–3)
Three 1-hour lectures per week. Prerequisite: course H114, and an introduction to quantum mechanics (which may be taken concurrently). Open to senior honor students with consent of instructor.
Two-quarter sequence beginning (W).

216A. Principles and applications of statistical mechanics: ensemble theory, statistical thermodynamics of ideal and real gases, solids, and chemical equilibrium.
216B. Topics chosen from among the following: liquids, solutions, light-scattering, polymeric systems, spectral line shapes, quantum statistics, phase transitions, transport properties.
Mr. Shirley (W); Mr. A. R. Harris (Sp)

217A–217B. Advanced Quantum Mechanics. (3–3)
Three 1-hour lectures per week. Prerequisite: course H117 or equivalent. Representation theory and matrix methods; symmetry and conservation laws; coupling of angular momentum; stationary-state perturbation theory; time-dependent quantum mechanics; interaction of radiation with matter; introduction to scattering theory. Two-quarter sequence beginning (W).
Mr. Schaefer

219A–219B. Chemical Kinetics. (3–3)
Three 1-hour lectures per week. Prerequisite: course H117, introduction to statistical mechanics, which may be taken concurrently. 219B, course H117 which may be taken concurrently. (219A: Deduction of mechanisms of complex reactions. Theory of elementary reactions, activated complex theory; 219B: Classical and quantum mechanical collision theory of elastic, inelastic, and reactive processes.) Two-quarter sequence beginning (W).
Mr. Miller

223A–223B. Advanced Nuclear Chemistry. (3–3)
Three 1-hour lectures per week. Prerequisite: course 123 and introductory quantum mechanics (which may be taken concurrently). Two-quarter sequence beginning (Sp).
Mr. Cerny, Mr. Rasmussen

295. Special Topics. (1–3)
From time to time, lecture series are offered on topics of current interest. The following have been offered recently: collision processes, hydrocarbon ions, flames, empirical spectra-structure correlation.
The Staff (Mr. Shirley in charge) (F, W, Sp)

298. Seminars for Graduate Students. (1–3)
Besides the weekly research conference of the College of Chemistry and weekly seminars on topics of interest in organic, physical, nuclear, and inorganic chemistry, there are as a rule seminars on specific fields of research. The following have been offered recently: spectroscopy, biophysical chemistry, nuclear magnetic and electron spin resonance. Seminars will be announced at the beginning of each quarter.
The Staff (Mr. Shirley in charge) (F, W, Sp)

299. Research for Graduate Students. (1–9)
The facilities of the laboratory are available at all times to graduate students pursuing original
investigations toward an advanced degree at this University. Such work is ordinarily in collaboration with a member of the staff. Credit is determined by the graduate adviser.

The Staff (Mr. Shirley in charge) (F, W, Sp)

300. Professional Preparation: Supervised Teaching of Chemistry. (2)
Prerequisite: graduate standing, appointment as a teaching assistant, or consent of instructor. Discussion, curriculum development, class observation, and practice teaching in chemistry. Must be taken on a passed/not passed basis.

The Staff (Mr. Shirley in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Shirley in charge) (F, W, Sp)

IDS 124. Chemical Methods in Nuclear Technology. (3)
See Interdepartmental Studies for the complete description of this course.

CHICANO STUDIES PROGRAM
See Ethnic Studies.

CLASSICS

(Department Office, 5303 Dwinelle Hall)

Professors:
John K. Anderson, M.A.
William S. Anderson, Ph.D.
W. Kendrick Pritchett, Ph.D.
Thomas G. Rosenmeyer, Ph.D.
Ronald S. Stroud, Ph.D.
Joseph Fontenrose, Ph.D. (Emeritus)
Arthur E. Gordon, Ph.D. (Emeritus)
William M. Green, Ph.D. (Emeritus)
Ivan M. Linforth, Ph.D., LL.D. (Emeritus)
Louis Alexander MacKay, M.A. (Emeritus)

Associate Professors:
Elroy L. Bundy, Ph.D.
P. D. A. Garnsey, D.Phil.
Crawford H. Greenewalt, Ph.D.
W. R. Johnson, Ph.D.
Charles E. Murgia, Ph.D.
W. Gerson Rabinowitz, Ph.D.

Assistant Professors:
John M. Dillon, Ph.D.
Stephen G. Miller, Ph.D.
Michael N. Nagler, Ph.D.
Robert H. Rodgers, Ph.D.
Leslie L. Threatte, Ph.D.

Departmental Major Advisers: (Greek, Latin, Classical Languages) Mr. Dillon and Mr. Johnson.

Departmental Graduate Adviser: (Classics) Mr. Murgia; (Classical Archaeology) Mr. Greenewalt.

The Department of Classics offers a complete undergraduate and graduate program in Greek and Latin languages, literatures, and civilizations. It groups its courses of instruction under the headings of Greek, Latin, and Classics. The object of the Greek and Latin courses is to teach students how to read the great works of ancient literature in the original languages, and to acquaint the students with the achievements of classical civilization. The undergraduate courses in Classics require no knowledge of Greek and Latin. The graduate courses, all of which are designated Classics, are advanced courses in Greek, Latin, and Classical Archaeology, all requiring knowledge of one or both of the languages. The purpose of the undergraduate courses called Classics is to give the student instruction in Greek and Roman civilization in all its phases—literature (read in translation), mythology, religion, government, and archaeology.

The Majors
The Department of Classics offers three undergraduate majors: Greek, Latin, and Classical Languages.

NOTE: For key to footnote symbols, see page 86.
**Major in Greek**  
Greek 1–2 or 1A–1B–1C; 40A–40B–40C (may be taken concurrently with upper division courses); 100, 101A–101B, 102A–102B, 103; 12 units chosen from other upper division Greek courses; 8 units chosen either from additional upper division courses in Greek or from recommended upper division courses. Recommended: Courses in Classics, Latin, Sanskrit (see South and Southeast Asian Languages and Literatures), Art 140A, 140B, 141, History 110A–110B.

**Major in Latin**  
Latin 1, 2, 3, 5, or equivalent; 9A–9B–9C (may be taken concurrently with upper division courses); 104A–104B, 105, 106, 107A–107B; 12 units chosen from other upper division Latin courses; 8 units chosen either from additional upper division courses in Latin or from recommended upper division courses. Recommended: courses in Classics, Greek, Sanskrit (see South and Southeast Asian Languages and Literatures), Art 144, History 111A–111B.

**The Major in Classical Languages**  
Greek 1–2 or 1A–1B–1C; Latin 1, 2, 3, 5 or equivalent; Greek 40A–40B–40C or Latin 9A–9B–9C (may be taken concurrently with upper division courses); Greek 100, 101A or 101B, 102A or 102B, 103; Latin 104A or 104B, 105, 106, 107A or 107B; one additional 4-unit course chosen from Greek 115, 120, Latin 145, 150. Recommended: Courses in Classics, Sanskrit (see South and Southeast Asian Languages and Literatures), Art 140A–140B, 141, 144, History 110A–110B, 111A–111B.

**Honors Program**  
**Greek:** (a) the major program, including Greek 150A–150B and at least one part of both Greek 115 and Greek 120; (b) three quarters of Greek H195 taken during the senior year.  
**Latin:** (a) the major program, including Latin 109 and at least one part of both Latin 145 and 150; (b) three quarters of Latin H195 taken during the senior year.  
**Classical Languages:** (a) the major program; (b) at least two courses chosen from Greek 115, Greek 120, Latin 145, Latin 150; (c) either Greek 150A or Latin 109; (d) three quarters of either Greek H195 or Latin H195 taken during the senior year.

Students in the honors program must have a grade-point average of at least 3.0 in all courses undertaken in the Department of Classics.

**Intercollegiate Center for Classical Studies in Rome.** There will be an opportunity for some Classics Majors to attend the Intercollegiate Classical Center at Rome. This is an intercollegiate program for classical undergraduates. All students interested in this program should consult the Major Adviser.

**Preparation for Graduate Study**  
To enter upon graduate study in Classics the student should complete the major in Greek or Latin or Classical Languages (or a satisfactory equivalent). He is strongly advised also to have an adequate reading knowledge of French and German, since he must pass examinations in both for the Ph.D. degree, and in one of them (or in Italian, which is also recommended) for the M.A. degree; furthermore, without both French and German he will be greatly handicapped in graduate study of classical subjects (and he will find Italian very useful too). The prospective graduate student in Classics should also take upper division prose composition in both languages (Greek 150A–150B and Latin 109); he will need competence in both Greek and Latin composition for the Ph.D. qualifying examinations.

**The Graduate Major**

The Master of Arts degree may be taken in Greek, Latin, Classics (each under Plan B: a program of 36 units in graduate and advanced undergraduate courses, and a series of examinations), or Classical Archaeology (under Plan A: a program of 30 units of graduate and advanced undergraduate courses, and a dissertation).
The Doctor of Philosophy degree may be taken in Classics or Classical Archaeology. Whatever the graduate student's principal interest—literature, history, archaeology, or other subjects—he should take a broad program and acquaint himself with every field of classical study. He must read widely in Greek and Latin authors and in Greek and Roman history, since both M.A. and Ph.D. qualifying examinations require an extensive knowledge of literature and history. He is especially advised to enter courses in epigraphy, paleography, comparative grammar, and Greek dialects when they are offered, since the interval between offerings of each is at least three years. The graduate program is varied from year to year so that in a normal period of graduate study the student may take courses in several fields and periods. For details of the M.A. and Ph.D. programs consult the graduate adviser for Classics (Greek, Latin) in 5216 Dwinelle Hall, for Classical Archaeology in 5214 Dwinelle Hall.

*Letters and Science List* for regulations governing this list, see the Announcement of the College of Letters and Science.

**Classics**

Courses that do not require a knowledge of Greek or Latin. Courses in this group are designated Classics 10A, Classics 10B, etc.

**10A–10B–10C. Ancient Greek and Roman Civilization. (4–4–4)**

Three 1-hour lectures per week. A study of Greek and Roman history the reading of several literary masterpieces, in whole, or in part, in translation. 10A. Hellenic Civilization. Mr. Rosenmeyer (F) 10B. Hellenistic Civilization. Mr. Dillon (W) 10C. Roman Civilization (Sp)

**17A–17B–17C. Elementary Course in Classical Archaeology. (4–4–4)**

Three 1-hour lectures per week. Against a background of Greek and Roman history the reading of several literary masterpieces, in whole, or in part, in translation. 17A. The development of Greek Civilization from the Late Bronze Age to 700 B.C. as illustrated by the monuments. Mr. J. K. Anderson, Mr. Greenewalt (F) 17B. Monuments of Greek civilization 700–300 B.C., with particular reference to the life of the citizen. Mr. Miller, Mr. Greenewalt (W) 17C. Monuments of western civilization from the Hellenistic Age to the Age of the Antonines, with particular reference to urban development and provincial growth. Mr. J. K. Anderson, Mr. Greenewalt (Sp)

**28. The Classic Myths. (4)**

Two 1½-hour lectures per week. A study of Greek, Roman, and Indian myths with emphasis on the universal meanings of ancient mythologies. The interaction of myth, religion, and philosophy as a means of understanding some aspects of past and present cultures. Mr. Nagler (W)

**34. Epic Poetry: Homer and Vergil. (4)**

Three 1-hour lectures per week. Lectures on the Greek and Roman epics with reading of *Iliad*, *Odyssey*, and *Aeneid*. Mr. Murgia (Sp)

**35. Greek Tragedy. (4)**

Three 1-hour lectures per week. Lectures on Greek tragic drama with readings of plays of Aeschylus, Sophocles, and Euripides. Mr. Johnson (W)

**36. Plato: Selected Dialogues. (4)**

Three 1-hour lectures per week. Lectures on the form and content of Plato's Dialogues. Mr. Rabinowitz (F)

*Upper Division Courses*

**100A–100B–100C. Greek and Latin Literature in Translation. (4–4–4)**

Three 1-hour lectures per week. Enrollment limited. 100B or 100C may be taken first. 100A. Greek literature to 300 B.C. Mr. Bundy (F) 100B. Hellenistic literature and Latin literature of the Roman Republic. Mr. Threette (W) 100C. Latin literature under the Roman Empire. Mr. Rodgers (Sp)

**136A–136B. Socrates and the Socratic Tradition. (4–4)**

Three hours of lecture per week. Study of what Socrates meant to his times, as seen through the works of Plato, Xenophon, and Aristotle. Analysis of the way later Greek thinkers expanded and altered Socrates' original significance. (W); (Sp)

*138. The Greek and Roman Historians. (4)*

Three 1-hour lectures per week. The five historians Herodotus, Thucydides, Polybius, Livy, and Tacitus, in English translation: their intellectual background, documentary sources, and philosophy of history.


Three 1-hour lecture and discussion sessions per week. The later parts may be taken before the earlier. 170A. Greek Vase-Painting from 700 B.C. to Exekias. Mr. J. K. Anderson (F) 170B. Greek Red-figured Vase Painting. Mr. J. K. Anderson (W) 170C. Greek Sculpture in the Sixth and Fifth Centuries B.C. Mr. J. K. Anderson (Sp) *170D. Greek Sculpture in the Fourth Century B.C. and Hellenistic Period.* 170E. Survey of Greek Architecture. *170F. Aspects of Roman Art.*
175A–175B–175C. Greek and Roman Cities and Sanctuaries. (4–4–4)
Three 1-hour lectures per week. The later parts may be taken before the earlier.

*175A. Ancient Greek Sanctuaries.
*175B. Topography and Monuments of Athens.
175C. Topography and Monuments of Rome and Ancient Italy
Mr. Miller (F)
175D. Topography and Monuments of Asia Minor.
Mr. Greenewalt (W)

*176. Ancient Greek Religion. (4)
Three 1-hour lectures per week; individual conferences to be arranged. The worship of the gods in ancient Greece; cults and religious ideas.

*178. Mythology. (5)
Three 1½-hour lectures per week. Prerequisite: a course in myths or folklore or advanced standing in a classical language. An introduction to the study of mythology based upon Greek mythology and its relations to Near-Eastern and Indo-European mythologies.

*185. Political and Social Thought of the Ancient Greeks. (4)
Three 1-hour lectures per week. Greek ideas about society and the state, from Homer to Aristotle.

186. Ancient Society and Economy. (4)
Three 1-hour lectures per week. Study of the economic system, classes, social mobility, the family, law, citizenship, and education in the Greco-Roman world.

198. Directed Group Study for Advanced Undergraduates. (1–5)
Prerequisite: restricted to senior honor students.
The Staff (Su, F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations on page 87. Additional restrictions: limited to senior honors students. Must be taken on a passed/not passed basis.
The Staff (Su, F, W, Sp)

Greek

Lower Division Courses

(Courses in this group are designated Greek 1, Greek 2, etc.)

1. Greek for Beginners. (6)
Five 1-hour class meetings per week. First part of two-part course in elementary Greek. ——— (W)

2. Greek for Beginners. (6)
Five 1-hour class meetings per week. Second part of two-part course in elementary Greek. ——— (Sp)

1A–1B–1C. Greek for Beginners. (4–4–4)
Three 1-hour class meetings per week. Three-part course in elementary Greek equivalent to Greek 1–2.
Mr. Fitchett, Mr. Rabinowitz (F);
Mr. Fitchett, Mr. Rabinowitz (W);
Mr. Fitchett, Mr. Rabinowitz (Sp)

40A–40B–40C. Intermediate Greek: Composition, Grammar, and Sight Reading. (4–4–4)
Three 1-hour class meetings per week. Prerequisite: courses 1–2 or 1A–1B–1C. Development of skills in writing of Attic prose and sight reading; review of grammar.
——— (F); ——— (W); Mr. Nagler (Sp)

Upper Division Courses

100. Xenophon. Anabasis. (4)
Three 1-hour class meetings per week. Prerequisite: courses 1–2 or 1A–1B–1C.
Mr. Fitchett, ——— (F)

101A–101B. Greek Epic: Homer and Hesiod. (4–4)
Three 1-hour class meetings per week. Prerequisite: course 100. Reading in the earliest Greek epic poets, Homer's Iliad and Odyssey, and Hesiod.
Mr. Bundy (W); Mr. Murgia (Sp)

102A–102B. Attic Prose. (4–4)
Three 1-hour class meetings per week. Prerequisite: course 100.

102A. Plato: Apology and Critio.
Mr. Rabinowitz (W)

102B. The Attic Orators.
——— (Sp)

103. Drama. (4)
Three 1-hour class meetings per week. Prerequisite: course 100.
Mr. Rosenmeyer (F)

115. Senior Course in Greek Poetry. (4)
Three 1-hour class meetings per week. Prerequisite: course 103.

115A. Aristophanes.
Mr. Threttay (W)
115B. Sophocles.
115C. Aeschylus.
——— (Sp)
115D. Lyric Poets
Mr. Bundy (F)
115E. Theocritus.

120. Senior Course in Greek Prose Authors. (4)
Three 1-hour class meetings per week. Prerequisite: course 103.

120A. Demosthenes.
120B. Herodotus.
Mr. Bundy (Sp)
120C. Thucydides.
Mr. Fitchett (W)
120D. Aristotle.
Mr. Dillon (F)
120E. Plato's Republic.

*125. The Greek New Testament. (4)
Two 1½-hour class meetings per week. Prerequisite: course 100. Readings in the gospels and epistles in Greek.

*139. Greek Political Institutions. (4)
Three 1-hour lectures per week. Study of Greek texts which elucidate the development of Greek political institutions.

150A–150B. Advanced Greek Prose Composition. (4–4)
Three 1-hour class meetings per week. Prerequisite: course 40A–40B–40C. Advanced instruction in the writing of Attic Greek prose.
——— (F); ——— (W)
198. Directed Group Study for Advanced Undergraduates. (1–5)
Prerequisite: restricted to senior honor students.

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations on page 87. Additional restriction: limited to senior honor students. Must be taken on a passed/not passed basis.

Latin

Lower Division Courses

(Courses in this group are designated Latin 1, 2, 3, 5, etc.)

1. Latin for Beginners. (4)
   (Formerly 1A)
   Three 1-hour class meetings per week.
   Staff (F, W, Sp)

2. Latin for Beginners. (4)
   (Formerly 1B)
   Three 1-hour class meetings per week.
   Staff (F, W, Sp)

3. Latin for Beginners. (4)
   (Formerly 1C)
   Three 1-hour class meetings per week.
   Staff (F, W, Sp)

4A–4B. Beginning Latin: Intensive Course. (6–6)
Five 1-hour class meetings per week. Introduction to Latin grammar and selected readings in prose and poetry.
   Staff (F, W)

5. Latin Poetry and Prose. (5)
   (Formerly Latin 2)
   Three 1-hour class meetings per week. Prerequisite: courses 1, 2, 3 or 4A–4B. Selections from Latin poetry and prose.
   Staff (F, W, Sp)

9A–9B–9C. Intermediate Latin Composition, Grammar and Sight Reading. (4–4–4)
Development of skills in writing of Latin prose and sight reading, review of grammar. Prerequisite: course 5.
   Staff (F, W); Mr. Garnsey (W); Mr. Rodgers (Sp)

Upper Division Courses

104A–104B. Latin Epic. (4–4)
Three 1-hour class meetings per week. Prerequisite: course 5. Vergil's Aeneid and Latin epics of the first century A.D. Mr. Murgia (F); Mr. Rodgers (W)

105. Caesar. (4)
Three 1-hour class meetings per week. Prerequisite: course 5. Mr. Johnson (F)

106. Horace: Odes and Epodes. (4)
Three 1-hour class meetings per week. Prerequisite: course 5.

107A–107B. Roman Philosophical Prose: Cicero and Seneca. (4–4)
Three 1-hour class meetings per week. Prerequisite: course 5. Reading of philosophic essays by Cicero and Seneca.
   (W); Mr. Garnsey (Sp)

109A–109B–109C. Advanced Latin Prose Composition. (4–4–4)
Three 1-hour class meetings per week. Prerequisite: course 9A–9B–9C. Advanced instruction in the writing of Latin prose.
   Mr. Murgia (F);
   Mr. Rodgers (W); Mr. Garnsey (Sp)

115. Readings in Latin Literature. (4)
Three 1-hour class meetings per week. Prerequisite: course 15. Selected readings in Latin prose and poetry designed for students who have taken the Latin Workshop during the summer sessions.
   Mr. Garnsey (F)

139. Roman Political Institutions. (4)
Three 1-hour lectures per week. Study of Latin texts which elucidate the development of Roman political institutions.

140. Introduction to Mediaeval Latin. (4)
Three 1-hour class meetings per week. Prerequisite: 8 units of intermediate poetry; 8 units of intermediate prose (courses 104, 105, 106, 107). Readings in prose and poetry from Cassiodorus to the Italian Renaissance, concentrating on outstanding periods such as the Carolingian Revival and the twelfth century, with reference to the classical tradition and its influence.

145. Senior Course in Latin Poetry. (4)
Three 1-hour class meetings per week. Prerequisite: courses 104 and 106.
   *145A. Roman Comedy.
   145B. Lucretius. Mr. Johnson (W)
   145C. Elegiac Poets. Mr. Bundy (Sp)
   145D. Juvenal. Mr. Thretaye (F)
   *145E. Horace: Satires and Epistles.

150. Senior Course in Latin Prose Authors. (4)
Three 1-hour class meetings per week. Prerequisite: course 107.
   *150A. Sallust.
   *150B. Seneca.
   150C. Cicero. Mr. Garnsey (Sp)
   150D. Tacitus. Mr. Miller (F)
   *156. Latin Verse Composition. (1)
One 1-hour class meeting per week. Prerequisite: course 109. Practice in the writing of Latin verse in various meters.

H195. Honors Course in Latin. (3)
One 1-hour meeting for discussion and recitation per week. Advanced and independent study for senior honor students in Latin. Special study over three terms of a philosophical, a historical, and a literary text. Writing of a thesis before end of the third term.
   Staff (F, W, Sp)

198. Directed Group Study for Advanced Undergraduates. (1–5)
Prerequisite: restricted to senior honor students.
   Staff (F, W, Sp)
CLASSES / 153

199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted by regulations on page 87. Additional restriction: limited to senior hour students. Must be taken on a passed/not passed basis.

Classics

Graduate Courses

For new students: Classics 200A is prerequisite to all other graduate courses in Greek, without special permission. Classics 200B is prerequisite to all other graduate courses in Latin, without special permission. Courses vary from year to year and are not necessarily given in alternating years.

200A-200B. Proseminar. (4-4)

Two 1½-hour class meetings per week. An introduction to the general literature of classical philology, to methods of research, and to textual criticism.

200A. Proseminar to Greek. Mr. Threate (F)

200B. Proseminar to Latin. Mr. Murgia (W)

201A-201B-201C. Survey of Greek Literature. (4-4-4)

Two 1½-hour class meetings per week. A sequence of readings and lectures on the Greek literature for which advanced graduate students are held responsible. To be offered in alternate years.

201A. Early Greek, Homer through Choral Lyric. Mr. Nagler (F)

201B. Tragedians and Historians of the Fifth Century. Mr. Rosenmeyer (W)

201C. From Aristophanes to Hellenistic Literature. Mr. Dillon (Sp)

202A-202B-202C. Survey of Latin Literature. (4-4-4)

Two 1½-hour class meetings per week. A sequence of readings and lectures on the Latin literature for which advanced graduate students are held responsible. To be offered in alternate years.

202A. Early Latin through Cicero. (F)

202B. Augustan Literature. (W)

202C. Post-Augustan Literature. (Sp)

*210A. The Language of Homer. (4)

Two 1½-hour class meetings per week. An introduction to the early history of the Greek language using the evidence of the Linear B tablets and the Homeric poems. Problems of phonology, morphology, and syntax will be studied and an introduction provided to the major dialect divisions and their significance for Homer.

*210B. Homer. (4)

Two 1½-hour class meetings per week. Language, meter, and questions of oral poetry.

211. Hesiod. (4)

Two 1½-hour class meetings per week. Mr. Bundy (W)

212. Greek Lyric Poets. (4)

Two 1½-hour class meetings per week.

* A. Earlier.

* B. Later.

213. Greek Dramatists. (4)

Two 1½-hour class meetings per week.

* A. Aeschylus.

* B. Sophocles.

C. Euripides.

* D. Aristophanes.

* E. Menander.

214. Greek Epigraphy. (4)

Two 1½-hour class meetings per week.

215. Greek Historians. (4)

Two 1½-hour class meetings per week.

* A. Herodotus.

* B. Thucydides.

* C. Aristotle’s Constitution of Athens.

* D. Polybius.

* E. Plutarch.

216. Greek Philosophers. (4)

Two 1½-hour class meetings per week.

A. Pre-Socratics. Mr. Rabinowitz (Sp)

* B. Plato.

* C. Aristotle.

* D. Later Platonism.

*217. Greek Orators. (4)

Two 1½-hour class meetings per week.

*218. Greek and Latin Romance. (4)

Two 1½-hour class meetings per week.

*221. Introduction to Papyrology. (4)

Two 1½-hour class meetings per week. An introduction to reading and editing Greek and Latin papyri, seeking to evoke an appreciation for the historical, legal, social, and literary contributions of papyrology to the knowledge of the classical world.

222. Greek and Latin Linguistics. (4)

Two 1½-hour class meetings per week.

* A. Greek Dialects.

* B. Comparative Grammar.

230. Roman Dramatists. (4)

Two 1½-hour class meetings per week.

* A. Plautus.

* B. Terence.

* C. Seneca.

231. Roman Epic Poets. (4)

Two 1½-hour class meetings per week.

* A. Lucretius.

* B. Vergil.

C. Post-Vergilian. Mr. Johnson (F)

*232. Roman Philosophers and Rhetoricians. (4)

Two 1½-hour class meetings per week.
234. Roman Lyric Poets. (4)
   Two 1½-hour class meetings per week.
   *A. Catullus.
   *B. Horace.

235. Roman Pastoral and Elegiac Poets. (4)
   Two 1½-hour class meetings per week.
   *A. Vergil.
   *B. Tibullus, Propertius and Ovid.

236. Roman Satirists. (4)
   Two 1½-hour class meetings per week.
   *A. Horace.
   *B. Persius and Juvenal.
   *C. Petronius.

237. Roman Historians. (4)
   Two 1½-hour class meetings per week.
   *A. Sallust.
   *B. Caesar.
   C. Livy. Mr. Rodgers (Sp)
   *D. Tacitus.
   *E. Suetonius.
   *F. Pliny.

245A–245B. Latin Literature of the Middle Ages.
   (4–4)
   One 2- to 3-hour class meeting per week.
   *245A. Latin Literature of the Early Middle Ages, 500–900 A.D. Special attention will be given to the classical tradition and its influence.
   *245B. Latin Literature of the High Middle Ages, 900–1300 A.D. Study of the evolution of medieval style with special attention to lyrical and satirical poetry.

*246. Roman Society and Roman Law. (4)
   Two 1½-hour class meetings per week. The social, legal, and administrative background to the literary sources for the Roman Empire.

247. Roman Politics and Administration. (4)
   Two 1½-hour class meetings per week. Select problems in Roman Imperial history from 69–235 A.D.
   Mr. Garney (F)

270A–270B–270C. Seminar in Classical Archaeology. (4–4–4)
   Two 1½-hour class meetings per week. Advanced study of ancient Greek art objects and sites.
   270A. Mr. Greenewalt (F)
   270B. Mr. Miller (W)
   270C. Mr. Greenewalt (Sp)

298. Special Study. (2–8)
   Prerequisite: completion of qualifying examination for the Ph.D. degree. This course is normally reserved for students writing the doctoral dissertation.
   Staff (F, W, Sp)

299. Special Study. (1–5)
   Special individual study for qualified graduate students.
   Staff (F, W, Sp)

1G. Latin for Graduate Students, First Course.
   (No credit)
   (F, W, Sp)

2G. Latin for Graduate Students, Second Course.
   (No credit)
   (F, W, Sp)

601. Individual Study for Master’s Candidates. (1–8)
   Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis.
   Staff (F, W, Sp)

602. Individual Study for Doctoral Candidates. (1–8)
   Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
   Staff (F, W, Sp)

Related Courses in Other Departments
For courses in Sanskrit see Department of South and Southeast Asian Languages and Literatures.

Readings in Mediaeval Latin (English 210A–210B). (5–5)
   Mr. Jones (W, Sp)

Reading in Renaissance Latin (English 210C). (5)

Indo-European Comparative Linguistics (Linguistics 165). (4)
   Mr. Beeler (F)

Advanced Indo-European Comparative Linguistics (Linguistics 244). (4)
   Mr. Beeler (W)

Medieval Studies Students who are interested in specializing in medieval studies should consult the Graduate Division section of this catalogue, in which the Committee for Medieval Studies is described.

# COMMUNICATION AND PUBLIC POLICY

Group Major in Communication and Public Policy

Adviser: Mr. Edward N. Barnhart

The group major in communication and public policy is offered in the College of Letters and Science and is designed to contribute to an understanding of the role of mass communication in society. It introduces the student to the study of the nature, function, content, values, and effects of communication on public policy and opinion.

NOTE: For key to footnote symbols, see page 86.
Courses in the program cover both the nature of language and the nature of the mass communication media (radio, press, film), and the effects of informative and persuasive communication on public opinion and public institutions.

**Lower Division Courses**  
Psychology 1, General Psychology (5). **Recommended:** Economics 1A, 1B, Elementary Economics (5–5); History 17A, 17B, The United States (3–3); Sociology 1, Introduction to Sociology: Selected Themes (4); Rhetoric 10, Argumentative Writing (5); Statistics 2, Introduction to Statistics (5).

**Upper Division Courses**  
Journalism 141, The Mass Media and Society (4); Philosophy 108, Social Philosophy (4); or Philosophy 128, Political Philosophy (5); Political Science 161A, Political Behavior (5); Rhetoric 108, Psychology of Belief (5) (formerly Rhetoric 12); Rhetoric 109, Analysis of Communication Content (5); Rhetoric 117, Rhetorical Theory and Practice (5); Rhetoric 162, Rhetoric and the Media (5); Rhetoric 190, Senior Proseminar (5); Sociology 110A, Ethnic and Racial Relations (5).

One course from the following list, or a relevant course approved by the adviser: Journalism 180, Issues in Television Journalism (4); Journalism 190, Comparative World Journalism (4); Political Science 160, Social Groups and Political Power (5); Political Science 161B or 161C, Political Behavior (5); Political Science 162A, Public Opinion (4); Psychology 160, Social Psychology (5); Rhetoric 143B, 143C or 143D, Rhetoric of Political Discourse (5); Sociology 110B, People of Color (5).

**Honors Program**  
Students accepted in the honors program will enroll in Rhetoric H196A–H196B, Honors Course, Communications and Public Policy Major (5–5), with emphasis on sociological aspects. In addition to class discussions and recommended readings, the student will write a thesis based on his independent research.

## Comparative Literature

(Department Office, 4401 Dwinelle Hall)

**Professors:**  
Paul J. Alexander, Ph.D. (History)  
Robert Alter, Ph.D. (Hebrew)  
William S. Anderson,† Ph.D. (Latin)  
Cyril Birch, Ph.D. (Chinese)  
Louise George Clubb, Ph.D. (Italian)  
Phillip Damon, Ph.D. (English)  
Eric O. Johannesson,† Ph.D. (Scandinavian)  
Thomas G. Rosenmeyer, Ph.D. (Greek)  
Blake L. Spahr, Ph.D., (German)  
John S. Coolidge, Ph.D. (English)  
Joseph J. Duggan, Ph.D. (French)  
Robert P. Hughes, Ph.D. (Slavic)  
W. R. Johnson, Ph.D. (Classics)  
James L. Larson,† Ph.D. (Scandinavian)  
James T. Monroe, Ph.D. (Arabic)  
L. Janette Richardson, Ph.D. (Rhetoric)  
Michael N. Nagler, Ph.D. (Classics)  
Gideon Shunami, Ph.D. (Hebrew)  
Kenneth Weisinger, Ph.D. (German)

**Assistant Professors:**  
Paul M. Bertrand Augst,† Ph.D. (French)

**Teacher Training:** consult Miss Richardson.

The undergraduate major in the Department of Comparative Literature is based on the theory that responsible literary criticism requires both a serious knowledge of at least one national literature and the close study of literary masterpieces written in more than one language, place, and time. It offers the student an opportunity (1) to develop his ability to read literature critically and responsibly, (2) to study one literature in depth and at least one other in areas immediately relevant to his aims and interests, (3) to acquire a broader sense of literary history and tradition than may be derived from the study of a single literature, and (4) to prepare himself for the methodical investigation of problems involving more than one literature. The junior course (CL 100) is designed to introduce the student to a variety of fundamental approaches to

**NOTE:** For key to footnote symbols, see page 86.
literature and to encourage him to formulate his own critical standards. The senior course (CL 190) is designed to permit the student to apply the principles studied in the junior course and to undertake a research project involving the comparative examination of one author from each of the literatures which he has studied separately in the preceding quarters. The specific requirements for the A.B. with a major in Comparative Literature are listed below.

The Major

Lower Division There are no specific lower division requirements beyond those of the College of Letters and Science, but the following courses are recommended: 2 quarters from Comparative Literature 41A–41B–41C–41D–41E, as much work as possible in at least one foreign language (note that candidates for the A.B. with honors must work in both a vernacular foreign language and in Greek or Latin), and Classics 10A–10B.

Upper Division A minimum of 45 approved upper division units in literature, including (1) CL 100 in the junior year and a section of CL 190 in the senior year, (2) at least four courses totaling not fewer than 18 units in one literature read in the original language and with emphasis on the classic works of that literature, (3) at least two courses totaling not fewer than 8 units in another literature read in the original language, and (4) at least two courses in upper division classical Greek and Latin in translation to be selected from the offerings of the Department of Classics, or Latin 104 or higher or Greek 101 and one additional upper division Greek course (students who have completed Classics 10A–10B and are not candidates for honors may substitute 8 units of upper division electives in the Department of Comparative Literature or in any literature for this requirement). Note that, although only two literatures (for example, English–French) are required for the A.B. degree, an adequately prepared student may find it advantageous to work in three literatures (for example, English–French–Latin).

Honors Program

A student who has attained junior standing may be admitted to the honors program if (1) he has accumulated at least a 3.00 grade-point average, (2) has completed at least 16 upper division units in literature, including Comparative Literature 100 or the equivalent, and (3) is prepared to do upper division work in both a vernacular foreign language and either classical Greek or Latin before graduation (note that students who satisfy this requirement with Greek must complete two courses beyond Greek 100). Attention is called to the special honors course (H196), which is designed to allow students who have completed H1A–H1B with distinction to prepare for honors throughout their entire undergraduate career.

In addition to the requirements for the regular program outlined above, a candidate for the A.B. with honors in Comparative Literature must (1) accumulate at least a 3.2 grade-point average by the time of his graduation, (2) do upper division work in both a vernacular foreign language and either classical Latin or classical Greek including two courses beyond Greek 100, (3) demonstrate, through either examination or course work, a sense of the historical development of his principal literature, and (4) earn a grade of B or higher for the writing of an honors thesis in Comparative Literature H198. Students interested in the honors program are urged to consult an adviser in the Department of Comparative Literature at their earliest opportunity.
The Graduate Program

The M.A. program normally prepares the student for doctoral work at Berkeley or, when taken in conjunction with the appropriate teaching credential, leads to teaching at the high school or junior college level. The Ph.D. program prepares students for teaching and research in English and the ancient and modern foreign languages and literatures; it is especially designed to encourage research involving the study of literary documents in more than one language. Additional information may be sought from the instructor in charge of graduate studies in the Department of Comparative Literature.

Undergraduate Preparation Students interested in the graduate program in Comparative Literature at Berkeley are advised that strong undergraduate preparation in foreign languages will speed up their work on the graduate level. A reading knowledge of two foreign languages is required for the M.A., and a reading knowledge of four foreign languages (including both Greek or Latin and French or German or Russian) is required for the Ph.D.

Requirements for the M.A. Degree A minimum of 36 approved graduate and upper division units including (1) at least 18 graduate units, (2) at least two introductory graduate courses in Comparative Literature, and (3) work in at least two separate foreign languages (for example, English and Italian), one of which must be studied in depth and the other in areas relevant to the student’s aims and interests. The required course work in individual literatures depends upon the student’s previous training but must include at least two courses (totaling not fewer than 8 units) in the minor literatures and three courses (totaling not fewer than 10 units and including two or more graduate courses) in the major literature. Courses on foreign literature in English translation may not normally be counted in satisfaction of the requirements listed above. The first year of graduate study is usually spent preparing for the M.A. written examination on a list of approved texts selected by the student in consultation with his adviser, but students working in Oriental or Near Eastern literatures should expect to spend at least two additional quarters preparing for the degree.

Requirements for the Ph.D. Degree While only one graduate seminar is formally required beyond the M.A., each student has the responsibility of preparing himself, through course work and reading, for the written and oral doctoral qualifying examination on (1) the development of one literature with heavy emphasis on one period of specialization and (2) two additional literatures in only one period each. After consultation with his adviser, a student may request to be examined on only two literatures if the examination covers the development of both in addition to the period or periods of specialization. In either case, the comparative questions are usually limited to the period or periods of specialization, and all the texts presented must have been read in their original linguistic form. The doctoral qualifying examination may not be taken until all four foreign-language reading requirements have been satisfied. There is a final oral examination on the dissertation and its immediate area.

Lower Division Courses

1A-1B. English Composition in Connection with the Reading of World Literature. (4-4)

Three 1-hour lectures and discussion periods and one tutorial meeting per week. Prerequisite: Subject A examination or course 1A or equivalent course is prerequisite to 1B. Expository writing based on analysis of selected masterpieces of ancient and modern literature. The Staff (F, W, Sp)

H1A-H1B. English Composition in Connection with the Reading of World Literature: Honors Section. (4-4)

Three 1-hour lectures and discussion periods and one tutorial meeting per week. Prerequisite: (a) Subject A examination, (b) a 3.00 grade-point average in high school English, (c) a reading knowledge of an ancient or modern foreign language, and (d) permission of the instructor in charge of Comparative
Literature 1A–1B. Credit and grade will be assigned upon completion of the full sequence. The honors section is limited to 10 qualified freshmen who meet as a group for round-table discussion and attend weekly tutorial sessions. In addition to the core reading, individual assignments provide each student with opportunity to exploit his linguistic and literary training. The Staff (F, W)

2A–2B–2C. Composition in Connection with the Reading of World and French Literature. (5–5–5)

Three 1½-hour lectures per week. Prerequisite: three years of high school French or two years with a B+ average. Course open only to entering freshmen. Expository writing done in connection with the reading of selected masterpieces of ancient and modern literature and study of selected French texts read in the original. Course will prepare students for more advanced work in French. — (F, W, Sp)

5A–5B–5C. Composition in Connection with the Reading of World and Spanish Literature. (5–5–5)

Three 1½-hour lectures per week. Prerequisite: three years of high school Spanish or two years with a B+ average. Course open only to entering freshmen. Expository writing done in connection with the reading of selected masterpieces of ancient and modern literature and the study of selected Spanish texts read in the original. Course will prepare students for more advanced work in Spanish. — (F, W, Sp)

40A–40B–40C. Women and Literature. (4–4–4)

Three 1-hour lectures and one hour of discussion per week. A study of women as portrayed in literature, and of women writers. The topic will vary from quarter to quarter; a student may take two in the series. — (F, W, Sp)

41A–41B–41C–41D–41E. Introduction to Literary Forms. (4–4–4–4–4)

Two 1½-hour lectures and one 1-hour meeting per week. Comparative study of Eastern and Western literary masterpieces of world literature. 41A. Forms of the Epic. Mr. Alexander (W) 41B. Forms of the Novel. Miss von Brembsen (F) 41C. Forms of the Drama. Mr. Johnson (Sp) 41D. Forms of the Lyric. Mr. Sweet (W) 41E. Forms of the Cinema. — (F, W, Sp)

50. The Literature of Mysticism. (4)

Two 1½-hour lectures per week and one additional hour of discussion to be arranged. Prerequisite: admission by consent of instructor. Reading and discussion of mystical texts, primarily Christian, Hindu, and Buddhist, ranging from autobiography to scripture, from lyric dream-vision poetry to inspiration discourse. — (Sp)

Upper Division Courses

Group I: Unrestricted Courses

(Open to all students in the upper division; enrollment not limited.)

*109. Study of and Practice in Comparative Verse Forms. (4)

Two 2½-hour meetings per week. Prerequisite: admission by consent of instructor. Pastiche and re-creative work will be done both in traditional English and foreign forms (the sonnet, alliterative verse, the haiku, etc.). The aim: to forge an instrument for creative translation.

120. The Biblical Tradition in Western Literature. (4)

Three 1-hour lectures per week. Examination of selected aspects of the Biblical tradition and their relevance to the study of later literature. — Mr. Coolidge (F)

*145A–*145B. Byzantine Literature. (4–4)

Three 1-hour lectures and discussion periods per week. Survey of the development of the principal literary genres. 145A: early Byzantine literature from the fourth to the mid-nineteenth century. *145B: later Byzantine literature from the mid-nineteenth to the twentieth century

The Period Courses

Prerequisite: upper-division standing or permission of the instructor; in addition, graduate students in Comparative Literature wishing to enroll in one of these courses must know at least one foreign language relevant to the primary materials studied therein. Lectures and discussion in relation to one period of literary history in related literatures.

*151A–*151B–*151C. The Ancient Mediterranean World. (4–4–4)

Three 1-hour lectures and discussion periods per week.

*152A–*152B–*152C. The Middle Ages. (4–4–4)

Three 1-hour lectures and discussion periods per week.

*153A–*153B–*153C. The Renaissance. (4–4–4)

Three 1-hour lectures and discussion periods per week.

*154A–*154B–*154C. Enlightenment and Romanticism. (4–4–4)

Three 1-hour lectures and discussion periods per week.

155A–155B–155C. The Modern Period. (4–4–4)

Three 1-hour lectures and discussion periods per week. — Mr. Alter (Sp)

*159A–*159B. Modern Literature and the Arts. (4–4)

Three 1-hour lectures and discussion periods per week. Prerequisite: at least four quarters in one foreign language and at least two quarters in lower division or upper division literature. Comparative investigation of the interrelationships between modern poetry and modern painting and sculpture with particular emphasis on the period from 1885 to 1930. Discussion of the methods used in this type of comparative analysis.

*160. Western Literary Crosscurrents in Twentieth-Century China. (4)

Three 1-hour lectures per week. The impact of western literature on modern China and China's response in literary theory, movements, and creation.
165. Myth and Literature. (4)

Two 1½-hour lecture and discussion periods per week. Study of the earliest myth-texts on record and the progressive growth of literature out of myth which has continued to the present day. Myth and oral composition. Emphasis on the timeless meanings of myth as reflected in varying idioms.

Mr. Nagler (Sp)

170. Milton in the European Tradition. (4)

Three 1-hour lectures and discussion periods per week. Milton's work as dramatist. The progressive rhetoric; which has continued to the origin of myth and complex length and complexity.

Mr. Coolidge (W)

Group II: Restricted Courses

(Designed primarily for students whose major subject is Comparative Literature; sections limited to fifteen students each.)

The Junior Courses

100. Introduction to Comparative Literature. (4)

Three 1-hour lectures and one tutorial meeting per week. Prerequisite: at least four quarters in one foreign language and at least two quarters in lower division or upper division literature. Selected critical and literary texts from classical antiquity to the present, read in English and one foreign language. Emphasis on principles of literary comparison and analysis.

The Staff (F, W, Sp)

*112A—*112B. Introduction to Modern Greek. (5-5)

Three 1½-hour meetings per week. Prerequisite: two years of classical Greek at college, including a course on Homer and a course on either Plato or a dramatist. Modern Greek pronunciation, vocabulary, morphology, and syntax studied in comparison with Attic Greek; reading of selections of progressive length and complexity.

The Senior Courses

190A. Comparison of Authors: English, French, German. (4)

Three 1-hour lectures and discussion periods per week. Prerequisite: course 100 or equivalent, and at least four quarters in upper division literature, including at least one quarter in French or German. Comparison of three important authors, English, French, German; one foreign author must be read in the original language; examination and substantial comparative paper required.

Mr. Shumami (F)

190B. Comparison of Authors: English, French, Latin. (4)

Three 1-hour lectures and discussion periods per week. Prerequisite: course 100 or equivalent, and at least four quarters in upper division literature, including at least one quarter in French or Latin. Comparison of three important authors, English, French, Latin; one foreign author must be read in the original language; examination and substantial comparative paper required.

Miss Richardson (Sp)

190C. Comparison of Authors: English, French, Spanish. (4)

Three 1-hour lectures and discussion periods per week. Prerequisite: course 100 or equivalent, and at least four quarters in upper division literature, including at least one quarter in French or Spanish. Comparison of three important authors, English, French, Spanish; one foreign author must be read in the original language; examination and substantial comparative paper required.

Mr. Sweet (W)

*190D. Comparison of Authors: English, Spanish, Italian. (4)

Three 1-hour lectures and discussion period per week. Prerequisite: course 100 or equivalent, and at least four quarters in upper division literature, including at least one quarter in Spanish or Italian. Comparison of three important authors, English, Spanish, Italian; one foreign author must be read in the original language; examination and substantial comparative paper required.

190UL. Comparison of Authors: Unlisted Literatures. (4)

Individual conferences to be arranged. Prerequisite: course 100 or equivalent, and at least four quarters in upper division literature, including at least one quarter in a relevant foreign language. Comparison of two or three important authors, including at least one belonging to a literature unlisted in the other 190 courses. The works belonging to the literatures unlisted in the other 190 courses must be read in the original languages. Substantial comparative paper required.

Mr. Hughes (F); The Staff (Mr. Weisinger in charge) (W, Sp)

Tutorial Courses

H196. Special Honors. (1)

Prerequisite: course H1A–H1B with a grade of B or higher, and permission of the instructor in charge of undergraduate studies in Comparative Literature. Weekly tutorial meetings including oral and written reports on a reading list designed to give a focal point to the work done in separate courses in literature and to lead to the writing of an honors thesis in Comparative Literature H198. May be repeated each quarter until the senior year.

The Staff (Mr. Weisinger in charge) (F, W, Sp)

H198. Honors Course. (1-4)

Prerequisite: honors standing, 12 units in upper division literature courses including course 100 or the equivalent, and a knowledge of a vernacular foreign language and either Greek or Latin. Preparation and writing of an honors thesis under the supervision of a member of the faculty.

The Staff (Mr. Weisinger in charge) (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1-4)

One to four hours lecture per week. Tutorial instruction in areas not covered by regularly scheduled courses.

The Staff (Mr. Weisinger in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted to regulations listed on page 87. Must be taken on a passed or not passed basis.

The Staff (Mr. Weisinger in charge) (F, W, Sp)
Graduate Courses

Introductory Graduate Courses

200. Methods of Study in Comparative Literature. (4)
Two 2-hour meetings per week. Prerequisite: admission to graduate standing in Comparative Literature. Required of all candidates for the M.A. degree, normally taken during the first year of residence. Lectures on such general topics as bibliography, textual criticism, and the scope and direction of comparative literary studies in the U. S. and abroad. Readings and discussion on representative novels, plays, and poems, and major critical treatments of each.
Mr. Alter (F)

*202A. Approaches to Epic Poetry. (4)
Two 1½-hour lectures and discussion periods per week. Prerequisite: admission to graduate standing in Comparative Literature; advanced undergraduates may be admitted with consent of instructor. Application of the methods of Comparative Literature to the study of epic poetry.

202B. Approaches to Lyric Poetry. (4)
Two 1½-hour lectures and discussion periods per week. Prerequisite: admission to graduate standing in Comparative Literature; advanced undergraduates may be admitted with consent of instructor. Application of the methods of Comparative Literature to the study of lyric poetry.
Mr. Weisinger (Sp)

*202C. Approaches to the Novel. (4)
Two 1½-hour lectures and discussion periods per week. Prerequisite: admission to graduate standing in Comparative Literature; advanced undergraduates may be admitted with consent of instructor. Application of the methods of Comparative Literature to the study of prose narrative.

202D. Approaches to Dramatic Literature. (4)
Two 1½-hour lectures and discussion periods per week. Prerequisite: admission to graduate standing in Comparative Literature; advanced undergraduates may be admitted with consent of instructor. Application of the methods of Comparative Literature to the study of dramatic literature.
Mr. Shunami (W)

Graduate Seminars

204A–204B. Studies in Relations Between Classical and Modern Literatures. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. 204A is not prerequisite to 204B. Comparative investigation of a topic in Western literature involving the study of classical and post-classical documents.
Mr. Rosenmeyer (W, Sp)

210A–*210B. Studies in Medieval Literature. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two medieval languages. 210A is not prerequisite to 210B. Comparative investigation of a topic in Western literature between the fifth century and the fourteenth.
Mr. Duggan (F)

215A–215B. Studies in Renaissance Literature. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. 215A is not prerequisite to 215B. Comparative investigation of a topic in Western literature in the Renaissance period.
Mrs. Clubb (F, W)

*220A–*220B. Studies in Neoclassical Literature. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. 220A is not prerequisite to 220B. Comparative investigation of a topic in Western literature between the end of the Renaissance and the beginning of the nineteenth century.

225A–*225B. Studies in Symbolist and Modern Literature. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. 225A is not prerequisite to 225B. Comparative investigation of a topic in Western literature between the end of the Neoclassical period and the beginning of the contemporary period.
Mr. Terdiman (W)

231A–231B. Studies in Relations Between Near-Eastern and Western Literatures. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages, one of which must be Near-Eastern. 231A is not prerequisite to 231B. Comparative investigation of a topic in both Near-Eastern and Western documents. Topics and texts will vary from year to year.
Mr. Monroe (F, W)

*240A–*240B–*240C. Problems in Comparative Literature. (4–4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. Investigation of a problem in the comparative study of literature.

245A–*245B. Studies in Contemporary Literature. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. 245A is not prerequisite to 245B. Comparative investigation of a topic in contemporary Western literature.
Miss von Broembsen (F)

*250A–*250B. Studies in Critical Theory. (4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. 250A is not prerequisite to 250B. Comparative investigation of a topic in the theory of literary criticism.

255A–*255B–*255C. Comparative Byzantine Studies. (4–4–4)
One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages, one of which must be Greek. Comparative investigation of a topic in Byzantine literature. Credit and grade will be assigned upon completion of the full sequence.
Mr. Alexander (Sp)
260A–260B. Pre-Romanticism and Romanticism. (4–4)

One 3-hour meeting per week. 260A. Interest centers on the lonely individual. Goethe (Wertber), Chateaubriand (René) and Byron (Don Juan) illustrate the characteristic pre-Romantic mixture of Welt schmerz, mal du siècle and melancholy arrogance. 260B. Development from the culte du moi to society. Rousseau (Contrat social), Mme de Stael, Heine, and Coleridge demonstrate the progression. Miss Bonwit (F, W)

270–274. Continuing Seminars. (2)

One 2-hour meeting per week. Prerequisite: restricted to students who have received the M.A. and are studying for their qualifying examinations in Comparative Literature. Discussions to focus on specific problems of the literature of the period.

270. Classical World.
271. Medieval Period.
272. Renaissance.
273. Enlightenment and Romanticism.
274. Modern Period.

The Staff (Mr. Johannesson in charge) (F, W, Sp)

Graduate Tutorial Courses

298. Special Study. (1–5)

Primarily for students engaged in preliminary exploration of a restricted field, involving the writing of a report. May not be substituted for available seminars.

The Staff (Mr. Duggan in charge) (F, W, Sp)

COMPUTER SCIENCE*

(Department Office, 573 Evans Hall)

Professors:
Martin H. Graham, Ph.D. (Chairman)
Michael A. Harrison, Ph.D.
William Kahain, Ph.D.
Richard M. Karp, Ph.D.
Derrick H. Lehmer, Ph.D. (Emeritus)

Associate Professor:
Beresford N. Parlett, Ph.D.

Assistant Professors:
Susan L. Graham, Ph.D.
James H. Morris, Ph.D.

Lecturers:
Robert M. Baer, Ph.D.
James A. Baker, Ph.D.
Charlie C. Bass, Ph.D.
Jackson C. Earley, Ph.D.
Laura Gould, B.A.
Loren P. Meissner, Ph.D.

The Major

The major in computer science offers the undergraduate at Berkeley a background in digital computing together with special courses designed to prepare the undergraduate for a career in computing or further study in computer science.

A student may prepare himself for any of several fields of emphasis such as (1) applications of computers to the physical and social sciences (e.g., scientific calculations,

*Administrative reorganization of the Department of Computer Science is being implemented for Fall 1973. Students in the College of Letters and Science interested in the major or other degree programs should contact the department office or the Office of Student Services in the College of Letters and Science concerning possible curricular changes.

NOTE: For key to footnote symbols, see page 86.
simulation, information retrieval); (2) programming and computer systems (e.g., design and implementation of compilers and assemblers, machine organization); and (3) abstract models of computers and languages.

Requirements for the Major All computer science majors will be required to take the following courses: Computer Science 2 (or 100), 102, 104, 106, 107, Mathematics 1A–1B–1C, 51A (or corresponding honors courses), 113A. The student may then choose 16 units from the following: any upper division or graduate Computer Science course (except 120A, 198, 199, 295, 299); Mathematics 104A–104B, 113B–113C, 125A–125B, 128A–128B, 129A–129B, 185; Electrical Engineering and Computer Sciences 105, 108, 150X, 151A–151B, 160A–160B; Engineering 111; Industrial Engineering 162, 167; Statistics 100A–100B (or 134A–134B), 135A–135B; Linguistics 106; IDS 114; Business Administration 147. Other programs for the major will require the specific approval of the major adviser.

Honors Program For details contact the department office.

Graduate Program For details contact the department office.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

2. Introduction to Computing, (5)

Two 1-hour small class meetings, one combined lecture, and at least two hours of program lab. Course 2 and Engineering 1 may not both be taken for credit. Algorithms, programs and computers. Basic programming and program structure. Programming and computing systems. Debugging and verification of programs. Data representation. Organization and characteristics of computers. Survey of computers, languages, systems, and applications. Computer solution of several numerical and nonnumerical problems using one or more programming languages.

Mr. Parlett (in charge) (F, W, Sp)

10. Computers and Data Processing, (4)

Three hours of lecture and one 1-hour program session per week. A survey course for students not planning further study in computer science. Topics selected from historical development, structure of simple computers, automatic control, pattern recognition, impact of computers on society. Students will write and run a few programs.

Mr. Baer (F, Sp)

Upper Division Courses

100. Introductory Computer Programming, (5)

Two 1-hour small lectures, one combined lecture, and at least two hours of lab. Students may not receive credit for course 100 and any of Engineering 1, Engineering 101, or course 2. Introductory course for upper division or graduate students interested in computer programming. Thorough study of the FORTRAN programming language. Introduction to other problem-oriented languages (Algol, Basic, Cobol, Snohol, PL/I). Various applications. Languages and applications may be selected in accordance with the interests of the students.

Mr. Parlett (in charge) (F, W, Sp)

102. Machine Structures, (4)

Three hours of lecture and one hour program session per week. Prerequisite: course 2 or equivalent.

Only one of course 102, course 103, and EECS 106 may be taken for credit. Characteristics of stored-program computers, machine-oriented programming techniques, assembly languages, macros, use of operating systems.

Mr. Morris, Mr. Bass (F, W)

*103. Basic Programming Concepts, (5)

Three hours of lecture and one 1-hour program session per week. Prerequisite: course 2 or equivalent. Only one of courses 103, Engineering 41, EECS 106, and EECS 153 may be taken for credit. Basic concepts and methods of non-numerical programming: assembly language, simple data structures (arrays, lists, trees) and their representation, searching and sorting, recursion, macros and conditional assembly, concepts of assembly, loading, compile time/run time.

104. Data Structures, (4)

Three hours of lecture and one hour problem session per week. Prerequisite: course 102. Only one of course 104, course 103, and EECS 107 may be taken for credit. Data packing and encoding: Lists, arrays, string, trees, sets, graphs. Design and analysis of algorithms for manipulation of data structures. Data structures in programming languages.

Miss Graham, Mr. Bass (W, Sp)

106. Programming Languages and Compilers, (4)

Three hours of lecture per week. Prerequisite: course 103 or equivalent. Course 106 and EECS 154 may not both be taken for credit. Programming language design and description: detailed study of one particular language. Use of list-processing or string-processing language. Implementation of compilers, interpreters, assemblers: lexical and syntax analysis, code generation and optimization, storage allocation.

Mr. Morris (in charge) (F, W, Sp)

107. System Architecture, (4)

Three hours of lecture. Prerequisite: course 102. Only one of course 107, course 110, and EECS 152A may be taken for credit. Design, communication, and control of memory devices and input/output devices. Cost/performance considerations for system configuration. Design of large programs.

Mr. Graham (Sp)
109. Operating Systems. (4)
Three hours of lectures per week. Prerequisite: course 103. Course 109 and EECS 155 may not both be taken for credit. Design and implementation of operating systems. Batch processing multiple-programming, time-sharing, scheduling, storage allocation, input/output.
Mr. Morris (W, Sp)

110. Computer Organization. (4)
Three hours of lecture per week. Prerequisite: course 103 or equivalent. Course 110 and EECS 152A may not both be taken for credit. Organization of computer modules (e.g. processing units, channels, etc.) into computer systems. Effects of module performance and cost on system configuration. Module design is covered in IDS 114, and is not included in C.S. 110.
Mr. Graham (in charge) (F, W)

120A–120B. Computers in the Humanities. (4-4)
Three hours of lecture and one 1-hour problem session per week. Prerequisite: consent of instructor. Introductory course for students in the humanities, with particular emphasis on the processing of natural language data. Sufficient instruction in SNOBOL 4 for programming basic text manipulation procedures.
Mrs. Gould (F, W)

130. Introduction to Mathematical Theory of Machines. (4)
Three hours of lecture per week. Prerequisite: Mathematics 113A. Turing machines, computable functions, unsolvability of the halting problem. Finite state machines, regular sets, construction of the semiformal language of a machine. Survey of other automata.
Mr. Harrison (F)

132. Introduction to Algorithms and Computability. (4)
Three hours of lecture per week. Prerequisite: none. The normal, Turing, Post, and Shepherdsen-Sturgis models of algorithms. The class of partial recursive functions and subclasses based on different notions of complexity. Rudimentary constructs in computability. Satisfies the prerequisite for Computer Science 230.

140. Introduction to Combinatorics. (4)
Three hours of lecture per week. Prerequisite: Mathematics 113C. Combinatorial methods and their computer implementation. Permutations and combinations; generating functions; partitions; principle of inclusion and exclusion; Pólya's theory of counting; Hall's theorem; assignment problem; backtrack technique; error-correcting codes; combinatorial optimization problems.

141. Switching Theory. (4)
Mr. Harrison, Mr. Karp (Spring of even years)

142. Graph Theory. (4)
Three hours of lecture per week. Prerequisite: Mathematics 113C. Graph theory, its associated algorithmic problems. Elementary connectivity concepts; Euler graphs, maze problems; Hamilton circuits; enumeration of trees; incidence, adjacency and reachability matrices; shortest-path algorithms; max-flow mincut theorem; planar graphs; coloring problems and 4-color conjecture; Ramsey's Theorem.
Mr. Karp (Sp)

198. Directed Group Studies for Advanced Under-Graduates. (2-5)
Prerequisite: courses 2, 100 or equivalent. Must be taken on a passed or not passes basis. Group study of selected topics in Computer Science.
The Staff (F, W, Sp)

H198. Special Topics in Computer Science for Honors Students. (3)
One 2¼-hour lecture per week. Prerequisite: courses 106, 130. For honors students only. Study in depth of several topics in Computer Science chosen by instructor. Students will assess current literature in the topics and present critiques to the class. Each student will be assigned a project. Course may be repeated (once) for credit.
——— (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.
The Staff (F, W, Sp)

Graduate Courses

*200A–200B. Design and Implementation of Programming Languages and Operating Systems. (4-4)
Three hours of lecture per week. Prerequisite: course 126, 200A-B is a two-quarter course covering the following topics: (1) Formal syntax and semantics; symbol manipulation systems; extendable languages and data structures. (2) Compiler writing systems; global optimization, incremental translation; data structures of presentation, (3) Scheduling, memory management, input/output, command languages, file systems. Sequence beginning (W, Sp)
Mr. Morris

206. Programming Language Design and Implementation. (4)
Three hours of lecture per week. Prerequisite: course 106. Selected topics from: a) analysis, comparison and design of programming languages, b) formal description of syntax and semantics; c) translation of programming languages; automatic syntax analysis, code improvement techniques, incremental compilers, compiler-generators; d) verification of programs: proofs of correctness, verifying compilers.
Miss Graham (F)

209. Advanced Operating Systems. (4)
Three hours of lecture per week. Prerequisite: course 109. In-depth study of important aspects of operating systems: memory management, file systems, paging, asynchronous processes, scheduling, resource allocation, deadlock, system modeling, performance prediction, simulation, performance measurement.
——— (Sp)

*210. Advanced Computer Organization. (4)
Three hours of lecture per week. Prerequisite: permission of instructor. Problems of acquiring computer systems suitable for particular tasks, task classification, availability of desired functional units, cost effectiveness analysis. Special attention will be given to current and predicted technology in considering these problems.
Mr. Graham (W)
220. Artificial Intelligence. (4)

Three hours of lecture per week. **Prerequisite:** course 106 or equivalent. Detailed treatment of topics from (a) pattern recognition, (b) natural language translation, (c) question answering systems, (d) game playing programs, (e) learning systems, (f) mechanical mathematics.

Miss Graham (Sp)

**226A—226B. Digital Computers in Experimental Systems. (4—4)**

Three hours of lecture per week. **Prerequisite:** permission of instructor. A detailed study will be made of one or more experimental systems which intimately involve the use of digital computers. The specific systems will be chosen according to the interests of the class from such fields as biology, physics, psychology.

Mr. Parlett (F, W)

230. Complexity of Computation. (4)

Three hours of lecture per week. **Prerequisite:** course 130 or equivalent knowledge of Turing machines. The course is a study of the time and storage required to compute functions by multitape Turing machines and other computer models.

Mr. Karp (F)

232. Automata Theory. (4)

Three hours of lecture per week. **Prerequisite:** course 130 or equivalent. Important families of automata and their properties. Relevant applications to programming. Finite semigroups and application to the decomposition of finite state machines.

Mr. Harrison (Sp)

**233. Theorem Proving and Computational Models. (4)**

Three hours of lecture per week. **Prerequisite:** Mathematics 125B or (course 130 and Mathematics 125A). Completeness, Herbrand expansion, the resolution principle. Efficient strategies for theorem proving by computer. Program schemata and their decision problems. Models for parallelism. Formal specification of programming semantics. Proving programs correct.

Miss Graham (W)

234. Theory of Formal Languages. (4)

Three 1-hour lectures per week. **Prerequisite:** course 130. Phrase structure grammars and languages. Applications of context-free techniques to programming languages, closure properties. Grammars and formal forms. Relation of context-free languages to pushdown automata. Iteration theorems. Ambiguity and inherent ambiguity. Solvable and unsolvable problems of language theory.

Miss Graham (W)

235. Theory of Parsing and Translating. (4)

Three 1-hour lectures per week. **Prerequisite:** course 234. Parsing algorithms for context-free languages and their computational complexity. Deterministic languages. Special classes of grammars, applications to programming, e.g. precedence grammars, LR(k) and LL(k) grammars, bounded (right) context grammars, Covers and canonical precedence parsing. Models of computers and translators.

Miss Graham (Sp)

246A. Initial Value Problems.

246B. Boundary Problems.

246C. Matrix Computations.

246D. Applications of Functional Analysis.

246E. Approximation of Functions.

246F. Implementation of Algorithms.

Mr. Parlett (F, W)

280. Advanced Graduate Study in Computer Science. (2—8)

Lecture courses on advanced topics in computer science. Staff and quarter are variable.

Mr. Harrison in charge (F, W, Sp)

280A. Theory of Discrete Linear Systems. (4)

Three hours of lecture per week. **Prerequisite:** course 130. Linear sequential machines. Minimization, finite memory property, controllability and observability. Behavior as linear functions and sequential relations. Algorithms for realizations and some unsolvable results. Decomposition theory of discrete linear systems.

Mr. Harrison (Sp)

280B. Advanced Theory of Formal Languages. (4)

Three hours of lecture per week. **Prerequisite:** course 234. Advanced topics in context free languages, e.g., Parikh's theorem and bounded languages. Categorical grammars. Context sensitive languages and linear bounded automata. Phrase structure grammars and Turing machines. Stack automata. Unification of language theory through balloon automata and abstract families of languages.

Mr. Harrison (Sp)

280C. Asynchronous Computation. (3)

Two hours of lecture per week. Problems of control, sequencing and resources allocation associated with multiprocessors and other asynchronous systems; types of parallel computers; Muller's speed-independent circuits; computation graphs and parallel program schemata; solutions to Dijkstra's "deadly embrace" problem; models of Holt, Dennis et al.

Mr. Karp (Sp)

280D. Sorting and Searching. (3)

Two hours of lecture per week. **Prerequisite:** course 140 recommended but not required. Trees, Huffman codes, entropy; sorting with a minimum number of comparisons; minimum-storage sorting; replacement selection; optimal tape sorting; disk sorting; sorting networks; address calculation sorting and hashing; AVL trees and other data structures for file maintenance.

Mr. Karp (W)

280E. Correctness of Programs. (4)

Three hours of lecture per week. **Prerequisite:** course 200A, Math 125A, consent of instructor. A research oriented course aimed at solving the general problem of obtaining correct computer programs. A variety of methods will be considered including: (a) formal and informal correctness proofs, (b) automatic verification and type-checking systems, (c) programming languages to facilitate correctness proofs. Students will be expected to do projects of their own devising.

Mr. Morris (F)

290. Seminars. (2—8)

One two hour seminar per week and consultation. **Prerequisite:** consent of instructor. Topics in programming systems, languages, numerical analysis, machine organization, computational complexity, and topics to be announced. Detailed study of important research contributions. The Staff (F, W, Sp)
295. Reading Course for Graduate Students. (2-8)
   By appointment. Prerequisite: consent of instructor. Investigation of special problems under the direction of members of the department.
   The Staff (Su, F, W, Sp)

299. Individual Research. (2-8)
   By appointment. Prerequisite: consent of instructor. Intended for candidates for the Ph.D. The Staff (Su, F, W, Sp)

601. Individual Study for Master’s Students. (1-6)
   Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Su, F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
   Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Su, F, W, Sp)

IDS 114. Elements of Digital Computers. (4)
   See Interdepartmental Studies for the complete description of this course.

IDS 401. Computer Science Internship. (3)
   See Interdepartmental Studies for the complete description of this course.

   Related Course
   See Philosophy 191.

CONSERVATION OF NATURAL RESOURCES (Experimental Field Major)
(Administered by College of Agricultural Sciences and School of Forestry and Conservation)
(Office, 112 Giannini Hall)

This is an interdisciplinary program for students motivated and concerned by issues in areas of interaction between population, natural resources, people and environment. The major’s orientation is towards individualized programs with the unifying thread being a holistic perspective of ecosystems.

The program allows students to use the entire Berkeley campus and the community at large as an educational resource in the development of individual curricula. A growing array of courses and continuous innovation within the major provide the flexibility for finding direction for the resolution of environmental problems. The major facilitates and encourages interaction within the student/faculty/off-campus community mix.

Students select their own advisers from the diverse Conservation of Natural Resources faculty. This and other structures provide opportunity for meaningful personal attention. A continuous process of planning and development (administrative and curricular) demands active participation and commitment by the students in the program.

Major Requirements

The requirements of the field major, beyond the general University requirements, fall into three categories which emphasize both flexibility and student choice.

A. Freshman and Sophomore Years

   I. Course Work (May include upper division work, and may be completed during the junior and senior years):
      a. Three quarter courses are required in each of four of the following five areas: humanities, physical sciences, mathematics and/or statistics, social sciences, and biological sciences.
      b. Three additional quarter courses are required in one of the four areas chosen above.
      c. Two quarter courses from the Interdepartmental Studies 10 series and one additional quarter course approved for the major by the Administrative Committee.
      d. Two quarter courses in reading and composition.

   NOTE: For key to footnote symbols, see page 86.
II. CNR 49—Introduction to Conservation of Natural Resources. Each Freshman or sophomore student in the major will be required to participate in this introductory course with faculty and students utilizing, where possible, weekends at off-campus locations. This course is recommended, but not required, for those students entering the major as juniors or seniors. The primary aim of this course is not only to promote student-faculty discussions, but to assist the student in determining his area of interest. Indeed, the student's interest at this point may crystallize to the point that he will prefer one of the traditional majors in the University. The object is also to promote continuing reexamination of the work offered in the Interdepartmental Studies courses.

These requirements for the first two years are designed to provide a breadth feature which is minimally restrictive, and to provide depth in one of the areas. Normally, but not necessarily, the remaining program in conservation of natural resources will be based on the area of depth selected in the first two years. The student will be free to select his adviser from the faculty of the College of Agricultural Sciences or the School of Forestry and Conservation, wherever appropriate.

B. Junior and Senior Years

I. Course Work:

In consultation with his adviser, and based on work in CNR 49, the student will establish an "area of interest" in conservation of natural resources. Ten courses in the area of interest are then required. The remainder of the program is elective. Work undertaken in the first two years may not be offered in satisfaction of the ten-course requirement. However, lower division courses taken as a junior or senior may be acceptable. Whenever the student is qualified to take them, graduate courses may also be offered to satisfy the requirements.

II. CNR 149—Senior Seminar in Natural Resources. Written and oral work in which the student integrates his accumulated experience in his area of interest in natural resources. To be taken during or near the last quarter of the senior year.

The curriculum derives its character and cohesiveness in two innovative ways:

1. The first year courses in Interdepartmental Studies, "Man and His Environment—Crisis and Conflicts." These courses present a variety of viewpoints concerning the current problems facing man who continues to exploit an already deteriorating environment. The ecosystem approach to understanding and solving the problems is the foundation of the courses. Students are thus brought immediately into the study of pressing contemporary problems which must otherwise be approached only in the upper or graduate divisions.

2. CNR 49 and 149. The key element is faculty involvement with students throughout the entire four years of study. This curriculum offers a continuing evolution of objectives developed by students and faculty in response to changing needs.
199. Supervised Independent Study and Research. 
(1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (Mr. Parmeter in charge) (F, W, Sp)

IDS 10A–10B–10C. Man and His Environment—Crises and Conflicts. (5–5–5)
Two 1½-hour lectures and two 1½-hour discussion sections per week. 10A is not prerequisite to 10B. 10B is not prerequisite to 10C. Orientation into human ecology. Areas of current conflict are presented from diverse viewpoints. Debate and discussion groups permit students to make value judgments on critical issues involving the quality of the environment and competition for resources.

The Staff (F, W, Sp)

IDS. 120. Environmental Education and Design. (5) See Interdepartmental Studies for the complete description of this course.

CONTemporary AsiAN stUDiES

See Ethnic Studies.

CRIMINOLOGY

(Department Office, 101 Haviland Hall)

Professors:
Bernard L. Diamond, M.D.
Caleb Foote, M.A., L.L.B.
Sheldon L. Mesinger, Ph.D. (Dean)
Arthur H. Sherry, A.B., L.L.B.
Jerome H. Skolnick, Ph.D.
Austin H. MacCormick, M.A. (Emeritus)

Associate Professors:
M. Edwin O’Neill, M.S. (Emeritus)
Paul T. Takagi, Ph.D.

Assistant Professors:
Barry A. Krisberg, Ph.D.
Aviva Menkes, Ph.D.
Anthony M. Platt, D.Crim.
Herman Schwendinger, Ph.D.
George A. Sensabaugh, D.Crim.

Lecturers:
Fariborz Amini, M.D.
Kermit Gruberg, M.D.
Lloyd Street, M.A.
John I. Thornton, M.Crim.

Students are admitted in the junior year, after completion of a 90-unit lower division precriminology curriculum. Before admission, all students are urged to become proficient in the reading and composition of English, the fundamentals of social and behavioral science theories and the logic of scientific inquiry, and the elements of statistical analysis. General criminology candidates are also recommended to have taken some work in the natural sciences and the humanities. Criminalistics candidates should have taken the following courses or their equivalents before admission to the School: Chemistry 1A–1B–1C, 5, 12A–12B (or 8A–8B); Physiology 1, Biology 1A–1B, or Zoology 10A–10B; Mathematics 1A; Physics 6A–6B–6C; Statistics 2 or 20.

After admission to the School, general criminology majors will take at least nine regular courses for letter grades; they may take two additional courses, including independent study, on a pass/not pass basis. They are strongly recommended to take Criminology 100A, 100B, and 130. Criminalistics majors will take Criminology 111, 151, 152, 153, 154, and 156.

NOTE: For key to footnote symbols, see page 86.
Upper Division Courses

100A. Introductory Criminology: Crime. (5)

Four lecture hours per week. Required of criminology majors. A survey of the major forms of contemporary crime with emphasis on social definitions of crime and the ways in which social class, ethnic status, sex, age, and other structural variables affect crime patterns.

Mr. Krisberg, Mr. Platt, Mr. Takagi (F)

100B. Introductory Criminology: Control. (5)

Four lecture hours per week. Required of criminology majors. Prerequisite: 100A. A survey of the major contemporary efforts to cope with crime, including prevention and therapeutic interventions, as well as the operation of criminal justice agencies.

Mr. Platt (W)

101. Principles of Criminal Investigation. (5)

(Formerly numbered 101A–101B)

Four lecture hours per week. Organization and functions of investigatory agencies, basic considerations in the investigation of crime, physical evidence, concepts of identification and proof, investigation of specific offenses, and critical analysis of investigative methodology.

Mr. Thornton (F)

102. The Etiology of Crime: Psychiatric. (5)

Four lecture hours per week. Psychopathology and psychodynamics of the psychoses, psychoneuroses, and character disorders; mental disorders in relation to crime and delinquency.

Mr. Diamond (F)

103. Sociological Perspectives on Crime. (5)

Four lecture hours per week. Prerequisite: six courses in criminology. Analysis of major sociological theories of crime and delinquency.

Mr. Schwendinger (Sp)

107. Psychological Perspectives on Crime. (5)

Four lecture hours per week. Prerequisite: six courses in criminology. Psychological views of the etiology of crime and other forms of deviant behavior; studies in conformity, moral development, family psychopathology and the assumption and maintenance of deviant roles; comparative studies of deviance in different cultural, ethnic, and sexual groups.

Mrs. Menkes

109. Political Perspectives on Crime. (5)

Four lecture hours per week. Prerequisite: six courses in criminology. Analysis of theories of political power, social control, and the criminal justice system. Critique of traditional criminological theory and examination of relationships between crime, class, and power. Emphasis on library research, analysis, and discussions.

Mr. Platt

110. Science and the Law. (3)

Three lecture hours per week. An analysis of the interaction of science and the law. Topics include a comparison of the nature and objectives of scientific and legal inquiry, the role and responsibilities of the scientist and lawyer, and the resolution of conflicts between science and law.

Mr. Thornton (F)

111. Introductory Criminalistics: Laboratory. (5)

Two lecture hours and six laboratory hours per week. An inquiry into the nature of proof as it applies to the analysis and interpretation of physical evidence. The lectures will consist of a survey of the major areas of physical evidence, and the laboratory will emphasize the interpretive aspects involved in the comparison of selected types of materials.

Mr. Thornton (F)

115A–115B. Criminal Law and Procedure. (5–5)

Four lecture hours per week. 115A is prerequisite to 115B. Basic concepts of the criminal law, their origin and development in Anglo-American jurisdictions; constitutional limitations on the police power; the administrative processes of law enforcement; modern criminal procedure.

Mr. Sherry (W, Sp)

126. Police: Law and Society. (5)

Four lecture hours per week. Prerequisite: senior or graduate standing; open to law students. The social and historical origins of the police; police culture, role, and career; police in the legal system; legal restraints on police practices; police discretion in practice; police and the community; police organization and community control.

The Staff (F)

130. Basic Criminological Research Operations. (5)

Four lecture hours per week. Required of criminology majors. Designed to provide a general introduction to research theory and methods of special relevance to the field of criminology. Mr. Krisberg (F)

132. Evaluation of Penal Measures. (5)

Four lecture hours per week. A review of the various attempts which have been made to assess the effectiveness of the deterrent and "treatment" effects of penal measures available to the courts. The methods discussed are limited to those related to this field and are developed in some detail.

The Staff

141. Community Structure, Power and Crime. (5)

Four lecture hours per week. The facts and theories of community explored with the view of providing a working handle for criminological study. Focus on studying a local community after a brief theoretical survey.

Mr. Street (W)

142. Crime, Class and Social Policy. (5)

Four lecture hours per week. Analysis of the effects of social class on crime patterns and efforts to cope with crime.

143. Crime, Race and Social Policy. (5)

Four lecture hours per week. An examination of crime in relation to race with the context being provided by policies guiding law enforcement, criminal justice, treatment and prevention programs.

Mr. Street (F)
144. Women, Crime and the Criminal Justice System. (5)

Four lecture hours per week. Women as deviants, criminals, victims, and as professionals in the criminal justice system; the legal status of women. (W)

145. The Judicial Process. (5)

Four lecture hours per week. An examination of judicial systems (criminal and juvenile), their functions and operation, their internal and external relationships, and their impact on the community. Emphasis on field visits, group projects, and research. Mr. Platt

146. The Correctional System. (5)

Four lecture hours. An analysis of the history and development of correctional agencies, particularly prisons, designed to raise questions about the contextual and organizational forces facilitating and impeding change. Mr. Takagi (Sp)

147A–147B. The Prison. (5–5)

Two lecture hours and eight hours of supervised field work per week. Open to men and women. Research and field study in problem areas in prisons. In-progress grades will be given. The Staff

§ 151. Principles of Optics and Microscopy, (3)

(Formerly numbered 151A–151B)

Two lecture hours and two laboratory hours per week. Principles of optics as applied to problems of image generation, the use of microscopes and optical techniques for the investigation of the structure and properties of materials. Mr. Thornton (W)

§ 152. Forensic Microanalysis. (5)

Two lecture hours and six laboratory hours per week. A systematic approach to the microanalysis of materials using chemical and physical techniques. Emphasis is on materials of forensic significance. Mr. Thornton (Sp)

§ 153. Analytical Instrumentation and Trace Analysis. (5)

(Formerly numbered 153A–153B)

Two lecture hours and six laboratory hours per week. Instrumental approaches to the identification and characterization of materials. Emphasis is on materials of forensic significance. Mr. Sensabaugh (F)

§ 154. Biochemical Individuality. (3)

Three lecture hours per week. Prerequisite: a beginning course in biochemistry or biology. A discussion of individuality, its genetic basis, its expression at the molecular level and its significance to the organism. Mr. Sensabaugh (W)

§ 154L. Biochemical Individuality: Laboratory. (3)

Six laboratory hours per week. Should be taken concurrently with 154. Laboratory techniques utilized in the analysis of biochemical individuality. Mr. Sensabaugh (W)

§ 155. Comparative Microscopy. (5)

Two lecture hours and six laboratory hours per week. Comparative analysis of the form and structure of materials at the microscopic level. Emphasis is on materials of forensic significance. Mr. Thornton (W)

§ 156. Forensic Toxicology. (5)

Two lecture hours and six laboratory hours per week. Detection and estimation of toxic substances by chemical and physical means. Systematic analysis as scientific study of normal and abnormal constituents to determine presence or absence of toxic substances in relation to legal standards of proof. Mr. Shulgin (Sp)

§ 157. Advanced Instrumentation in the Forensic Sciences. (3)

(Formerly numbered 277)

Three lecture hours per week. A survey of advanced instrumental techniques of value in forensic analysis. The Staff

180. Juvenile Delinquency, Prevention and Control. (5)

Four lecture hours per week. Social dimensions of juvenile delinquency, its nature, amount, and distribution; comparison and analysis of agencies of control and correction; the role of the police and the courts; individual, group, and community oriented programs of treatment and prevention. Mr. Schwendinger (Sp)

190. Seminar in Advanced Topics. (5)

Four seminar hours per week. Prerequisite: admission by consent of instructor. Advanced study in criminology, with specific topics to be announced prior to each quarter. May be repeated for credit. The Staff (F, W, Sp)

197. Field Study in Criminology. (1–5)

Supervised experience relevant to specific aspects of criminology in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required. Staff (F, W, Sp)

198. Directed Group Study for Undergraduates. (1–5)

Prerequisite: consent of instructor. Meetings to be arranged. Group studies of selected topics which vary from year to year. Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87 of this catalogue. Must be taken on a passed/not passed basis. Staff (F, W, Sp)

Graduate Courses

The requirements for admission to the Graduate Division are listed on page 28. The requirements for the Master of Criminology and the Doctor of Criminology are listed in the ANNOUNCEMENT OF THE SCHOOL OF CRIMINOLOGY.

200A. Theories of Crime. (4)

One 3-hour seminar per week. Prerequisite: 201. An analysis of theories of crime and delinquency, in historical perspective, with emphasis on sociological and social psychological frameworks. Mr. Schwendinger (W)

200B. Theories of Control. (4)

Two 2-hour seminars per week. Prerequisite: 201 and 200A. An analysis of theories of social control, in historical perspective, with emphasis on their application to the control of crime and delinquency. Mr. Takagi (Sp)
201. Introduction to Criminological Graduate Studies. (4)

Two 2-hour seminars per week. An introduction to theoretical and policy issues in criminology. Overview of different schools of criminological thought and analysis of contemporary problems in practice and theory. Discussion, field visits, and guest speakers.

Mr. Messinger (F)


One 3-hour seminar per week. Prerequisite: 102 or equivalent upper division course in abnormal psychology and psychoanalytic theory. Advanced work in the psychopathology and psychodynamics of certain varieties of criminal behavior. Mr. Diamond (W)

230. Methods of Criminological Research. (4)

One 3-hour seminar per week. A treatment of criminological research methods emphasizing the logic of social inquiry, problems of research design and execution, problems of measurement and analysis.

Mr. Kisberg (W)

231. Advanced Methods in Criminological Research. (4)

One 3-hour seminar per week. Prerequisite: course 230 or equivalent course. Topics of relevance to criminology with specific emphasis on quantitative research. Issues of measurement, sampling, design, and analysis will be treated on both a formal and a practical level. Previous exposure to statistics and probability theory is strongly recommended.

Mr. Kisberg (Sp)

232. Qualitative Research in Criminal Justice. (4)

One 3-hour seminar per week. An introduction to qualitative research in criminal justice as a methodological tool. An examination of major studies of communities, organization and institutions, followed by an examination of field studies of the criminal justice system. Students who wish to continue with this research may do so in a 290 seminar in the following quarter.

Mr. Skobnick

242. The Politics of Childhood. (4)

One 3-hour seminar per week. Literature on relations between adults and children will be sought and discussed to discover what can be said about changes, the role of power, and the implications for social and legal control.

Mr. Street (Sp)

244. Race and Crime. (4)

One 3-hour seminar per week. An examination of race and ethnicity in accounts of crime; perspectives on the relative contributions of race and ethnicity to crime patterns will be considered.

Mr. Street

254. Instruments of Discovery in Criminal Research. (4)

One 3-hour seminar per week. A view and analysis of methods and tools as a means of stimulating theoretical concept formation, as well as testing of interrelated theorems about crime. Introduction to and study of a variety of methods of concept formation that aid in discovery of new empirical uniformities.

Mr. Schwendinger

256. Groups, Crowds, and Gangs. (4)

One 3-hour seminar per week. An examination of the social and social-psychological dynamics of groups, crowds, and gangs with special emphasis on adolescents.

Mr. Schwendinger

264. Seminar in Problems of Criminal Responsibility. (4)

One 3-hour seminar per week. Current problems of criminal responsibility; an historic review of legal concepts and contemporary theological, philosophical, and behavioral science aspects; contemporary ideas of individual responsibility.

Mr. Diamond

267. Aggression. (4)

One 3-hour seminar per week. A critical examination of methods of data collection and theoretical formulations of aggression in a variety of disciplines. Discussions of field observations, tapes and films of quarrels.

Mrs. Menkes

268. Therapeutic Intervention and the Criminal Justice System. (4)

One 3-hour seminar per week. Innovative methods of prevention and treatment of crime and mental disorder, such as behavior therapy, crisis intervention, training of police violence prevention units, storefront clinics, use of non-professionals, and community action and advocacy. Field placements.

Mrs. Menkes

270. Selected Problems in Scientific Evidence. (5)

(Formerly numbered 274) Two lecture hours and six laboratory hours per week. Primarily intended for students at the graduate level having no undergraduate preparation in the field.

Mr. Sensabaugh (F)

272. Advanced Forensic Chemistry. (4)

Three seminar hours per week.

The Staff

273. Advanced Forensic Biology. (4)

Three seminar hours per week.

Mr. Sensabaugh (Sp)

274. Advanced Comparative Evidence and Evaluation. (4)

(Formerly numbered 278) Three seminar hours per week.

The Staff

275. Seminar in Scientific Evidence. (3)

Two seminar hours per week. May be repeated for credit. Topics to vary.

The Staff

276. Seminar on Science and the Law. (3)

Two seminar hours per week.

The Staff

290. Seminar in Criminology. (4)

One 3-hour seminar per week. Special topics to be announced at the beginning of each quarter. May be repeated for credit.

Staff (F, W, Sp)

298. Directed Group Study. (2-6)

Individual conferences.

Staff (F, W, Sp)

299A. Research and Special Study for Master's Candidates. (2-6)

Individual conferences, research, internship and supervised field study.

Staff (F, W, Sp)

299B. Research and Special Study for Doctoral Candidates. (2-6)

Individual conferences, research, internship and supervised field study. Must be taken on a passed/not passed basis.

Staff (F, W, Sp)
601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the

DIVISION OF INTERDISCIPLINARY AND GENERAL STUDIES
See Interdisciplinary and General Studies, Division of (DIGS).

DRAMATIC ART
(Department Office, 101 Dwinelle Annex)

Professors:
Travis Bogard, Ph.D.
Robert W. Goldsby, M.F.A.
Henry May, B.A.
William I. Oliver, Ph.D.
Marvin Rosenberg, Ph.D.
Garff B. Wilson, Ph.D.
David K. C. Wood, B.A.
Fred Orin Harris, M.F.A. (Emeritus)

Associate Professors:
Jean-Bernard Bucky, M.F.A.

Charles R. Lyons, Ph.D.
Dunbar H. Ogden, III, Ph.D.

Assistant Professors:
Douglas A. Johnson, M.F.A.
John Warren Travis, M.F.A.

Lecturers:
Jane Mazzone-Clementi, B.F.A.
Anna R. Mittelholzer
Marni Wood, B.A.
George Ulnic, B.A.

The Major

Lower Division

Upper Division
Forty-five units of upper division courses in the Department of Dramatic Art including; 120, 129; ten units chosen from courses 122, 123A, 123B, 124, 125, 126, 127; at least 2 and not more than 5 units of 170, 171 or 190. All candidates for the A.B. degree with a major in Dramatic Art are required to include Physical Education 12 (Theatrical Fencing) in their major programs. See also Tryout Regulations, below.

Honors Program
Majors in the Department of Dramatic Art with an overall grade-point average in the University of 3.0 may apply for admission to the honors program. Application should be made through a departmental major adviser not later than the end of the student’s junior year. A student accepted in the honors program will include in his program course H195A, intensive critical study of problems of dramatic literature, acting, playwriting, directing, or designing; and H195B, development of studies begun in H195A, either under circumstances of actual theatrical production or as a senior thesis.

Graduate Programs

Preparation for Graduate Study
The background of a student undertaking work toward an advanced degree should approximate that of an undergraduate major student in the Department of Dramatic Art at Berkeley. Applicants for admission who

NOTE: For key to footnote symbols, see page 86.
need extensive preparatory work either in dramatic literature or in performance may be required to take the necessary courses while enrolling for two or three quarters as students in limited status in the College of Letters and Science. In some instances a one-year course of study for a second bachelor's degree may be in order.

Advising and Evaluation of Student Program Graduate students will be assigned to a team of two advisers with whom they will evolve their programs from year to year. In addition to the regular indications of course grades and of the comments of their instructors and advisers, students will receive at regular intervals evaluations, made by the entire departmental staff, of their general progress toward their degree and objectives. The intention of these evaluations is to ensure, insofar as such assurance is possible, that each student is working at maximum capacity toward a professional goal.

Requirements for the M.A. Degree Forty-five units of graduate and upper division work in the Department of Dramatic Art (a minimum of eighteen graduate units) including one of the following seminars in the first year: 222A–222B–222C; 223A–223B–223C; 224A–224B–224C; 225A–225B–225C. In the second year: a year long program of performance work to be determined in consultation with the staff; a language examination in either French or German; the M.A. qualifying examination.

Requirements for the Ph.D. Degree Graduate study work in the Department of Dramatic Art; two language examinations, each in a language in which there is a major body of dramatic literature, including French or German; a qualifying examination; a doctoral dissertation. Programs must include in the first year one of the following seminars: 222A–222B–222C; 223A–223B–223C; 224A–224B–224C; 225A–225B–225C. In the second year: 260A–260B–260C, Advanced Directing. Normally, the doctoral program requires four years for its completion.

For further details on the requirements of advanced degrees, consult the Graduate Division Section of this catalogue, and the department office in 101 Dwinelle Annex.

The University Theatre

Under the direction of the Department of Dramatic Art, the University Theatre offers a major and workshop series of play productions, extending into the laboratory of stage practice, the theories of dramatic literature, criticism, and production studied in the departmental curriculum. These programs are selected so as to present to the University community distinguished dramas of all times and countries. Participation is open to all registered students, majors or nonmajors, interested in acting, design, or stagecraft. Unit credit may be earned by work in production.

For further information inquire at the office of the Department of Dramatic Art.

Tryout Regulations

Undergraduate majors and graduate students are required to participate (until cast once) in general tryouts, held during the academic year for faculty-directed performances. Unless cast during general tryouts, each student in an acting class, with the exception of course 10, must participate in all special tryouts for Dramatic Art H195B, 260A–260B–260C, and 293 productions until cast in one role during a given quarter. Dramatic Art major students with a declared dance emphasis may fulfill the departmental tryout regulations by trying out for dance programs exclusively.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

10. Introduction to Acting. (5)

Five 1-hour sessions per week. Prerequisite: consent of instructor. **(F)**

11A–11B. Beginning Scene Study and Voice Work. (5-5)

Courses to be taken consecutively, beginning winter quarter. Five 1-hour sessions per week. Prerequisite: course 10 and consent of instructor. Credit and grade will be awarded upon completion of the full sequence. (W, Sp)
Introduction to Dramatic Literature.

Courses to be taken consecutively, beginning fall quarter. Five 1-hour lectures per week. Prerequisite: Subject A, examination or course. Reading and composition in connection with the study of dramatic literature. Mr. Ogden (F, W, Sp)

Introduction to Playwriting. (5)
Three 1&frac12; -hour lectures per week.

Introduction to Film. (5)
Three 1-hour lectures and one 3-hour laboratory per week. Course 40A is not prerequisite to 40B. History and criticism of the film.

Introduction to Theatre. (5-5-5)
Three 1-hour lectures and ten hours of laboratory per week. Prerequisite: 45A is not prerequisite to 45B. Consent of instructor is required for all courses.

Scenic construction from designer's concept to physical realization.
Stage practice.
Stage management. Mr. Ulnic (F, W, Sp)

Upper Division Courses

Acting

Intermediate Acting. (3-3-3)
Courses to be taken consecutively, beginning fall quarter. Three 2-hour sessions per week. Prerequisite: one year of undergraduate work in acting, and consent of instructor. Must be taken concurrently with 112A—112B—112C.

Advanced Acting. (5-5-5)
Courses to be taken consecutively, beginning fall quarter. Five 2-hour sessions per week. Prerequisite: two years of undergraduate work in acting instruction or the equivalent, including voice and speech training, and consent of instructor.

Advanced Study of Voice and Speech. (2-2-2)
Courses to be taken consecutively, beginning fall quarter. Two 1-hour sessions per week. Prerequisite: consent of instructor. Must be taken concurrently with 110A—110B—110C.

Mrs. Mazzone-Clementi (F, W, Sp)

Preparation and Production of Chekhov. (3-3-3)
Courses to be taken consecutively, beginning fall quarter. Five 2-hour sessions per week. Prerequisite: admission by audition and consent of instructor. Intensive study of essential background material and of performance technique, leading to the production of a play by Anton Chekhov. Credit and grade will be awarded upon completion of the full sequence.

Mr. Goldsby, Mr. Johnson (F, W, Sp)

Literature

Dramatic Theory. (5)
Five 1-hour lectures per week. Prerequisite: junior standing. Major documents of dramatic criticism and theory, studied in historical sequence and related to analysis of important plays.

Dramatic Literature of Western Civilization: The Ancient Greek and Roman Drama, (5)
Five 1-hour lectures per week. Mr. Ogden (W)

Dramatic Literature of Western Civilization: British Drama to 1700. (5)
(Formerly numbered 123A—123B—123C) Five 1-hour lectures per week.

The Seventeenth Century Drama, Mr. Bogard (F, W)

Dramatic Literature of Western Civilization: Continental Drama, 1500—1700. (5)
Five 1-hour lectures per week.

Dramatic Literature of Western Civilization: European Drama, 1700—1850. (5)
Five 1-hour lectures per week.

Dramatic Literature of Western Civilization: European Drama, 1850—1918. (5)
Five 1-hour lectures per week.

Dramatic Literature of Western Civilization: European and American Drama, 1918 to Present. (5)
Five 1-hour lectures per week. 

Senior Proseminar. (5)
(Formerly numbered 181) Five 1-hour lectures per week. Prerequisite: course 120, senior standing. Sections limited to 20 students. Studies in a single playwright or mode of theatre. Not for practice of acting or playwriting. Designed primarily for senior students majoring in dramatic art.

Playwriting

Playwriting. (5-5-5)
Three 1½-hour lectures per week. Prerequisite: course 39. Practice in the fundamentals of dramatic composition. Group readings and discussion of written work. Any year that course is not given, qualified students may apply to the instructor for permission to take course 239A—239B—239C.

Dance

Students intending to complete the sequence of courses in dance as part of the major in dramatic art must consult with Mr. Wood prior to enrollment.

Beginning Dance Technique. (1-1-1)
Five 1½-hour studios per week. Prerequisite: consent of instructor. Study in elementary body alignment and basic locomotor patterns, utilizing the body and extremities as a totality. Must be taken on a passed/not passed basis.

Mr. Wood, Mrs. Wood, Miss Mittelholzer (F, W, Sp)
141A–141B–141C. Intermediate Dance Technique. (1–1–1)

Five 1½-hour studios per week. Prerequisite: courses 140A–140B–140C or consent of instructor. Development of physical control through off-center movement and its utilization in spatial exploration. Must be taken on a passed/not passed basis. May be repeated for credit.

Mrs. Wood, Miss Mittelholzer (F, W, Sp)

142A–142B–142C. Advanced Dance Technique. (1–1–1)

Five 1½-hour studios per week. Prerequisite: courses 141A–141B–141C or consent of instructor. Refined movement techniques and qualitative analysis of movement with regard to rhythm, dynamics, and style. Must be taken on a passed/not passed basis. May be repeated for credit.

Mr. Wood (F, W, Sp)

143A–143B–143C. Company Class. (1–1–1)

Five 1½-hour studios per week. Prerequisite: courses 142A–142B–142C or consent of instructor. Exploration of existing styles and forms of movement and their musical relationship using both individual and group awareness. Must be taken on a passed/not passed basis. May be repeated for credit.

Miss Mittelholzer (W, Sp)

144A–144B. Sources of Movement. (3–3)

One 1½-hour lecture and two 1½-hour studios per week. Prerequisite: courses 140A–140B–140C. Beginning application of dance technique as a means of communication in the theatre. Use of basic technical fundamentals as a means of extending natural movement in rhythm, energy, and space with emphasis on style and qualitative analysis. 144A is individually directed; 144B is group directed.

Miss Mittelholzer (W, Sp)

146A–146B–146C. Choreography. (5–5–5)

Two 1½-hour lectures and three 1½-hour studios per week. Prerequisite: courses 144A–144B. Analysis of theories of form and structure and their practical application in relation to content. Course 146A directed towards solos; 146B towards duets and trios; 146C towards groups.

Mr. Wood (F, W, Sp)

147A–147B. Dance Analyses. (5–5)

One 1½-hour seminar and two 1½-hour studios per week. Prerequisite: courses 142A–142B–142C, 144A–144B, and consent of instructor. Instruction in the methods and principles of class construction with emphasis placed on movement development.

Mr. Wood (F, W)

148A–148B–148C. Introduction to Dance Techniques for Actors. (1–1–1)

Three 1-hour studios per week. Prerequisite: course 110 and consent of instructor.

Mrs. Wood (F, W, Sp)

149. Repertory and Production. (5)

Five 1½-hour studios per week. Prerequisite: consent of instructor. Advanced students of dance are to be organized as a company for the development of a dance repertory for public performance, the creation of new dance works, and the study of those already created. May be repeated for credit.

Mrs. Wood (F, W, Sp)

150A–150B. Dance History. (5–5)

(Formerly numbered 129A–129B)

Three 1-hour lectures and two 1-hour studios per week. Prerequisite: consent of instructor.

150A. Primitive to Renaissance.

150B. Renaissance to Twentieth-Century.

Mrs. Wood (F, W)

History of the Theatre

151A–151B–151C. History of Theatre. (5–5–5)

(Formerly numbered 150A–150B–150C)

Five 1-hour lectures per week. Prerequisite: consent of instructor. The development of theatrical production in its cultural background, including theatre architecture, the stage, scenery and scene design, costume, acting, and directing.

151A. The beginning to 1600.
151B. 1600 to 1800.
151C. 1800 to present.

152. History of the American Theatre. (5)

(Formerly numbered 145)

Three 1½-hour lectures per week. Prerequisite: consent of instructor. The development of the American Theatre from colonial times to the twentieth century.

Mr. Wilson (F)

Directing


Three 1½-hour lectures per week.

160A. Prerequisite: junior standing and consent of instructor.

160B. Prerequisite: 160A or consent of instructor.

161. Intermediate Directing. (5)

Five 1½-hour sessions per week. Prerequisite: courses 160A–160B and consent of instructor.

Design and Lighting

173A–173B. Scenic Design for the Theatre. (5–5)

(Formerly numbered 155A–155B)

Three 1½-hour lectures per week. Prerequisite: consent of instructor; course 173A is prerequisite to 173B.

Mr. May (W, Sp)

174A–174B. Costume Design for the Theatre. (5–5)

(Formerly numbered 154A–154B)

Two 2-hour lectures per week. Laboratories to be arranged. Prerequisite: consent of instructor; course 174A is prerequisite to 174B.

Mr. Travis (F, W)

175A–175B–175C. Lighting Design for the Theatre. (5–5–5)

(Formerly numbered 156A–156B–156C)

Five 1-hour lectures and five hours laboratory per week. Prerequisite: consent of instructor; course 175A is prerequisite to 175B; 175B is prerequisite to 175C.

Mr. Travis, Mr. Ulnic (F, W, Sp)

177. Visual Arts in Theatre. (3)

(Formerly numbered 157)

Two 2-hour lectures per week. Prerequisite: consent of instructor. Survey of visual arts as components of style in theatre.

Mr. Travis (F)
Special Courses

Performance—University Theatre

170. Theatre Laboratory. (1–5)
To be arranged. Prerequisite: consent of instructor. Practice in theatre design, lighting, and stage production in faculty-directed productions. May be repeated for credit. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)

171. Theatre Performance. (1–5)
To be arranged. Prerequisite: consent of instructor. Practice in acting in faculty-directed productions. May be repeated for credit. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)

190. University Theatre. (1–5)
To be arranged. Prerequisite: consent of instructor. Practice in theatre design, lighting, playwriting, and acting in student-directed productions. May be repeated for credit. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)

Honors Course

H195A. Honors Course. (5)
To be arranged. Prerequisite: candidacy for honors in the Department of Dramatic Art. Seminar leading to the preparation of a research paper on a single aspect of the theatre.
The Staff (F, W, Sp)

H195B. Honors Course. (5)
To be arranged. Prerequisite: completion of H195A with an honors grade. Development of subject studied in H195A either as a bachelor's thesis or a laboratory project in acting, directing, playwriting, or design.
The Staff (F, W, Sp)

Individual Studies

199. Supervised Independent Study and Research. (1–5)
To be arranged. Prerequisite: enrollment is restricted by regulations listed on page 87. Twelve or more units in the Department of Dramatic Art with an average grade of not less than B. Reading and conference. Restricted to senior honor students. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)

Graduate Courses

*210A—210B—210C. Advanced Acting: Company Class. (5–5–5)
Five 2-hour sessions. Prerequisite: three years of undergraduate work in acting instruction or the equivalent, including voice and speech training, and consent of instructor. May be repeated for credit.

Courses to be taken consecutively, beginning fall quarter. Five 2-hour sessions per week. Prerequisite: admission by audition and consent of the instructor. Intensive study of essential background material and of performance techniques, leading to the production of a play by Anton Chekhov. Credit and grade will be awarded upon completion of the full sequence.
Mr. Goldsby, Mr. Johnson (F, W, Sp)

Courses to be taken consecutively, beginning fall quarter. One 3-hour lecture per week. Prerequisite: graduate standing in the Department of Dramatic Art, Berkeley. Credit and grade will be awarded upon completion of the full sequence.
Mr. Lyons (F, W, Sp)

*223A—223B—223C. Studies in Tudor and Stuart Theatre. (5–5–5)
Courses to be taken consecutively, beginning fall quarter. One 3-hour lecture per week. Prerequisite: graduate standing in the Department of Dramatic Art, Berkeley. Credit and grade will be awarded upon completion of the full sequence.

Courses to be taken consecutively, beginning fall quarter. One 3-hour lecture per week. Prerequisite: graduate standing in the Department of Dramatic Art, Berkeley. Credit and grade will be awarded upon completion of the full sequence.

Courses to be taken consecutively, beginning fall quarter. One 3-hour lecture per week. Prerequisite: graduate standing in the Department of Dramatic Art, Berkeley. Credit and grade will be awarded upon completion of the full sequence.

239A–239B–239C. Advanced Playwriting. (5–5–5)
Three 1-hour lectures per week. Prerequisite: courses 139A–139B–139C or consent of instructor. Any year that Dramatic Art 139A–139B–139C is not given, qualified undergraduate students may apply to the instructor for permission to take 239A–239B–239C.
Mr. Rosenberg (F, W, Sp)

246A—246B—246C. Advanced Choreography. (5–5–5)
Courses to be taken consecutively, beginning fall quarter. Five 12-hour studios per week. Prerequisites: courses 143A–143B–143C; 146A–146B–146C or equivalent; one year of graduate study in the Department of Dramatic Art, Berkeley, and consent of instructor.

249. Repertory and Production. (5)
Five 12-hour semesters per week. Prerequisite: consent of instructor. Advanced students of dance are to be organized as a company for the development of a dance repertory for public performance, the creation of new dance works, and the study of those already created. May be repeated for credit.
Mrs. Wood (F, W, Sp)

250A–250B–250C. Advanced Stage, Costume, and Lighting Design. (5–5–5–)
Courses to be taken consecutively, beginning fall quarter. Five 1½-hour lectures per week. Prerequisites: courses 151A–151B–151C or equivalent; 155A–155B or equivalent; 156A–156B–156C or equivalent; submission of portfolio; one year of graduate study in the Department of Dramatic Art, Berkeley; and consent of instructor.
Mr. May (F, W, Sp)
260A—260B—260C. Advanced Directing. (5—5—5)

Courses to be taken consecutively, beginning fall quarter. Five 1½-hour laboratories per week. Prerequisite: one year of undergradate directing courses or equivalent; one year of graduate study in the Department of Dramatic Art, Berkeley, and consent of instructor. Recommended: one year of acting training.  Mr. Johnson (F); Mr. Goldsby (W); Mr. Bucky (Sp)

Special Courses

Performance—University Theatre

270. Theatre Laboratory. (1—5)

To be arranged. Prerequisite: graduate standing and consent of instructor. Practice in theatre design, lighting, and stage production in faculty-directed productions. May be repeated for credit. Must be taken on a passed/not passed basis.  The Staff (F, W, Sp)

271. Theatre Performance. (1—5)

To be arranged. Prerequisite: graduate standing and consent of instructor. Practice in acting in faculty-directed productions. May be repeated for credit. Must be taken on a passed/not passed basis.  The Staff (F, W, Sp)

290. University Theatre. (1—5)

To be arranged. Prerequisite: graduate standing. Advanced practice in theatre design, lighting, playwriting, and acting in student-directed productions. May be repeated for credit. Must be taken on a passed/not passed basis.  The Staff (F, W, Sp)

293. Theatre Laboratory. (1—6)

To be arranged. Prerequisite: consent of instructor. Advanced practice in play direction. May be repeated for credit.  The Staff (F, W, Sp)

Special Studies

295. Special Studies. (6)

Prerequisite: consent of instructor. Advanced directorial practice for third and fourth year graduate students in the Department of Dramatic Art, Berkeley.  The Staff (F, W, Sp)

298. Special Studies. (5—10)

To be arranged. Reserved for students engaged in work on their doctoral dissertations. Must be taken on a passed/not passed basis.  The Staff (F, W, Sp)

299. Special Studies. (1—6)

To be arranged. Prerequisite: not open to practice of acting, directing, design, or playwriting. May be repeated for credit.  The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1—8)

Prerequisite: may be taken by students who have completed the 45-unit course requirement for the M.A. degree. Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.  The Staff (F, W, Sp)

DUTCH

For courses in the Dutch language and literature see listing under Department of German.
The Major

Students will be admitted to the major who have satisfactorily completed Economics 1 and 2 and either Statistics 2, Mathematics 1A, or Mathematics 16A. A grade-point average of 2.0 or better in all college courses taken to date is also required.

The requirements for the major include 40 quarter units in upper division or graduate economics courses, other than Economics 103A–103B. The 40 units must include either Economics 100A–100B or Economics 101A–101B. The required theory courses must be completed prior to the senior year. Of the remaining 30 units, up to two upper division courses may be chosen from outside the Department of Economics, provided they constitute an integral part of the major program and are approved by the student’s adviser.

The following are strongly recommended for economics majors:
(1) specialization within the major by taking a two-course sequence in a core field of economics; (2) Economics 140; (3) completion of the theory requirements (100A–100B or 101A–101B) in the sophomore year; (4) the taking of upper division electives in other social sciences.

Students planning to do graduate work in economics should consult with faculty advisers regarding appropriate programs.

Departmental Honors

The Department of Economics recommends certain students for graduation with Distinction or Great Distinction. These awards are based on (a) evidence of superior

NOTE: For key to footnote symbols, see page 86.
performance provided by a thesis written in the senior year, and (b) the student’s course grade record. The senior thesis may be prepared by enrolling in Economics 196A–196B or in some other way, for example, by enrolling in Economics 199 to carry on research under the guidance of a faculty member.

**Letters and Science List:** for regulations governing this list, see the Announcement of the College of Letters and Science.

**Lower Division Courses**

1. Introduction to Microeconomics. (5)
   (Formerly numbered 1A)
   Three hours of lecture and two hours of laboratory per week. Students may take course 1 and course 2 at the same time. Neither course is prerequisite to the other. Introduction to issues concerning resource allocation and price determination.
   The Staff (F, W, Sp)

2. Introduction to Macroeconomics. (5)
   (Formerly numbered 1B)
   Three hours of lecture and two hours of laboratory per week. Students may take course 1 and course 2 at the same time. Neither course is prerequisite to the other. National income accounts, national income determination, and public policy.
   The Staff (F, W, Sp)

88. World Population and Economics. (4)
   Three hours of lecture and one hour of laboratory per week. A survey course covering basic population analysis, the history of population, the problem of “over-population” in historical perspective, and the interrelationships between population and economic conditions.
   Mr. Cipolla (F)

§ 91A. The Business Firm and Society. (2)
   Two hours of lecture per week. An analysis of the role of a business firm in a democratic society.
   Mr. Churchman (F)

**Upper Division Courses**

*Prerequisite:* for 103A–103B, junior standing. For all other courses, unless otherwise specified in the individual course description: Economics 1 and 2 or 103A–103B. Students who complete 103A may not receive credit for 1; those who complete 103B may not receive credit for 2.

100A–100B. Economic Analysis and Economic Policy. (5–5)
   Four and one-half hours per week. Credit will not be given for both 100A and 101A or for both 100B and 101B.
   100A. Analysis of price determination in a market economy, problems of economic efficiency, competition and monopoly.
   100B. Analysis of problems of economic stability, economic progress and the foreign economic relations of the United States.
   The Staff (F, W, Sp)

   Four and one-half hours per week. Prerequisite: four quarters of undergraduate mathematics and statistics. Recommended for majors. Topics as in 100A–100B, with emphasis on rigorous analysis and use of more powerful theoretical tools. Credit will not be given for both 100A and 101A or for both 100B and 101B.
   101A: Mr. Radner (W); 101B: ———— (Sp)

103A–103B. Introduction to Economic Principles, Institutions and Policies. (4–4)
   Four hours per week. Prerequisite: junior standing. Analysis of determination of prices, income and employment, with applications. Primarily for non-majors, does not count toward upper division requirements for majors.
   103A: Mr. Cipolla (F); Mr. Grossman (W)

104. History of Economic Doctrine. (5)
   Four and one-half hours per week. The classical school and its antecedents, through Adam Smith and down to Keynes. Historical and doctrinal analysis.
   Mr. Ward (F)

105. Radical Approaches to Economic Problems. (5)
   Four and one-half hours per week. A review of current radical critiques of orthodox economics and of the structure and functioning of the American economy. Radical literature of the past two centuries will be considered. The latter part of the course will be concerned with the new radical economics of the 1960’s and 1970’s.
   Mr. Ward (Sp)

106. Economics of Marxism. (5)
   Four and one-half hours per week. The economic thought of Marx and his followers.
   Mr. Roehl (Sp)

110. Economic Development. (5)
   Four and one-half hours per week. Theories of economic development and of under-development; historical aspects; policies for achieving development in poor countries; favorable conditions for development in rich countries.
   Mr. Jarvis (W)

112A–112B. Economic History of Europe. (5–5)
   Four and one-half hours per week. 112A. A view of the relevant economic and social developments in Western Europe from the eleventh to the seventeenth century that paved the way for the Industrial Revolution.
   Mr. Cipolla (F)
   112B. A general survey of the economic history of Europe, beginning with the Industrial Revolution and ending with World War II.
   Mr. Roehl (W)

113. Economic History of the United States. (5)
   Four and one-half hours per week. Survey of trends in main components of the American economy; emphasis on factors making for economic growth and on the analysis of economic problems and policies in their historical setting.
   Mr. Sutch (F), Mr. Fishlow (Sp)

114. Economic Development and Problems of Latin America. (5)
   Four and one-half hours per week. Evolution of Latin-American economics in terms of basic institutions and international influences; standards of liv-
115. Economic Development and Problems of the Far East. (5)
Four and one-half hours per week. Prospects and problems of economic development in the economies of China, India, Pakistan, Japan, and Southeast Asia; resource allocation and economic organization in these economies.

Mr. Jarvis (Sp)

Four and one-half hours per week. Economic organization and institutions, and their impact on economic variables. Models of economic systems, studies of actual economies. Mr. Ward (W)

*118A–118B. Economics of the Soviet Union and Eastern Europe. (5–5)
Four and one-half hours per week. Prerequisite: 118A or consent of instructor is prerequisite to 118B.

118A. The Soviet economy: growth, institutions and problems. Mr. Grossman (F)
118B. The Soviet economy (advanced topics); other East European economies; the Communist bloc as a whole. Mr. Grossman (W)

121A–121B. Industrial Organization. (5–5)
Three hours of lecture and one discussion section per week. The organization and structure of industries and their markets in the American economy; competitive behavior, price policy and market performance in such industries. Problems of public policy; maintaining competition, control of prices in regulated industries. Mr. Keeler (F)  
Mr. Gaskins (W)

130. Government Finance. (5)
Four and one-half hours per week. Budget-making, expenditures, public debt, taxation, and fiscal policy for federal, state and local levels. Primarily for students not majoring in economics. Mr. Rolph (F)  
— (Sp)

131. Economics of Public Finance. (5)
Four and one-half hours per week. Prerequisite: 100A or 101A and 100B or 101B. Analysis of the incidence and effects of taxation, government expenditure programs, and public debt operations. Mr. Rolph (Sp)

135. Money and Banking. (5)
Three hours of lecture and one discussion section per week. Commercial banks, the Federal Reserve and the supply of money; monetary theory and monetary policy in the American economy. A survey of the field. Primarily for nonmajors. Mr. Sutch (W)

136. Monetary Theory and The Banking System. (5)
Four and one-half hours per week. Prerequisite: 100A or 101A. The monetary economy, survey of monetary, interest and income theory; commercial and central banks, the Treasury, and the supply of money. Mr. Peck (F)

137. Aggregative Economic Policy. (5)
Four and one-half hours per week. Prerequisite: 131 or 136. Analysis of problems of policy for economic stability and growth. Mr. Gordon (W); Mr. Hansen (Sp)

140. Economic Statistics and Econometrics. (5)
Four and one-half hours per week. Prerequisite: course 100A and Statistics 2. It is recommended that the course be taken during the junior year. Introduction to problems of observation, estimation, and hypothesis testing in economics through the study of the theory and application of the linear normal regression model; critical evaluation of selected examples of empirical economic research, and exercises in applied econometrics. Mr. Peck (Sp)

150. Labor Economics. (5)
Four and one-half hours per week. The social background of labor legislation and trade unionism. Students will not receive credit for both course 150 and Business Administration 134. (F)

153. Wage Theory and Policy. (5)
Four and one-half hours per week. Theoretical and empirical analysis of wage and employment problems, at both the micro- and macroeconomics level; national wage and manpower policy. (W)

185. Economics of Health, Education and Welfare. (5)
Four and one-half hours per week. An analysis of the reasons for the persistence of poverty in affluent societies and the role of health, education, and welfare policies in relation to problems of economic growth and the reduction of income inequality. Mr. Wiseman (F)

186A–186B. Urban Poverty. (5–5)
Three hours of lecture and one discussion section per week. Prerequisite: course 1A or a basic introductory course in Economics. Section 1: Regular grading. Section 2: Credit and grade to be awarded upon completion of the full sequence. A seminar on urban poverty in which students in Section 2 will be expected to do a term project involving field work in the Bay Area. Meetings will consist of student projects and of reading to be assigned each week. Mr. Levy, Mr. Wiseman (W, Sp)

190A–190B. International Economic Relations. (5–5)
Four and one-half hours per week. Prerequisite: 100A or 101A and 100B or 101B. Sequence beginning: 190A. Theory of international trade, monetary relations and finance. Mr. Letchef (F)  
190B. International economic policies. (W)

191. Experimental Courses in Economics. (3–5)
Three to five hours per week. Prerequisite: consent of instructor. Topics to be covered will be announced at the beginning of each quarter that the course is offered. The Staff (F, W, Sp)

191C. The Economics of Environmental Degradation and Its Regulation. (5)
Four and one-half hours of lecture per week. General theoretical analysis and case studies of the sources
of environmental degradation—including pollution and the misallocation of land among users—and of public policy measures designed to preserve and improve human environments. Theoretical analysis will not presuppose study in economic theory beyond the level of Economics 100A, and students lacking this preparation may be admitted with the consent of the instructor.

Mr. Bain (Sp)

195A–195B. Seminar in Economics. (5–5)
(Formerly numbered H195A–H195B–H195C)
Four and one-half lecture hours per week. Prerequisite: 100A or 101A and 100B or 101B. Economics 100B may be taken concurrently with 195A. Enrollment limited to 15 students with permission of instructor. 195A will be devoted to round table discussions of topics in economic policy and economic theory. 195B will be devoted to discussion of papers prepared by students for presentation to the seminar. Credit and grade will be awarded upon completion of the full sequence.

Mr. Roehl (W, Sp)

196A–196B. Thesis. (5–5)
(Formerly H196A–H196B)
Four and one-half hours of lecture per week. Prerequisite: consent of instructor. Open to all junior and senior economics majors. Admission based on quality of proposed thesis topic. Individual consultations with the instructor, and occasional seminar meetings. Credit and grade will be awarded upon completion of the full sequence.

Mr. Roehl (W, Sp)

198. Directed Group Study for Undergraduates.
(1–5)
Prerequisite: consent of instructor. Meetings to be arranged. Seminars for the group study of selected topics, which will vary from year to year. Student initiative in the choice of subjects is solicited and welcomed.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research.
(1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.

Graduate Courses

Admission to graduate courses requires, where indicated, the consent of the instructor. Undergraduate courses are not prerequisite to graduate courses except where indicated.

(5–5)
Three hours per week. Prerequisite: consent of instructor. A graduate level survey course in basic economic theory, designed primarily for students outside the Department of Economics and for M.A. students in economics.

200A. Microeconomics: the behavior of firms and households, and the determination of prices and resource allocation patterns in a decentralized economy.

200B. Macroeconomics: determination of national income, employment, price level, growth, distribution.

Mr. Keeler (Sp)

201A–201B–201C. Economic Theory. (4–4–4)
Three hours per week. Prerequisite: enrollment is limited to students in the department's Ph.D. program, or to students in other departments with equivalent preparation, or by consent of instructor. Intermediate economic theory, and Mathematics 190A–190B–190C or equivalent; Mathematics 190B may be taken concurrently with Economics 201A and Mathematics 190C may be taken concurrently with Economics 201B. Basic preparation for the Ph.D. program, including: organization of economic data; theory of the firm, the consumer, and individual markets; general equilibrium; capital theory; welfare economics; aggregate economic theory; policy analysis.

The Staff (F, W, Sp)

Three hours per week. Prerequisite: Mathematics 190A–190B–190C and course 201A–B–C. For 202D–G, the instructor may impose additional prerequisites as announced each year, therefore the consent of instructor is required.

The Staff (F, W, Sp)

Separation theorems, constrained optimization, linear and nonlinear programming, the Kuhn-Tucker theorem, local conditions.

Mr. McFadden (F)

Consumer demand under certainty and uncertainty; various models of production, including activity analysis, input-output, production and cost functions, technical change; existence and optimality of competitive equilibrium, social welfare, externalities.

Mr. McFadden (W)

*202C. Advanced Macro-Economic Theory.
A cross-theoretical survey of the major models, whether aggregate or disaggregate, which deal with the totality of the economy of a country or of the world. The accent is upon the comprehension of the structures of the various models.

202D. Capital, Investment, and Optimal Growth.
The nature of capital; formal models of production possibilities in time; techniques of inter-temporal optimization; efficient and optimal investment and growth for an economy; optimal investment for an enterprise or sector of an economy; examples of special investment problems.

Mr. Goldman (Sp)

*202E. Welfare Economics.
The role of ethics and values in social decision, social welfare functions, market optimality and second best theory, externalities and public goods, welfare implications for public policy, distribution theory.

*202F. Economic Models of Consumer and Firm Behavior.
Problems of testing the axioms of economic theory and of building econometric models from theoretical propositions. Detailed consideration of a variety of special models suitable for econometric applications.

*202G. Special Topics.
Sections to be announced annually.

204A–204B. History of Economic Thought. (5–5)
Three hours per week. Analysis of the relationships between historical conditions, economic theory, and economic policy from the Greeks to modern times.
207A–207B. Mathematical Economics. (5–5)
Three hours per week. Prerequisite: Mathematics 104A, Mathematics 111, and one quarter of upper division probability. Mathematical analysis of economic theory. The problems treated involve a wide range of mathematical techniques and of economic topics as possible, including theories of utility, personal probability, value, games, growth, stability and dynamic programming.

Sequence beginning 207A: Mr. Hildenbrand (W) 207B: Mr. Radner (Sp)

208. Mathematical Economics Seminar. (3–5)
Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit.
Mr. Hildenbrand (F); Mr. Radner (Sp)

Three hours per week. Prerequisite: consent of instructor.

210A. Introduction to Economic History. A survey of United States and European economic history, from approximately the eighteenth century, with emphasis on the process of industrialization in economic development. This course is normally to be taken in satisfaction of the history requirement.
Mr. Roehl (F)

*210D. Topics in Economic History. May be repeated for credit.

211. Economic History Seminar. (3–5)
Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit. Mr. Roehl (Sp)

Three hours per week.

216A. Prerequisite: course 116 or consent of instructor. Economic systems. Mr. Ward (W)

216B. Prerequisite: course 118A. Economics of the Soviet Union and Eastern Europe. Mr. Grossman (Sp)

*216C. Prerequisite: consent of instructor. Economy of Communist China.

221A–221B. Industrial Organization. (5–5)
Three hours per week. The organization and structure of the American enterprise economy, with special reference to manufacturing and processing industries. Competitive behavior, price policy, and workability of competition in such industries. Public policies affecting competition and monopoly.
Sequence beginning 221A: Mr. Bain (F); 221B: Mr. Gaskins (W)

222. Economics of Public Enterprise. (5)
Three hours per week. Criteria for the efficient performance of public enterprises operating in a dominantly private-enterprise economy, and appraisal and explanation of the actual performance of public enterprises. External effects generated by public enterprises, and "public good" characteristics of their outputs will be considered. Attention will also be given to legislative and political constraints and to political decision-making processes as influences on public-enterprise performance.
Mr. Bain (W)

223. Industrial Organization Seminar. (3–5)
Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit. Mr. Bain (Sp)

Two hours per week. Prerequisite: credit and grade will be awarded upon completion of the full sequence. Public finance and taxation theory; public debt and fiscal policy; public policy with respect to taxation.
Mr. Rolph (F, W, Sp)

231. Public Finance Seminar. (3–5)
Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit.

234A–234B. Monetary Theory. (5–5)
Three hours per week. Analysis of monetary theory and institutions.
Mr. Hansen (F) ———— (W)

*235. International Monetary Economics. (5)
Three hours per week. A systematic survey of the theory of international finance and a review of recent and current problems affecting the international monetary system.

236A–236B–236C. Aggregate Economics. (5–5–5)
(Formerly numbered 233, 236, 237)
Three hours of lecture per week. Prerequisite: courses 201A–201B–201C. Theories of growth and cyclic fluctuations; macroeconomic econometric models; theory of aggregate economic policy; short-term planning models; fiscal and monetary policy in practice.

236A: Mr. Goldman (F); 236B: Mr. Gordon (W)
236C: Mr. Gordon, Mr. Hansen (Sp)

*238. Monetary Economics Seminar. (3–5)
Two or three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit.
Mr. Sutch (F)

240. Introduction to Econometrics. (5)
Three hours per week. Prerequisite: Statistics 131 or equivalent. Problems in the application of statistical methods in economics, illustrated by a representative selection of empirical studies.
Mr. Peck (F); Mr. Hsiao (Sp)

241A–241B. Econometrics. (5–5)
Three hours per week. Prerequisite: Statistics 135B or equivalent and one course in linear algebra. Credit and grade will be awarded upon completion of the full sequence. Theory and applications of statistical methods in economics.
Mr. McFadden (W); Mr. Rothenberg (F)

242. Econometrics Seminar. (3–5)
Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit.
Mr. Rothenberg (Sp)

250A–250B–250C. Advanced Labor Economics. (3–3–3)
Two hours per week. Credit and grade will be awarded at the end of 250A and at the end of the 250B–250C sequence. Analysis of labor market behavior.
Mr. Flanagan (F, W, Sp)

Three hours of lecture per week. Prerequisite: course 201A–201B–201C. In addition course 202A is required for 280C. Credit and grade will be awarded upon completion of the 280A–280B sequence; letter grade also awarded at end of 280C. Facts and theory related to development in poor countries. Aggregated models for development. External economies and economies of scale. Development problems in foreign trade, agriculture, industry and public sector. Monetary and fiscal policy for development. Long-term macro planning. Investment criteria. Case studies.

280A: Mr. Fishlow (F); 280B: Mr. Hansen (W); 280C: — (Sp)

281. Economic Development Seminar. (3–5)

Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit.

Mr. Fishlow (W)

288. Population and Economic Development. (5)

Three hours per week. Population and migration problems in economic development.

290A–290B. International Economics. (5–5)

Three hours per week. The world economy as a general equilibrium system; growth, short-run disturbances, and adjustment in the balance of payments of member countries; restrictions, welfare, and policy. Sequence beginning 290A; Mr. Letiche (F) 290B; Mr. Rothenberg (W)

292. International Economics Seminar. (3–5)

Two to three hours per week. Prerequisite: consent of instructor. Primarily for students at the dissertation stage. May be repeated for credit.

296. Special Topics in Economics. (3–5)

Two to three hours per week. Prerequisite: consent of instructor. Topics of different sections to be announced annually. May be repeated for credit.

The Staff (F, W, Sp)

298. Directed Group Study for Graduates. (1–9)

Prerequisite: consent of instructor. Meetings to be arranged. Seminars for the group study of selected topics which will vary from year to year. Offered on passed/not passed basis.

The Staff (F, W, Sp)

299. Supervised Independent Study and Research. (1–9)

Open to candidates for the Ph.D. degree who have passed the qualifying examination and who are engaged in research for the thesis, and in special cases, with consent of the instructor in charge, to graduate students who desire to do special work in a particular field. Offered on a passed/not passed basis.

The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory-unsatisfactory basis.


See Interdepartmental Studies for complete description of this course.

EDUCATION

(Department Office, 1501 Tolman Hall)

Professors:
Millie Almy, Ph.D.
Charles S. Benson, Ph.D.
Merle L. Borrowman, Ed.D. (Chairman)
Eli M. Bower, Ed.D.
Lyman A. Glenny, Ph.D.
Paul A. Heist, Ph.D.
James L. Jarrett,† Ph.D.
Arthur R. Jensen, Ph.D.
Reginald L. Jones, Ph.D.
Henry F. Kaiser, Ph.D.
Frederic Lilge, Ph.D.
Walter D. Loban, Ph.D.
Jack London, Ph.D.
John U. Michaelis, Ph.D.
Theodore L. Reller, Ph.D.
William D. Rohwer, Jr., Ph.D.
Robert B. Ruddell, Ed.D.
Lloyd F. Scott, Ph.D.
Lawrence H. Stewart, Ed.D.
James C. Stone, Ed.D.

NOTE: For key to footnote symbols, see page 86.
For details of the credential and degree programs please see the ANNOUNCEMENT OF THE SCHOOL OF EDUCATION.

Upper Division Courses

110. Learning and The Learner. (3)
Two 1½-hour lectures per week. General introduction to educational psychology, primarily for teaching credential candidates.
Mr. R. Case, Mr. Rohwer (F); Mr. Hurst (F, W, Sp)
Mrs. Marshall (F, Sp)

115. The Exceptional Child. (2–2)
One 2-hour lecture per week. Introduction to social, psychological, and educational problems and programs for exceptional children. Must be taken concurrently with course 115L.

115A. Mental and Emotional Handicaps.
Topics: mentally retarded, emotionally disturbed, learning disabilities, multihandicapped, gifted, and preschool programs for the young handicapped.
Mr. Bower (F)

115B. Sensory and Motor Handicaps.
Topics: Blind, partially seeing, deaf, hard of hearing, deaf/blind, and physically handicapped.
Mr. Bower (W)

115L. The Exceptional Child Laboratory. (1–5)
Three to fifteen hours of field work per week. Conferences, observations, and supervised field experiences with a variety of exceptional children. May be repeated twice.
Mr. Bower (F, W, Sp)

118A. Introduction to Educational Research. (3)
One 3-hour lecture per week. An introduction and orientation to the concepts and process of research, the basic logic and methods of systematic inquiry, the fundamental techniques of inferential statistics, and the varieties and styles of research employed on educational problems. Mr. Wenkert (F)

118B. Foundations of Educational Research. (3)
One 3-hour lecture per week. Introduction to and review of selected philosophical concerns basic to educational research, such as the topics of theory, causality and operationalism; also acquainting students with the logic of design, analysis, inference, and non-experimental investigations in various domains of concern to education.
Mr. Watts, Mr. Wenkert (W); Mr. Hardycy (Sp)
119A. Introduction to Educational Statistics. (3)
Two 2-hour lectures per week. Prerequisite: consent of instructor. Introduction to probability; frequency and probability distributions; descriptive measures of central tendency and variability; sampling; point estimation and interval estimation.
Mr. Marascuilo (F); Mr. Kaiser (W)

119B. Foundations of Educational Statistics. (3)
Two 2-hour lectures per week. Prerequisite: course 119A and consent of instructor. Introduction to statistical inference and hypothesis testing; t-test, F-test; one-way analysis of variance; simple correlation and regression; simple chi-square tests of independence and homogeneity.
Mr. Marascuilo (W); Mr. Kaiser (Sp)

119L. Educational Statistics Laboratory. (1)
One 3-hour laboratory per week. Must be taken concurrently with course 119A.
Mr. Marascuilo (F); Mr. Kaiser (W)

119M. Educational Statistics Laboratory. (1)
One 3-hour laboratory per week. Must be taken concurrently with course 119B.
Mr. Marascuilo (W); Mr. Kaiser (Sp)

130. The School in America. (3)
One 3-hour lecture or two 1½-hour lectures per week. Development and operation of the school as a social institution; current problems; roles of school personnel, relations to other social agencies, professional and legal aspects of teaching.
Mr. Webster (F); Mr. Livingston (Sp); Mr. Ryan (F, W, Sp)

131. The Elementary School Curriculum. (3-3-3-3-3)
Prerequisite: enrollment in Elementary Block or Early Childhood Education teaching credential programs. Purposes, content, organization, instructional materials, and evaluation of subjects in the curriculum.
131A. Arithmetic. The Staff (F, W)
131B. Music. The Staff (F)
131C. Reading and Language Arts. The Staff (F, W)
131D. Social Sciences. The Staff (F, W, Sp)
*131E. Foreign Languages.
131F. Science. The Staff (W, Sp)
131H. Art. The Staff (F, Sp)

132. Selected Teaching Strategies in Early Childhood Education. (3)
Two 2-hour lectures per week. Prerequisite: limited to students in teaching credential program. This course, designed for the Early Childhood Credential Program, focuses on teaching strategies in traditional and innovative programs with immediate relevancy for the beginning teacher. Miss Almy (W)

136. Teaching the Language Arts to Speakers of Nonstandard Dialects. (3)
(Formerly numbered 191E)
One 3-hour lecture and field work per week. An examination of instructional problems in teaching the language arts to children who speak nonstandard dialects. The course focuses on the structure of nonstandard dialects, interference of these dialects with learning the language arts, and teaching strategies to correct interference. Mr. Johnson (F, W, Sp)

170. Introduction to Adult Education. (3)
Two 1½-hour lectures per week. The role of adult education in an industrial society.
Mr. London (Sp)

191. Experimental Courses.
191A—191B—191C. The Learner and the High School Experience. (2—2—2)
One 2-hour lecture per week. Prerequisite: enrollment in Social Studies, English, Educational Program for the secondary teaching credential. Relationship of teaching experiences to: authority and discipline, classroom organization and achievement, learning theory, techniques of assessment and identification, psychology of adolescence, needs of minority pupils, remediation of special learning and behavior problems. Small groups meet with a school psychologist. Must be taken on a passed/not passed basis. Credit and grade will be assigned upon completion of the full sequence.
Mr. Lambert in charge (F, W, Sp)

191D. Developing Competence in Reading. (3)
One 3-hour lecture and one 4-hour laboratory per week. Prerequisite: consent of instructor. Orientation to teaching basic reading skills; diagnostic procedures; materials of instruction. Part I of a two-quarter program covering the reading requirements of the Ryan Act governing the preparation and licensing of teachers in California.

191E. Developing Competence in Reading. (3)
One 3-hour lecture and one 4-hour laboratory per week. Prerequisite: consent of instructor. Theories of reading instruction; individual differences; assessment of progress; and all other requirements of the Ryan Act. Part II of a two-quarter program covering the reading requirements of the Ryan Act governing the preparation and licensing of teachers in California.

192. Social Foundations of Education. (3)
Two 1½-hour lectures per week. A study of the historical and contemporary relations of education and society, and of schools and colleges as social systems, from the perspectives of the social sciences.
Mr. Matlin (W)

193. Psychological Foundations of Education. (3)
Two 1½-hour lectures per week.

194. Philosophical and Humanistic Foundations of Education. (3)
Two 1½-hour lectures per week. A history of educational thought with emphasis on the epistemological, logical, and ethical foundations of the major philosophies of education.
Mr. Mosier (F, Sp)

197. Field Studies. (1—5)
Prerequisite: Upper division standing and consent of instructor, division spokesman, and community agency. Written proposal must be approved by the coordinator. University organized and supervised field projects involving experiences in school and school-related activities. Projects will be reviewed each quarter and evaluated in terms of success or failure in reaching stated objectives. Must be taken on a passed/not passed basis.
197A. Policy Planning and Administration.
The Staff (F, W, Sp)
197B. Counseling Psychology. The Staff (W, Sp)
197C. Curriculum and Instruction.
The Staff (F, W, Sp)
214. Human Development and Education. (3–3–3)
Two 1½-hour lectures per week.
214B. Social and Emotional Development.
Prerequisite: courses 193, 119A, 119B or equivalents.
Mr. Watts (F)
214C. Mental Health.
Prerequisite: course 193 or equivalent.
Mr. Bower (Sp)
214D. Play and Games in Human Learning.
(Formerly numbered 2911)
Prerequisite: consent of instructor. Multidisciplinary examination of the modality of play and games in relationship to human learning and development. Each student will devise and present a game and theory related to human learning. Game developers and researchers in play will serve as consultants.
Mr. Bower (F)

215. Advanced Topics on Exceptional Children. (3)
(Formerly numbered 215B)
One 3-hour seminar and one hour of field work per week. Prerequisite: consent of instructor. Topics vary; suggested topics: gifted children; learning disabilities; cerebral palsied children; speech defects and disorders; etc. Topic: (W) special problems of exceptional children.
Mr. Bower (W)

216B. Principles and Theories of Psychological Measurement. (3)
Two 2-hour seminars per week. Prerequisite: courses 119A, 119B, and consent of instructor. Topics vary; suggested topics: advanced research in formal and informal tests, evaluation and appraisal.
Mr. Kaiser (F)

216C. Advanced Studies in Theory and Research Regarding Measurement and Change of Attitudes and Opinions. (3)
One 3-hour seminar per week. Prerequisite: consent of instructor. Topics vary from quarter to quarter. (W) an information processing approach to attitude change.
Mr. Watts (W)

Prerequisite: course 193 or equivalent.
217A. Proseminar in Intellectual Development and Education. One 3-hour seminar per week.
Miss Almy, Mr. Ammon, Mr. R. Case, Mr. Hardyck, Mr. Jensen, Mr. Rohwer (F)
217B. Cognitive Development.
One 3-hour seminar per week. A graduate-level introduction to the development of thinking from early childhood through adolescence, with primary emphasis on Piagetian theory and research.
Mr. Ammon, Mr. R. Case (F)
One 3-hour seminar per week. Mr. Hardyck (Sp)

Graduate Courses
Graduate course numbers which end in 0–4 are introductory courses; numbers which end in 5–9 are advanced courses.

One 2-hour lecture plus supervised field experience per week. Prerequisite: admission to School Psychology Program. Topics: (F) controversial issues regarding the field; (W) major theories of child development; (Sp) psychology of instruction and survey of current trends in teaching reading, mathematics, science, and social studies.
Mr. Sandoval (F, W, Sp)

One 2-hour lecture plus supervised field experience per week. Prerequisite: courses 210A–210B–210C. Topics: (F) theories of consultation, related ethical and value dilemmas; (W) theories and procedures for individual and group assessment of children’s prerequisite skills for acquiring specific capabilities in reading and mathematics; (Sp) classroom management problems and exploration of parameters of school-based consultation contrasted with community-based consultation.
Mrs. Lambert (F, W, Sp)

211. Proseminar in Theory and Research in Attitude Change. (3)
(Formerly numbered 211A)
One 3-hour lecture per week. Lectures and discussion with staff covering concepts related to and areas of contemporary research.
Mr. Watts (F)

212. The Psychology of Reading. (3)
(Formerly numbered 212B)
One 3-hour seminar per week. An examination of research concerned with the psychological processes of reading acquisition and an analysis of models of mature reading.
Mr. Simons (W)

*213A. Standard Tests in Education. (3)
One 2-hour lecture and one 2-hour laboratory per week
213C. Individual Appraisal. (4)
One 3-hour lecture and one 5-hour laboratory per week. Prerequisite: course 213A and consent of instructor. Theories of intelligence and the history and techniques of individual appraisal. Supervised practice in administration and scoring of contemporary tests of intelligence.
Mr. Lambert (F)

213D. Individual Appraisal. (4)
One 3-hour lecture and one 5-hour laboratory per week. Prerequisite: course 213C and consent of instructor. Theories of intelligence and the history and techniques of individual appraisal. Supervised practice in administration and scoring of contemporary tests of intelligence.

197D. Educational Psychology.
The Staff (F, W, Sp)
197F. Social and Humanistic Foundations.
The Staff (F, W, Sp)
197G. Teacher Education.
The Staff (F, W, Sp)
217D. Children's Learning. One 3-hour seminar per week. A consideration of theories, methods, and experimental research pertaining to varieties of children's learning that have relevance for educational practice. Mr. Rohwer (W)

217E. Theories of Intelligence. One 3-hour seminar per week. A consideration of psychometric approaches to the study of individual differences in human mental abilities, with emphasis on intelligence, including theories and empirical research on the measurement, nature, and structure of abilities, from Galton to the present. Mr. Jensen (W)

218. Seminars in Intellectual Development and Education. (3-3-3-3-3-3)

Prerequisite: course 119B and consent of instructor.

218A. Cognition. One 3-hour seminar per week. An intensive examination of specific topics in the area of cognitive development; topics vary.
Mr. R. Case, Mr. Hardyck, Mr. Jensen, Mr. Rohwer (W)

218B. Language. One 3-hour seminar per week. Seminar devoted to selected topics in such areas as language and cognition, the development of communication skills, and subcultural variation in child language, as these relate to education.

218C. Learning. One 3-hour seminar per week. An intensive examination of specific topics (e.g., the development of imagery processes; social-class comparisons) in the area of the development of learning processes.
Mr. Rohwer (Sp)

218D. Cognitive Style. One 3-hour seminar per week. This seminar explores the relationship between cognitive style, intellectual development, and learning. Particular emphasis is placed on the cognitive style of field independence or dependence, and its importance in understanding Piagetian data on development and learning.
Mr. R. Case (Sp)

218E. Individual Differences. One 3-hour seminar per week. Recent theory and research on individual differences in educationally relevant abilities; intelligence, learning, memory, aptitude training interaction, and related non-cognitive factors, with emphasis on experimental, factor analytic, and behavior-genetic analysis of human abilities.
Mr. Jensen (Sp)

218F. Information Processing. One 3-hour seminar per week. A consideration of theory and research on verbal processes such as speech and thinking, inner speech, and sensory deficits in verbal information processing, with reference to education.
Mr. Hardyck (F)

219. Advanced Topics in Educational Statistics. (3)

Two 2-hour lectures per week. Prerequisite: courses 119A and 119B. Topics vary; suggested topics: correlation and regression; analysis of variance; nonparametric methods; sampling surveys; scaling; factor analysis; experimental design.
(F, Sp); Mr. Marasculo (W)

219L. Advanced Educational Statistics Laboratory. (1)

One 3-hour laboratory per week. Must be taken concurrently with course 219.
(F, Sp); Mr. Marasculo (W)

220A. Philosophy of Education: An Introduction. (3)
One 2-hour lecture and one 1-hour conference per week. Axiology, ethics, political philosophy, religion, psychiatry, and aesthetics as they relate to education.
Mr. Mosiér (F)

220B. Philosophy of Education: An Introduction. (3)
One 2-hour lecture and one 1-hour conference per week. Epistemology, logic and theory of signs as they relate to education.
Mr. Mosiér (W)

221A. History of Educational Thought. (3)
One 2-hour lecture and one 1-hour conference per week. The development of educational thought with special reference to the processes of teaching and learning.

221B. History of Educational Thought. (3)
One 2-hour lecture and one 1-hour conference per week. The development of educational thought with special reference to philosophical analysis and the techniques of inquiry.

221C. History of American Education. (3)
Two 1½-hour lectures per week. Social and intellectual history of American education from the colonial period to the Civil War. Mr. Borrowman (F)

221D. History of American Education. (3)
Two 1½-hour lectures per week. Social and intellectual history of American education since the Civil War, with emphasis upon the Progressive Education Movement and the evolution of the American university. Mr. Borrowman (W)

222A. Comparative Education: An Introduction. (3)
Two 1½-hour lectures per week. Comparative methods and theories in the humanities and the social sciences applicable to the study of educational systems in various countries.
Mr. Livingston (F)

222B. Comparative Education: An Introduction. (3)
Two 1½-hour lectures per week. Case studies of the contemporary relationships of education to economic, political, and social development in selected Asian, African, European or Latin-American societies.
Mr. Livingston (W)

223. Sociology of Education. (3)
Two 1½-hour lectures per week. The organizational structure of educational institutions, the processes of control and socialization within schools, and the function of schools in society.
Mr. Wenkert (W)

224. Anthropology of Education. (3)
One 2-hour seminar and one 1-hour conference per week. Theories of the relations of socialization to culture; institutions of education in a cross-cultural perspective; content and processes of education as presented in the ethnographic literature.

225. Seminar in Philosophy of Education. (3)
One 3-hour seminar per week. Topics on selected educational theorists and trends in educational thought. (W) educational thought in the 18th century; (Sp) Sec. 1, educational thought in the 19th century; Sec. 2, educational thought in the 20th century.
Mr. Lilge (W, Sp)

226. Seminar in History of Education. (3)
One 3-hour seminar per week. Mrs. Clifford (Sp)
227. Seminar in Comparative Education.
(3-3-3-3)
One 3-hour seminar per week. The historical and contemporary study of educational systems within selected societies.
227A. Russia and Eastern Europe. Mr. Lilge (F)
227B. Western Europe. Mr. Lilge (F)
227C. Asia. Mrs. Ichman (W)
227E. Africa. Mr. Livingston (Sp)

228. Seminar in Sociology of Education. (3)
One 3-hour seminar per week. Perspectives of contemporary sociology applied to selected topics in education. (F) college course design and instruction; (W) research design; (Sp) Sec. 1, research design; Sec. 2, to be announced.
Mr. Hansen (F, W, Sp, Sec. 1);
Mr. Wenkert (Sp, Sec. 2)

(3-3-3-3-3-3-3-3)
One 2-hour seminar and one 1-hour conference per week. Critical analyses of curriculum innovations.
230A. Reading.
Prerequisite: course 131C or equivalent, and consent of instructor.
Mr. Ruddell (F);
Mrs. Maxwell (F, W)
230B. Speaking, Listening, and Writing.
Prerequisite: consent of instructor.
Mr. Loban (F)
230C. Literature.
Prerequisite: consent of instructor.
Mr. Loban (F)
230D. Mathematics.
Prerequisite: consent of instructor.
Mr. Scott (W)
230E. Social Sciences.
Prerequisite: consent of instructor. Topics will vary from quarter to quarter. (F) basic trends and new developments; (W) emphasis on values and valuing strategies; (Sp) to be announced.
Mr. Michaelis (F, Sp)
230F. Science.
Prerequisite: teaching credential and Physics 11A–11B–11C or Zoology 11A–11B, or consent of instructor.
Mr. Miller (Sp)
230G. Foreign Languages.
Prerequisite: consent of instructor.
Mr. Schevill (F)
230H. Art.
Prerequisite: consent of instructor.
Mr. Luca (Sp)
230I. Music.
Prerequisite: consent of instructor.
Mr. Kyme (F)
230J. Diagnosis and Treatment of Reading Difficulties.
(Formerly numbered 291F)
Prerequisite: consent of instructor. Diagnosis and correction of reading and study skills difficulties of intellectually capable students. Suggested topics: etiology of reading deficiencies, diagnostic tests; techniques and materials for remediation; problems of upper-level educationally handicapped students who aspire to college.
Mrs. Maxwell (W, Sp)
(Formerly numbered 291E)
Prerequisite: consent of instructor. Overview of the current theories and curricular developments in high school and college developmental reading programs. Suggested topics: diagnostic and evaluative testing; assessment of appropriate materials and equipment; methods of integrating the reading program into other academic areas and procedures for administering program.

231. Research in Curriculum and Instruction.
(3-3-3-3-3-3-3-3-3-3-3)
One 2-hour seminar and one 1-hour conference per week. Critical analyses of research in the subject areas.
231A. Reading.
Prerequisite: course 230A.
Mr. Ruddell (W); Mr. Simons (Sp)
231B. Speaking, Listening, and Writing.
Prerequisite: consent of instructor.
Mr. Ruddell, Mr. Loban (Sp)
231C. Literature.
Prerequisite: consent of instructor.
Mr. Loban (Sp)
231D. Mathematics.
Prerequisite: consent of instructor.
Mr. Scott (Sp)
231E. Social Sciences.
Prerequisite: consent of instructor.
Mr. Michaelis (F)
231F. Science.
Prerequisite: courses 119A and 119B or equivalent; course 230F recommended; and consent of instructor.
Mr. Miller (W)
231G. Foreign Languages.
Prerequisite: consent of instructor.
Mr. Schevill (Sp)
231H. Art.
Prerequisite: consent of instructor.
Mr. Luca (W)
231I. Music.
Prerequisite: consent of instructor.
Mr. Kyme (W)
231J. Linguistics in Language Arts.
Prerequisite: English 110A–110B or English 205, or consent of instructor.
Mr. Simons (W)

232. Early Childhood Programs. (3-3-3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor. Traditional and innovative programs for the education and care of young children.
232A. Infant and Preschool Programs.
Miss Almy (F)
232B. Kindergarten and Early Primary Programs.
Miss Almy (W)
232C. Selected Issues in Early Childhood Education.
Miss Almy (Sp)

233. The Media in Education. (3)
Two hours of lecture and one hour of conference per week. Survey of new developments in media and their utilization in teaching, administration, curriculum planning, and research. Topics: mass media, individualized media, auto-tutorial and multi-media techniques with projected and audio materials. Current trends in theory, research, and development are discussed.
Mr. Hatfield (W)

234. Programmed and Automated Instruction. (4)
Three hours of lecture and two hours of laboratory per week. Prerequisite: consent of instructor. Lectures, discussions, and readings regarding the nature and applications of automated techniques in instruction. Emphasis will be upon instructional strategies. Students will prepare simple instructional programs and use a computer to evaluate their effectiveness.
Mr. Woodson (F)

235. Theory and Practice in Curriculum and Instruction. (3-3-3)
One 2-hour seminar and one 1-hour conference per week. Bases for making public school curriculum decisions.
Mr. Webster (W)

Mr. Webster (Sp)

*235C. Supervision of Instruction. One 2-hour seminar and one 1-hour conference per week. Prerequisite: teaching credential, two years of teaching experience, and consent of instructor. Research into the supervisor-teacher relationships, and practice with classroom visits, faculty meetings, and individual conferences will provide the basis for criticism and analysis of supervisory techniques.

235D. The Logic of Instruction. One 2-hour lecture and one 1-hour conference per week. The teaching-learning process considered from the standpoint of symbolic logic and its applications to problems in curriculum and instruction.

Mr. Mosiér (W)

236. Advanced Studies in Elementary and Secondary Education. One 2-hour seminar and one 1-hour conference per week.

*236A. The Elementary School. (3) Prerequisite: studies of topics and problems in elementary education.

*236B. The Junior High School. (3) Research on early adolescence and studies of junior high schools will be related to instruction and a curriculum sequentially linked to elementary and high school education.

*236C. The Secondary School. (3) Prerequisite: teaching credential, two years of teaching experience, and consent of instructor. Organization of subjects suitable for adolescent learning will be examined with reference to principles worked out in course 235A.

236D. Current Trends and Issues. (3) Prerequisite: consent of instructor. Critical consideration of current issues and trends in the public schools.

Sec. 1. Elementary schools. Mr. Webster (F)

Sec. 2. Secondary schools.

236E. The Socially Disadvantaged Learner. (4) One 3-hour lecture and one ½-hour laboratory per week. Prerequisite: consent of instructor. Seeks to increase knowledge and understanding of socially disadvantaged learners in American society. Attention is devoted to learning-related problems encountered by socially disadvantaged students and the possible etiologies of these problems. Relevant educational programs are covered.

Mr. Webster (W)

*236F. Problems in Urban Education. (4) One 3-hour lecture and one 1½-hour laboratory per week. Prerequisite: consent of instructor. A survey of educational problems found in urban areas, ranging from preschool to adult re-education. Students are required to engage in field work which relates to some urban educational program.

237. Curriculum Philosophy. (3) One 3-hour lecture per week. Philosophical analysis of curriculum development and instructional processes; logical basis of teaching and learning.

Mr. Mosiér (Sp)

*238. In-Service Education. (3) One 2-hour seminar and one 1-hour conference per week. Theories, procedures, practices, and evaluation of in-service education for public school personnel.

240. Student Personnel and Counseling Psychology. (3-3-3-3) One 2-hour lecture and one 2-hour laboratory per week.

240A. Principles and Theories of Guidance. Prerequisite: consent of instructor. Development and scope of guidance work as a profession; critical analysis of basic philosophies, ethics, and professional responsibilities. Miss Hammond (F)

*240B. Theoretical Foundations of Counseling. Prerequisite: consent of instructor. Pertinent theoretical and empirical developments in the social sciences for counseling theories and practices.

*240C. Environmental Factors in Counselor Adjustment. Prerequisite: consent of instructor. Theories of interaction of environmental and personal factors in the counseling process. Analysis of theories of career development. Sources and interpretation of vocational data.

*240D. Group Guidance. Prerequisite: consent of instructor. Group procedures in counseling and personnel work. Theory, function, and operation of group guidance activities in an educational setting.


245. Advanced Counseling. (3-3) Three 1-hour seminars per week.

245A. Counseling Theory. Prerequisite: courses 240A and 240B. Counseling theories and schools of counseling. Intensive examination of counseling techniques and related research. Miss Hammond (Sp)

*245B. Case Analysis. Prerequisite: course 245A. Illustration of counseling theories and principles through intensive case analysis, evaluation of counseling.

249. Special Problems in Counseling Theory and Research. (3) One 2-hour seminar and one 1-hour conference per week. Prerequisite: courses 240A and 240B. Designed to develop special areas of interdisciplinary research and theory which bear on problems of current interest and significance to the counseling field. Miss Hammond (W)

251. Foundations of Educational Administration. (3-3-3) One 3-hour seminar per week. Prerequisite: consent of instructor.

251A. Education and Government. Educational policy-making and administration in federal, state, and local governments; intergovernmental relations in education; the role of the courts in the conduct of education.

Mr. Reller (F)
252. Administration of the Individual School. (3)

One 3-hour seminar per week. **Prerequisite: consent of instructor.** Principles and practices in the organization and administration of the elementary and secondary school.

Mr. Reed (F)

255. Educational Planning.

255A. Introduction to Educational Planning. (4)

One 3-hour lecture and one 1-hour conference per week. The concept of planning education. Principal techniques used. Model building and system analysis in education. Manpower, social demand and cost benefit planning. Relationship between planning and administration. Planning at international, national, and regional levels.

Mr. Benveniste, Mr. Ritzen (F)

255B. Advanced Seminar in Educational Planning. (3)

One 3-hour lecture per week. **Prerequisite: course 255A or consent of instructor.** Measurements and statistics in planning. Qualitative vs. quantitative planning. Manpower analysis vs. the social demand approach. Case studies of educational planning in Europe, the United States, and in developing countries.

Mr. Zelan (Sp)

255C. Introduction to System Analysis in Education. (4)

One 3-hour lecture and one 1-hour conference per week. Introduction to systems theory and its application in education. Optimization theory, control theory, computer simulation analysis, complex information theory, and others. Case studies in education. Particular attention given to application in school management.

255D. Seminar in Systems Analysis in Education. (3)

One 3-hour lecture per week. **Prerequisite: course 255C or consent of instructor.** A study of optimization techniques and cost benefit analysis applied to education problems.

Mr. Benveniste, Mr. Ritzen (W)

255E. Advanced Seminar in Systems Analysis in Education. (3)

One 3-hour lecture per week. **Prerequisite: course 255D or consent of instructor.** Topics in mathematical and computer modeling in education including modern control theory and computer simulation techniques.

Mr. Ritzen (Sp)

256. Economics of Education.

256A. Economics of Education. (4)

One 3-hour lecture and one 1-hour conference per week. Topics to be considered include the following: alternative methods of assessing the contribution of education to economic growth; demand for education services; education production functions; efficiency criteria; cost analysis and sectoral planning; economic aspects of innovation.

Mr. Ritzen (F)

256B. Finance and Economics of Education: Public and Private Schools. (4)

One 3-hour lecture and one 1-hour conference per week. Sources of revenue for elementary and secondary schools; methods of distributing state and federal contributions; analysis of the functional distribution of school expenditures; cost-effectiveness analysis; economic aspects of proposals to shift operation of public schools into the private sector.

Mr. Benson (F)

256C. Economics of Higher Education. (4)

One 3-hour lecture and one 1-hour conference per week. Cost benefit analyses and economic returns of higher education. Resources allocation and economic policy of local, state and federal governments. Economics of student loans and grants. Consequences and viability of various investment policies and financial incentives for institutional programming. International comparisons.

Mr. Benson (W)

256D. Finance and Economics of Education: Informal Programs. (4)

One 3-hour lecture and one 1-hour conference per week. Arrangements for the administration and finance of programs falling outside the formal education system. Special attention will be given to work-oriented training on the job, apprenticeship, work experience, and refresher courses. Public involvement in such activities will be examined.

Mr. Benson (Sp)

256E. Comparative Financing of Education and Training. (3)

One 3-hour lecture. Economics and financing of education in different social systems; allocation of gross national product for education; national and state budgeting; contribution of private sector to educational development; problems of inefficiency, student dropout, examination failure, brain drain, and educated unemployed.

257. Politics and Education.

257A. Determinants of State and Local Educational Policy. (4)

One 3-hour lecture and one 1-hour conference per week. Examination of state and local governmental arrangements and political processes which influence the direction of school systems. Emphasis upon application of political science concepts and research strategies to local, intermediate, and state level policy processes.

Mr. Guthrie (W)

257B. National Government Influences on Educational Policy. (4)

One 3-hour lecture and one 1-hour conference per week. The role of a national government in forming and administering educational policy. Problem areas include (1) social and political influence; (2) concepts of formal bureaucracies; and (3) administration of national government policy.

Mrs. Illchman (F)

257C. Special Topics on Educational Policy Formation. (3)

One 3-hour lecture per week. Advanced research into political processes affecting educational policy at any level of government. Topic: (Sp) legislative behavior.

Mr. Guthrie (Sp)

258. Organizational Theory and Education.

258A. Organizational Theory and Education. (4)

One 3-hour lecture and one 1-hour conference per week. Sociological approaches to the study of organizations with particular reference to education. Power and authority, control analysis, role analysis. Professional and bureaucratic conflicts. Incentive systems and organizational equilibrium.

Mr. Benveniste (F)
258C. Comparative Educational Administration. (3)
One 3-hour lecture per week. Theory building in the analysis of educational organizations. Methodologies of field research. Mr. Benveniste (Sp)

259. Educational Administration.
259A—259B. Urban Educational Administration. (4-4)
One 3-hour lecture and one 1-hour conference per week. Social, economic, and political forces in urban school systems. Policy problems include: "the community school"; school district decentralization; equality of educational resource allocation; power struggles between teacher and lay groups; new instructional techniques and curricula for urban educational problems. Mr. Reed (F, W)

259C. Administration of Instructional Programs and Services. (3)
One 3-hour lecture per week. Theories, policies, and practices relative to the administration of the program of instruction and auxiliary services in the public schools.

259D. Advanced Personnel Administration in Public Education. (3)
One 3-hour lecture per week. Theories, policies, and practices relative to educational personnel. Mr. Grant, Mr. Reed (Sp)

259E. The Law and Education. (3)
One 3-hour lecture per week. An examination of the historic and contemporary influence of the United States Constitution, statutory and case law upon education. Attention is given to the structure and processes associated with legal influences upon educational policy determination.

260. The Junior College. (3)
One 2-hour seminar and one 1-hour conference per week. Nature and role of the junior college in American society; a consideration of purposes, curriculum, student characteristics, and implications for instruction and student personnel. ——- (F, Sp)

260L. The Junior College Laboratory. (2)
One 2-hour laboratory per week. Conferences and observations pertaining to curriculum and instruction in junior colleges. Must be taken concurrently with course 260. ——- (F, Sp)

261. Higher Education in the United States. (3)
(Formerly numbered 261A—261B)
One 3-hour lecture per week. Introductory course to the Program in Higher Education, required of entering students, and serving as an orientation to the particular curriculum, the essential bibliography, the resources provided by faculty and students, and the maximized alternatives included in the degree program. Mr. Glenny (F)

264. College Teaching. (3)
One 2-hour seminar per week and one 1-hour conference. Prerequisite: master's degree or equivalent, or consent of the instructor. An attempt to develop a typology of college teaching styles, and to describe and demonstrate some of the instructional techniques and procedures commonly found in higher education classrooms. Mr. Stone (F)

268. Advanced Study in Higher Education.
(4-4-4-4-4-4)
Prerequisite: course 261, or consent of instructor.
268A. The Student in Higher Education.
One 3-hour seminar per week. Consideration of the college student as a developing human being, social creature, learner, and participant in institutional governance. Analytical review of research on personal characteristics, campus environments and cultures, the student movement(s), and the influences and effects of college education. Mr. Tillery (Sp)

268B. The Curriculum of Higher Education.
One 2-hour seminar and one 1-hour laboratory per week. Nature and development of educational programs in general, liberal, professional and graduate education. Mr. Stone (W)

268C. The Administration of Higher Education.
One 3-hour seminar per week. The government, organization, and administration of colleges and universities; the relevance of organizational and administrative theory in other fields to institutions of higher education. Mr. Glenny (W)

268D. Teacher Education.
One 2-hour seminar and one 1-hour laboratory per week. Intensive study of the research and problems in the education of teachers. Mr. Stone (Sp)

268E. Problems in Junior College Administration.
One 2-hour seminar and one 1-hour conference per week. Intensive study of selected problems related to junior college administration and organization. Mr. Tillery (F); ——- (Sp)

268F. Financing Higher Education.
Two 1-1/2-hour seminars per week. Alternate methods of developing unit costs, management information systems, and budget formulas for operations and capital facilities. Strategies for effecting program planning, budgeting systems. Sources of funding and financing research, public service instruction, and buildings. Mr. Glenny (Sp)

270. Problems in Adult Education. (3)
One 3-hour seminar per week. Topics will include students, curriculum, administration, financing, leadership, teacher training, education and aging. ——- (F)

275. Seminar in Adult Education. (3—3—3)
One 3-hour seminar per week.
275A. Sociology of Adult Education.
A study of the social forces which create and mold various designs of adult education in an industrial society, and in newly developing societies. Mr. London (F)

275B. Problems of Work and Leisure.
The relationships of work and leisure to the continuing education of adults. Mr. London (Sp)
275C. Community Development.
An examination of community development programs in the developing countries and the United States. [Mr. London (F)]

One 3-hour seminar and one 1-hour conference alternate weeks. Prerequisite: open only to members of special doctoral program for preparation of educational leaders. Basic concepts, issues, and strategies will be identified and analyzed. Major attention will be given to interaction between theory and practice. Credit and grade will be assigned upon completion of the full sequence. [The Staff (F, W, Sp)]

One 3-hour seminar per week. Divisional proseminars conducted by two or more faculty members, with emphasis upon the theories, methods, and techniques most commonly employed in research on educational problems within each division.

290A. Policy Planning and Administration. [Mr. Guthrie (Sp)]

290C. Curriculum and Instruction. [Mr. Woodson (F)]

*290D. Educational Psychology. [Mr. Tillery (F); Mr. Stone (W); Mr. Witten (Sp)]

290F. Social and Humanistic Foundations. [Mr. Woodson (Sp)]

290N. Methodology of Language and Reading Research. Prerequisite: consent of instructor. A critical analysis of methods employed in research on reading, language acquisition, and other psycholinguistic processes; sociolinguistics, verbal learning, and instruction in the language arts. Students collect and analyze language and reading data. [Mr. Simons (Sp)]

291. Experimental Courses.

$291D–291E–291F. Advanced Study and Research in the Methodology of Teaching. (4–2–2)
One 3-hour seminar per week (F); one 2-hour seminar per week (W, Sp). Prerequisite: restricted to M.A. degree students enrolled in the Mt. Diablo Teacher Training Project. Exploration and research in advanced methods and strategies of teaching. Credit and grade will be assigned upon completion of the full sequence. [Mr. Miller (F, W, Sp)]

$291G. Inter-ethnic and Interpersonal Relations in Education. (4)
One 3-hour lecture and one 1-hour laboratory per week. Study of the sub-cultures of non-Anglo minorities, basic principles and research findings in the field of interpersonal relations, and methods of curriculum development as they relate to inter-ethnic and interpersonal relations. [Mr. Webster (Sp)]

*§291H. Training Seminar in Qualitative Education. (3)
One 3-hour lecture per week. Non-statistical aspects of designing, implementing and analyzing evaluations of educational products, procedures, personnel, students, and systems. Emphasis on realistic examples including collaboration on a contract for evaluation. Materials provided will include background modules on ethics, value judgments in science, etc. [Mr. Webber (F)]

§291K. Topics in Alternative Education. (3)
One 3-hour seminar per week. Prerequisite: consent of instructor. Seminar on aspects of the alternative education movement both inside and outside of the public school system. Emphasis on synthesis and application. Topics will include: philosophies and history, evaluation and research methodology, content and context, current problems. [Mr. Hurst (F, W, Sp)]

§291L. Development and Administration of Education in Metropolitan Areas. (3)
One 3-hour lecture per week. Prerequisite: admission limited to candidates for higher degrees. The relationship of governmental, economic, and social factors to development, decision-making, and administration of education in the metropolis. [The Staff (F)]

§291N. Language and Reading Development Pro-seminar. (3)
One 3-hour seminar per week. An introduction to: the relationship between language and society; linguistic and psycholinguistic concepts; language acquisition; language and cognition; the reading process; instructional approaches to reading and language development; language and reading in early childhood; and the aesthetics of language and literature. [Miss Almy (W)]

292. Special Topics in the Methodology of Educational Research. (3)
One 3-hour seminar per week. Coordinated seminars offered by faculty from several divisions to introduce special topics, such as questionnaire construction, attitude measurement and scaling, interviewing, interaction analysis, path analysis, and other topics not adequately covered elsewhere. Topics and content vary from quarter to quarter.[Mr. Woodson (Sp)]

294. Thesis Seminar. (3–8; 3–8; 3–8; 3–8; 3–8)
One 3-hour seminar per week. Prerequisite: consent of instructor. Recommended for master's and doctor's candidates in connection with seminar papers, and dissertations (theses). [Mr. Stewart (F, W, Sp)]

294B. Counseling Psychology. [Mr. Stewart (F, W, Sp)]

294C. Curriculum and Instruction. [Mr. Scott (F); Mr. Loban (W); Mr. Buddell (Sp)]

294D. Educational Psychology. [Mr. Kaiser (F)]

294E. Higher Education. [Mr. Stone (F); Mr. Tillery (W); Mr. Huddell (Sp)]

294F. Social and Humanistic Foundations. [Mr. Wenkert (F)]

298. Group Study for Graduate Students. (1–5)
(Formerly numbered 295) Group study and research on special problems and topics not covered by any other course or seminar. Topics will vary from quarter to quarter. [The Staff (F, W, Sp)]

299. Special Study and Research. (1–8)
Open to qualified graduate students who wish to pursue special studies and research under the direction of a member of the staff. [The Staff (F, W, Sp)]

299A. Policy Planning and Administration. [The Staff (F, W, Sp)]
310. Internship in School Psychology. (3–6)
(Formerly numbered 310C)
One 2-hour lecture and one 1-hour meeting with mental health consultant per week. Supervised assignment to a school district in capacity of school psychologist. Must be taken on a passed/not passed basis. The Staff (Mrs. Lambert in charge) (F, W, Sp)

311. Field Work in Special Education. (3)
Hours to be arranged. Mr. Bower (F, W, Sp)

Seminars, individual conferences, observations, and supervised teaching. Only candidates who meet established criteria can be accepted; enrollment begins in the fall quarter and is limited to available facilities.
331A. Introduction to Elementary Supervised Teaching. (3)
One 2-hour lecture and 10 hours of field work in the public schools per week. Supervisory Staff (F)
331B. Elementary Supervised Teaching. (4)
One 3-hour lecture and 10–15 hours of field work in the public schools per week. Prerequisite: course 331A. Supervisory Staff (W)
331C. Elementary Supervised Teaching. (8)
One 3-hour lecture and 16–20 hours of field work in the public schools per week. Prerequisite: courses 331A and 331B. Supervisory Staff (Sp)

Prerequisite: only candidates who meet established criteria may be accepted; enrollment is limited to available facilities. The sequence in supervised teaching normally begins in the fall quarter and extends through the spring quarter, terminating with the close of the secondary school year. Initial entry into supervised teaching in quarters other than fall is possible in some teaching fields, subject to special arrangement with supervisors in those fields.
332A. Introduction to Secondary Supervised Teaching. (4)
One 1-hour lecture and five hours of field work per week. Conferences, observation, and supervised teaching. Supervisory Staff (F)
332B. Secondary Supervised Teaching in Major Field. (4)
One 1-hour lecture and five hours of field work per week. Conferences, observation, and supervised teaching. Supervisory Staff (W)
332C. Secondary Supervised Teaching in Major or Minor Field. (4)
One 1-hour lecture and five hours of field work per week. Conferences, observation, and supervised teaching. Supervisory Staff (Sp)
332D. Procedures, Materials, and Curriculum. (3)

One 3-hour lecture or one 2-hour and one 1-hour lecture per week. Study and evaluation of curriculum and curriculum trends, instructional procedures and materials of a specific subject matter area commonly taught in secondary school. This course is normally taken concurrently with supervised teaching in the major and minor fields.
Supervisory Staff (F, W, Sp)

333. Practicum.
An extra-session course scheduled to coincide with the calendar of the public schools. Enrollment is limited to available facilities and supervisory sponsors.
333A. Supervised Teaching in Secondary Schools. (1–6)
One 1-hour lecture and two to 12 hours of field work per week. Prerequisite: consent of instructor.
Supervisory Staff (F, W, Sp)
333B. Supervised Teaching in Elementary Schools. (1–6)
One 1-hour lecture and two to 12 hours of field work per week. Prerequisite: consent of instructor.
Mrs. Roger (F, Sp)
333C. Directed Practice in School Libraries. (6)
One 1-hour lecture and 10 to 12 hours of field work per week. Prerequisite: consent of instructor.
Miss Maxwell (F, W, Sp)

340. Field Work in Student Personnel and Counseling Psychology.
340A. Counseling Practicum. (3)
One 2-hour case conference plus a 1-hour individual conference per week. Prerequisite: courses 240A, 240B, 245A, 245B, and consent of instructor. Supervised experience in vocational, educational, and personal adjustment counseling.
Miss Hammond (F, W, Sp)
340B. Internship in Student Personnel and Counseling. (3–8)
One 2-hour seminar plus supervised field experience. Prerequisite: course 340A and consent of instructor. Supervised practice in selected aspects of student personnel and counseling services at elementary, secondary, and college level, and in other agencies.
Miss Hammond (F, W, Sp)

350. Internship in Educational Administration. (1–6)
One 2-hour seminar alternate weeks plus supervised field experience. Prerequisite: consent of instructor. Conferences and supervised field experience.
Mr. Roller (F, Sp), Mr. Salinger (F, W, Sp)

360. Supervised Teaching in Junior Colleges. (4)
One 2-hour lecture and five hours of field work per week. Conferences, observation, and supervised teaching. Enrollment is limited to available facilities.

391. Experimental Courses.
§391B. Teaching Reading in the Secondary Schools. (3)
One 3-hour seminar per week. Prerequisite: enrollment in Social Studies, English Experimental Program for the secondary teaching credential. Seminar on the teaching of reading in the high
school to be held concurrently with student teaching experience in reading classes.

Mrs. Maertins (F, W, Sp)
Two 2-hour seminars per week. Prerequisite: enrollment in Social Studies, English Experimental Program for the secondary teaching credential. Study and evaluation of curriculum and instructional procedures, and materials in the areas of Social Studies and English. Conferences, observation, and supervised teaching in a secondary school. Credit and grade will be assigned upon completion of the full sequence.

Mrs. L’Aventure, Mrs. Jackson, Mrs. Maertins (F, W, Sp)

Individual Study Courses

601. Individual Study for Master's Candidates. (1–8)
Individual study for the comprehensive examination in consultation with the faculty adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the faculty adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ed.D. or Ph.D. degrees. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

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**ENGINEERING**

(Office of the Dean, 315 McLaughlin Hall)

Deans:

Associate Dean:
Victor F. Zackay, Ph.D.

**CHEMICAL ENGINEERING**

(See page 139)

**CIVIL ENGINEERING**

(Department Office, 760 Davis Hall)

Chairman:
Howard D. Eberhart, M.S.

Hydraulic and Sanitary Engineering

(Division Office, 633 Davis Hall)

Professors:
James A. Harder, Ph.D.
Joe W. Johnson, M.S.
Warren J. Kaufman, Sc.D.
William J. Oswald, Ph.D.
Erman A. Pearson, Sc.D.
Robert E. Selleck, Ph.D.
Bernard D. Tebbens, Sc.D.
Jerome F. Thomas, Ph.D.
David K. Todd, Ph.D. (Chairman)
Robert L.Wiegel, M.S.
Hans Albert Einstein, D.S.T. (Emeritus)

Assistant Professor:
Pat Wilde, Ph.D.

Assistant Professor:
Alexander J. Horne, Ph.D. (Acting)

Lecturer:
Clarence Golueke, Ph.D.

Structural Engineering and Structural Mechanics

(Division Office, 721 Davis Hall)

Professors:
Frank Baron, D.Sc.

Vitelmo Bertero, Sc.D.

Jack G. Bouwkamp, C.I.

NOTE: For key to footnote symbols, see page 86.
Transportation Engineering

(Division Office, 215 McLaughlin Hall)

Professors:
Ben C. Gerwick, Jr., B.S.
Robert Horonjeff, B.S.
W. Norman Kennedy, B.S.
Adolf D. May, Jr., Ph.D.
James K. Mitchell, Sc.D.
Francis H. Moffitt, M.C.E.
Carl L. Monismith, M.S. (Chairman)
Gordon F. Newell, Ph.D.
Harry Bolton Seed, Ph.D.
Paul A. Witherspoon, Ph.D.
Harmer E. Davis, M.S. (Emeritus)
Dan M. Finch, B.S. (Emeritus)
Francis S. Foote, E.M. (Emeritus)
Paul F. Keim, M.Sc. (Emeritus)
Ralph A. Moyer, M.S., C.E., Sc.D. (hon.) (Emeritus)

Associate Professors:
James M. Anderson, Ph.D.

Electrical Engineering and Computer Sciences

(Department Office, 231 Cory Hall)

Professors:
Diogenes J. Angelakos, Ph.D. (Vice-Chairman)
Herbert B. Baskin, M.S.
Arthur R. Bergen, Ph.D.
Elwyn R. Berlekamp, Ph.D.
Charles K. Birdsall, Ph.D.
Manuel Blum, Ph.D.
Charles A. Desoer, Sc.D.
Thomas E. Everhart, Ph.D. (Chairman)

Edward L. Wilson, D.Eng.
Joe W. Kelly, B.S., D.Eng. (emeritus)
Bruce Jameson, B.S. (Emeritus)
George E. Troxell, B.S. (Emeritus)

Associate Professors:
Anil K. Chopra, Ph.D.
James M. Kelly, Ph.D.
Jacob Lubliner, Ph.D.
Graham H. Powell, Ph.D.
R. Brady Williamson, Ph.D.

Professor:
Earl R. Parker, Met.E.
Samuel Silver, Ph.D.
Otto J. M. Smith, Ph.D.
Charles Jusskind, Ph.D.
Aram J. Thomasian, Ph.D.
George L. Turin, Sc.D.
Theodore Van Duzer, Ph.D.
Pravin P. Varaiya, Ph.D.
Shyh Wang, Ph.D.
William J. Welch, Ph.D.
John R. Whinnery, Ph.D.
Richard M. White, Ph.D.
Eugene Wong, Ph.D.
Lotfi A. Zadeh, Ph.D.
Leonard J. Black, Ph.D. (Emeritus)
Charles F. Dalziel, E.E. (Emeritus)
Paul L. Morton, Ph.D. (Emeritus)
Lester E. Reukena, Ph.D. (Emeritus)
Burtis L. Robertson, Ph.D. (Emeritus)
Herbert J. Scott, E.E. (Emeritus)
David H. Sloan, Ph.D. (Emeritus)
John R. Woodyard, Ph.D. (Emeritus)

Associate Professors:
Leon O. Chua, Ph.D.
Albert C. English, Ph.D.
David A. Hodges, Ph.D.
Michael Lieberman, Ph.D.
Kenneth K. Mei, Ph.D.
Richard S. Muller, Ph.D.
William G. Oldham, Ph.D.
Steven E. Schwarz, Ph.D.
Jerome R. Singer, Ph.D.
Frank S. Werblin, Ph.D.

Assistant Professors:
Robert S. Fabry, Ph.D.
Domenico Ferrari, Dr. Ing.
Paul R. Gray, Ph.D.
T. Kenneth Gustafson, Ph.D.
Lance J. Hoffman, Ph.D.
Edward L. Keller, Ph.D.
Robert G. Meyer, Ph.D.
Andrew Neureuther, Ph.D.
Chakravartih Ravi, Ph.D.
Philip M. Spira, Ph.D.
Michael R. Stonebraker, Ph.D.
John Q. Torode, Sc.D.
John C. Wiesner, Ph.D.

Professors:
Lawrence Stark, Ph.D.
Corinulius A. Tobias, Ph.D.

Lecturers:
James A. Baker, B.A.
L. Stephen Coles, Ph.D.
Richard W. Conn, A.B.
Richard O. Duda, Ph.D.
James H. Eaton, Ph.D.
Sydney Fernbach, Ph.D.
Thomas Fessenden, Sc.D.
Charles W. Hartman, Ph.D.
Thomas L. Hayes, Ph.D.
Horace C. Jackson, E.E.
Jean-Paul Jacob, Ph.D. (Visiting)
Bertram Raphael, Ph.D. (Visiting)

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH
(Department Office, 4135 Etcheverry Hall)

Professors:
Richard E. Barlow, Ph.D.
Edward R. F. W. Crossman, Ph.D.
Stuart E. Dreyfus, Ph.D.
David Gale, Ph.D.
Raymond G. Grassi, M.S.
William S. Jewell, Sc.D.
Richard M. Karp, Ph.D.
Robert M. Oliver, Sc.D.
E. Paul DeGarmo, M.S. (Emeritus)
Ronald W. Shephard, Ph.D., (Chairman)

Associate Professors:
C. Roger Glassey, Ph.D.
Edward C. Keachie, Ph.D.
James T. Lapsley, Jr., M.S.
Sheldon M. Ross, Ph.D.
Ronald W. Wolff, Ph.D.

Assistant Professor:
Ilan Adler, Ph.D.

Lecturer:
Stephen Lanier, Ph.D.

MATERIALS SCIENCE AND ENGINEERING
(Department Office, 210 Hearst Mining Building)

Professors:
Bimal K. Bhattacharyya, Ph.D.
Robert H. Bragg, Ph.D.
Douglas W. Fuerstenau, Sc.D. (Chairman)

Assistant Professors:
Earl R. Parker, Met.E.
Joseph A. Pask, Ph.D.
Alan W. Searcey, Ph.D.
Gareth Thomas, Ph.D., D.Sc.
Jack Washburn, Ph.D.
Victor F. Zackay,† Ph.D.
Ralph R. Hultgren, Ph.D. (Emeritus)
Donald H. McLaughlin, Ph.D., D.Eng.
(Emeritus)
S. Frederick Ravitz, Ph.D. (Emeritus)

Associate Professors:
Marshall F. Merriam, Ph.D.
H. Frank Morrison, Ph.D.

MECHANICAL ENGINEERING

(Department Office, 6193 Etcheverry Hall)

Professors:
Cyril P. Atkinson,† M.S., M.E.
Stanley A. Berger, Ph.D.
G. Wayne Brown, M.S.
Gilles M. Corcos,‡ Ph.D.
Israel L. Cornet, Ph.D.
Don M. Cunningham, M.S.
Irving Fatt, Ph.D.
Iain Finnie, Sc.D.
Joseph Frisch, M.S.
Werner Goldsmith, Ph.D.
Frank E. Hauser, Ph.D.
Maurice Holt, Ph.D.
Chieh S. Hsu,† Ph.D.
Franklin C. Hurlbut, Ph.D.
Francis W. Hutchinson, M.S., M.E.
Harold W. Iversen,‡ M.S.
Shiro Kobayashi, Ph.D.
Alan D. K. Laird, Ph.D.
Edmond V. Laitone,‡ Ph.D.
George Leitmann, Ph.D. (Vice-Chairman for Graduate Studies)
Paul Lieber, Ph.D.
George J. Maslach, B.S. (Provost)
Paul M. Naghdi, Ph.D.
Antoni K. Oppenheim, Ph.D.
Charles W. Radcliffe, M.S., M.E.
Reinhardt M. Rosenberg,‡ M.S., Ph.D. (hon.)
Samuel A. Schaaf, Ph.D.
Ralph A. Seban, Ph.D.
Frederick S. Sherman, Ph.D.
Wilbur H. Somerton, Pet.E.
Walter W. Soroka, Sc.D.
Robert F. Steidel, Jr., D.Eng. (Chairman)
Yasundo Takahashi,† Ph.D.

Assistant Professors:
Thomas S. Mika,‡ D.Eng.
J. W. Morris, Jr., Sc.D.

Associate Professors:
Michael C. Williams, Ph.D.
R. Brady Williamson, Ph.D.

Lecturers:
Kenneth K. Kelley, Ph.D.
Robert B. Langston, Ph.D.

Lawrence Talbot, Ph.D. (Vice-Chairman for Administration)
Herman Thal-Larsen, M.S.
Erich G. Thomsen, Ph.D.
Chang-Lin Tien,† Ph.D.
D. Roger Willis,‡ Ph.D.
E. Paul DeGarmo, M.S. (Emeritus)
Everett D. Howe, M.S. (Emeritus)
Alexander S. Levens, M.S. (Emeritus)
Ernest S. Starkman, M.S. (Emeritus)
Leonid M. Tichvinsky, D.E.M. (Emeritus)

Associate Professors:
David M. Auslander, Sc.D.
David B. Bogy,‡ Ph.D.
Michael M. Carroll, Ph.D.
Ralph Grief, Ph.D.
Clayton D. Mote, Ph.D.
Robert F. Sawyer, Ph.D.
Paul B. Stewart,‡ Ph.D.
George J. Trezek, Ph.D.

Assistant Professors:
Melvyn C. Branch, Ph.D.
Patrick J. Pagni,‡ Ph.D.

Professors:
Kurt S. Spiegler, Ph.D. (In-Residence)
Lawrence Stark, M.D.

Associate Professor:
Franklin A. Robben, Ph.D. (In-Residence)

Lecturer:
Milton R. Pickus, Ph.D.

NAVAL ARCHITECTURE

(Department Office, 202 Naval Architecture Building)

Professors:
J. Randolph Paulling, Jr., D.Eng. (Chairman)
John V. Wehausen,‡ Ph.D.
Henry A. Schade, Dr. Ing. (Emeritus)

Assistant Professor:
William C. Webster, Ph.D.

Lecturer:
Oswald J. Sibul, M.S.
NUCLEAR ENGINEERING
(Department Office, 4105 Etcheverry Hall)

Professors:
Harvey J. Amster, Ph.D.
Paul L. Chambrc, Ph.D.
Lawrence M. Grossman, Ph.D. (Chairman)
Donald R. Olander, Sc.D.
Thomas H. Pigford, Sc.D.
Lawrence Ruby, Ph.D.
Virgil E. Schrock, M.S., M.E.

Associate Professors:
Selig N. Kaplan, Ph.D.

Assistant Professors:
George Yadigaroglu, Sc.D.

Senior Lecturer:
Robert V. Pyle, Ph.D.

Lecturer:
Roger W. Wallace, Ph.D.

CHEMICAL ENGINEERING
(See page 139)

CIVIL ENGINEERING

Civil engineering is concerned with the planning, design, and construction of public and private works such as buildings, bridges, dams, transportation systems and water supply systems. The civil engineer must have a full understanding of the physical and economic aspects of structures and systems. The four-year undergraduate curriculum leading to the B.S. degree is designed to provide a basic and fairly comprehensive background in civil engineering and related fields. This curriculum may provide a student with a direct entry to professional experience upon graduation or with preparation for graduate study. The student may arrange his program to integrate graduate and undergraduate study into a five-year program, leading to the bachelor's degree by the end of the fourth year and the master's degree by the end of the fifth year.

CURRICULUM FOR THE BACHELOR'S DEGREE

A total of 180 units is required. The program of study is described in detail in the Annoucement of the College of Engineering (available without charge from the College of Engineering, University of California, Berkeley, California 94720). All students must complete a total of 27 units of humanistic-social studies which must include a 2-quarter sequence from an approved list. At least 9 units must be upper division courses. Other courses include:

**Lower Division**

Required: Mathematics 1A–1B–1C, 51A–51B–51C. Chemistry 1A–1B. Physical or Biological Science or Statistics: a 4-unit course in a subject approved by the adviser. Physics 4A–4B–4C–4D–4E. A student who has a clearly defined interest in one of the major areas of Civil Engineering may take additional courses in physical or biological science or statistics as a replacement of either Physics 4D (4 units) and the laboratory portion of Physics 4E (1 unit), or the laboratory portions of Physics 4D and 4E (2 units). Engineering 28, 36, and 45. Civil Engineering 10 and 15. The course Civil Engineering 15 may be satisfied by Engineering 1 or Computer Science 2. Electives: 18 units including at least 15 units in humanities or social sciences.

**Upper Division**

Required: Mechanical Engineering 104A. Civil Engineering 110, 118, 121, 130, 131, 133 or 134, 140, 165A–165B, 170, 192 and 194. Electives: 15 units of upper division civil engineering courses; 8 units of environmental breadth courses selected from an approved list of University offerings. 24 units of electives including humanities and social sciences.
GRADUATE STUDY

Graduate programs of study leading to the master’s and doctoral degrees are available in the major civil engineering fields: construction, geodesy and photogrammetry, hydraulics, sanitary, geotechnical engineering, ocean engineering, structural engineering and structural mechanics, transportation, and water resources. For details, please consult the Announcement of the College of Engineering.

ELECTRICAL ENGINEERING AND COMPUTER SCIENCES

With the rapid growth in technology in recent years, the field of electrical engineering and computer sciences now encompasses many areas including solid-state devices, integrated circuits, microwave electronics, quantum and optical electronics, biophotonics, radiation and propagation, plasmas, power systems, control systems, communication systems, circuit theory, large-scale networks and systems, ecological systems, pattern recognition, information theory, computer systems, computer programming, heuristic programming and artificial intelligence, switching and automata theory, symbol manipulation, and information retrieval.

CURRICULUM FOR THE BACHELOR’S DEGREE

A total of 180 units is required for the bachelor’s degree with the following minimum requirements:

I. Sixty units of engineering must be taken with 45 units in the upper division, including: (a) Engineering 1, 17, and 45*; (b) 4 upper division laboratory courses in electrical engineering and computer sciences; (c) 30 upper division units in electrical engineering and computer sciences; (d) 8 units in engineering not in electrical engineering and computer sciences, not including Engineering 1, 17, and 45.

II. A total of 24 units of physical or life science including Physics 4A, 4B, and 4C.

III. A total of 24 units in mathematics and statistics including Mathematics 1A, 1B and 1C.

IV. Seventy-two units of electives including at least 27 units of humanities and social sciences with at least 9 units of the latter at the upper division level and containing at least one two-quarter sequence from an approved list of courses.

Beyond satisfaction of the minimum requirements for the B.S. degree, the student follows one of three basic paths in selecting his major program. He may elect the General Electrical Engineering and Computer Sciences program in which he will receive an introduction to a large number of the areas outlined above. He may plan his curriculum in one of the four main programs in the Department of Electrical Engineering and Computer Sciences: electronics, systems, computer sciences, and bioelectronics. Or he may plan an individual program to suit his special needs or background.

General Electrical Engineering and Computer Sciences Program

The lower division program contains Physics 4A through 4C, Mathematics 1A through 1C, Engineering 1, 17, and 45, about 15 units of humanities and social science, and about 40 units of electives. It is recommended that part of the elective units be taken in engineering, physical or life science, mathematics and statistics so as to strengthen and broaden the background and to satisfy some of the requirements in these areas. The upper division program contains a balanced selection of courses in electric circuits, electronics, systems analysis, electromagnetic fields, communication and control theory, computer systems and programming, dynamics, thermodynamics,

* Students with a special objective as approved by their advisers and the department Undergraduate Study Committee may substitute for Engineering 45 one of the sequences or course from the following list: Biology 1A–1B–1C, Geology 5A–5B, Engineering 41, Physiology 1. If a sequence is substituted, the sequence must be completed to satisfy the Engineering 45 requirement.
and quantum mechanics. A detailed listing of recommended courses can be found in the Announcements of the College of Engineering.

Programs in Specific Areas

In order to provide a choice of well-integrated programs for the student who has clearly defined interest in one of the major areas of Electrical Engineering and Computer Sciences, the department offers four programs of study in the following general areas:

Electronics. For students whose interests fall into areas such as solid state electronics, cryogenic electronics, integrated circuits, plasmas, electron beams, microwave electronics, quantum electronics, optical electronics, and super-conductivity, energy conversion.

Systems. For students whose interests fall into areas such as networks, control theory, information theory, communication theory, finite-state systems, mathematical programming, system theory, and large-scale systems.

Computer Sciences and Engineering. For students interested in machine organization and logical design, programming systems and languages, digital devices and circuits, heuristic programming and artificial intelligence, switching and automata theory, algebraic theory of machines, mathematical theory of languages, data structures, coding theory, pattern classification, and learning systems.

Bioelectronics. For students interested in animal control systems, physical modeling of neural systems, application of circuit and system techniques to living systems, and ecological systems.

GRADUATE PROGRAM

To prepare the graduate student for work in the rapidly developing fields of electrical engineering and computer sciences, the department's program emphasizes fundamentals, yet provides a wide selection of courses and seminars and a reasonable amount of freedom for meeting degree requirements. There is no single required sequence of courses. Programs are designed by consultation between the student and his faculty adviser.

Graduate degree programs are available as preparation for research and teaching (Master of Science and Doctor of Philosophy), and for careers in design, development, and management (Master of Engineering and Doctor of Engineering). The Master of Science program requires about one year of study. About three additional years are usually required for the Doctor of Philosophy. The Master of Engineering degree requires five quarters of study and includes a minor in a technical subject outside the major and a second minor in a nontechnical subject such as law, business administration, etc. The Doctor of Engineering program, of about two years duration, builds on the course work for the Master of Engineering and requires a one-year internship in a design and development organization. Students with either a B.S. or an M.S. who intend to study for the D.Eng. should apply first for the M.Eng. program.

A detailed description of the available fields of graduate study in electrical engineering and computer sciences is given in the Announcement of the College of Engineering. For further details on graduate programs and procedures, see the "Electrical Engineering and Computer Sciences Graduate Orientation Notes," available from the Electrical Engineering and Computer Sciences Office for Graduate Student Matters, 332 Cory Hall.

ENGINEERING SCIENCE

The student in engineering science studies in one of several areas where engineering closely interacts with the natural sciences, mathematics, statistics, or medicine. Students in this program may choose to prepare for graduate study in the engineering
fields, the natural sciences, or medicine. Graduate programs in engineering science are offered by the individual engineering departments.

**PROGRAMS FOR THE BACHELOR'S DEGREE**

The undergraduate Engineering Science curriculum is multidepartmental and is administered by the Engineering Science Committee. Admission to the engineering science curricula requires a grade-point average of 2.75 or better. This average must be maintained in the lower division. A grade-point average of 2.5 or better must be maintained in the upper division. All Engineering Science programs must include 27 units of social science and humanities courses, of which 9 units must be of upper division level.

**Lower Division**  
Required: (for all upper division programs in engineering science)  
Mathematics 1A–1B–1C, 51A–51B–51C; Chemistry 1A–1B–1C (except Engineering Mathematics–Mathematical Statistics); Physics 4A–4B–4C–4D–4E (Engineering Mathematics–Mathematical Statistics requires Physics 4A–4B–4C); English 1A or Rhetoric 1A; technical electives, 8 units which must include Biology 1A–1B–1C for those in bioengineering, Geology 5A–5B for those in engineering geoscience.

**Upper Division**  
All Engineering Science programs must include 24 units of upper division engineering courses (required upper division engineering courses may be included).

Particular requirements of the various options in the engineering science program are described below. The *Announcement of the College of Engineering* should be consulted for full details.

**Bioengineering.** Required: Chemistry 8A–8B, 14; Biochemistry 102; Medical Physics 102A–102B. Electives must include: 8 units of upper division mathematics; an upper division course in mechanics; an upper division course in fluid mechanics.  
*Note for premedical students:* Zoology 105 is required; foreign language requirements of medical schools should be taken into account.

**Engineering Geoscience.** Required: Physics 105A or Mechanical Engineering 103; Physics 110A–110B, Mathematics 121A–121B; Geology 150; Geophysics 122A–122B; a course in fluid mechanics and a course in continuum mechanics; electives which must include: (a) 4 units of upper division courses in geology or geophysics; (b) an upper division course in statistics; (c) for those who did not take in the lower division a course in materials such as Engineering 45, an upper division course dealing with materials; (d) a course in thermodynamics.

**Engineering Mathematics or Mathematical Statistics.** Required: Mathematics 112, 120A–120B–120C or three courses from Mathematics 104A–104B, 105, 185; Statistics 134A–134B; electives, which must include: at least four upper division courses in mathematics or statistics; sufficient units of physical or life sciences so that total is 24 units including Physics 4A–4B–4C.

**Engineering Physics.** Required: Mathematics 120A–120B–120C; Physics 110A–110B, 137A–137B–137C; a two-quarter sequence in mechanics or dynamics; a three-quarter sequence in either materials science (courses in statistical mechanics, solid state physics, and continuum mechanics) or physical chemistry (courses in physical chemistry and chemical thermodynamics); an upper division laboratory course is also required.

**PROGRAMS FOR GRADUATE DEGREES**

Students with a B.S. degree in fields other than engineering, as well as those with a B.S. degree in engineering, may be eligible for the M.S. and Ph.D. degrees in engineering science. Programs of study and research leading to a graduate degree in engineering science are offered by all of the engineering departments. These programs emphasize the theoretical principles of mathematics, chemistry, physics, geology, and
biology on which developments in engineering and the applied sciences are based. Examples of special programs are bioengineering and ocean engineering; flexibility exists for developing other programs.

For those students interested in applying their engineering background to the solution of specific environmental problems, graduate study is strongly recommended. At the present time it is possible to undertake graduate study in programs concerned with water quality management, solid waste management, ocean engineering, and urban transportation planning in the Department of Civil Engineering, with some aspects of air pollution control in the Departments of Mechanical Engineering and Civil Engineering, and with radiation safety in the Department of Nuclear Engineering.

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Industrial engineering and operations research is a modern field of systems design, analysis, and control which is concerned with integrated systems of men, machines, and material and their interaction with their environment. Increased emphasis is placed on applications in socio-engineering, such as water resources management, transportation systems, pollution and waste disposal systems, and highway accident prevention, as well as the classical studies of production automation, inventory control, scheduling, systems reliability, engineering economics, incentives, organization, and man-machine systems.

The undergraduate in Industrial Engineering and Operations Research receives broad training in engineering fundamentals, principles of economics and advanced mathematics and statistics in order to prepare him for elective sequences which stress the construction of systems models, the role of the human being in these systems, and the related mathematical methods of optimization and control. A unified core program is offered for both students who wish to pursue the professional aspects of the field, and for those who, after further education at the graduate level, wish to engage in teaching and research. In order to satisfy the needs of students with diverse objectives, considerable flexibility in planning individual programs is provided.

CURRICULUM FOR THE BACHELOR'S DEGREE

A total of 180 units is required, including:

Lower Division  Required: Mathematics 1A–1B–1C, 51A–51B–51C; Chemistry 1A–1B; Physics 4A–4B–4C–4D–4E; Engineering 1, 17, 45; 4 units of an Engineering, Physical, or Biological Sciences elective, 23 units of electives.°

Upper Division  Required: Engineering 102; Industrial Engineering and Operations Research 120, 162, 170, 150, 180, 154 or Electrical Engineering and Computer Sciences 153; Mechanical Engineering 111 or 105A, and 134; Electrical Engineering and Computer Sciences 100A; Statistics 134A–134B, 147; 41 units of electives.°

° Electives: (1) Must include sufficient total units in social science and humanities so that the total of such courses in the lower and upper divisions is at least 27. The 27 units must include a two-quarter sequence from an approved list and must include at least 9 units of upper division courses. (2) Must include at least 18 units of upper division courses in engineering, science, mathematics, or statistics, of which at least 7 units must be in courses given by the Department of Industrial Engineering and Operations Research. (3) Must be chosen to satisfy one of the following: (3-a) (primarily for students intending to practice the profession of Industrial Engineering) Business Administration 120, Industrial Engineering and Operations Research 172, and a suitable technological sequence of at least two courses as approved by the student's adviser; (3-b) (primarily for students intending to pursue operations research at the graduate level) Mathematics 104A, and two of Industrial Engineering and Operations Research 164, 166, 167, or Statistics 169; (3-c) for students wishing to specialize in ergonomics and man machine systems: Electrical Engineering and Computer Sciences 119 or 124, Industrial Engineering and Operations Research 174, and one of Physiology 132, Psychology 130, 125 or Physical Education 105A–105B. (3-d) for students wishing to specialize in human and organizational aspects of Industrial Engineering: Industrial Engineering and Operations Research 171, Industrial Engineering and Operations Research 172, and two of Industrial Operations Research 176 or Business Administration 150, Psychology 181, Sociology 129, Business Administration 151. (3-e) (primarily for students interested in computer applications) Industrial Engineering and Operations Research 154, Electrical Engineering and Computer Sciences 153, Mathematics 128A, and one of Interdepartmental 114, Electrical Engineering and Computer Sciences 154, or Mathematics 128B.
To aid the student in the selection of electives, the lists of suggested or recommended courses and other information are provided below, grouped by field:

**Industrial Engineering.** A technological sequence in one of the following areas is acceptable: Manufacturing—Mechanical Engineering 102A and one of Mechanical Engineering 121, 123. Construction—Civil Engineering 180 and 193. Transportation—Civil Engineering 170 and 171. Petroleum—Mechanical Engineering 148A–148B. Some recommended electives are courses 153, 154, 164, 176, Statistics 161, 166.


**Human Factors in Technology.** Electrical Engineering and Computer Sciences 153, 154; Interdepartmental Studies 108, 120, 129; Business Administration 150, 151, 154; Psychology 104, 120, 121, 180, 181, 183A–183B.

**Computer Applications.** Computer Sciences 103, 106, 110, 140, 142, Electrical Engineering and Computer Sciences 159.

**GRADUATE PROGRAMS**

Graduate programs leading to the M.S., M.Eng., Ph.D., and D.Eng. are offered in three interrelated areas of study.

**Industrial Engineering.** This program has been developed to meet the needs and interests of engineers and scientists wishing to enhance their competence in industrial, service and public systems design, analysis and operation, thus preparing students for administrative positions.

**Operations Research.** This program prepares the student for advanced work in the theory of systems science. The development of quantitative model structures and necessary methods of analysis and optimization are emphasized.

**Human Factors in Technology.** This program includes engineering psychology, man-machine systems design, socio-technical systems and analysis and organizational studies and their civil and industrial applications.

Undergraduates from scientific disciplines other than engineering may be accepted into these programs. A master's degree may be earned by thesis or by comprehensive examination. Doctoral degrees require oral examination in the major and two minor fields followed by submission of a thesis demonstrating ability to conduct independent advanced research. Graduate research facilities are available in the Human Factors in Technology Laboratory, and in the Operations Research Center.

The department requires all graduate applicants to submit Verbal and Quantitative Aptitude scores of the Graduate Record Examination. Further information on graduate programs may be obtained from the Industrial Engineering and Operations Research Office, 4135 Etecheverry Hall and in the Announcement of the College of Engineering.

**MATERIALS SCIENCE AND ENGINEERING**

The Department of Materials Science and Engineering administers an undergraduate program in materials science and graduate programs in materials science and engineering geoscience. (The undergraduate program in engineering geoscience is part of Engineering Science; page 199.)

Materials science deals with natural and man-made materials—their extraction, development, and characterization for uses particularly in advanced applications such as solid-state electronics, atomic energy, and aerospace industries. A student in the materials science and engineering curriculum is provided a basic background in chemistry, physics, and engineering and applies this background to a field of specialization:
ceramic engineering, extractive metallurgy, or physical metallurgy.

Engineering geoscience applies the discoveries and knowledge of mathematics, statistics, physics, chemistry, and the geosciences to our total environment: the solid earth, the oceans, the atmosphere, and space. The program provides education in the fundamental subject matter necessary for engineering occupations in mining exploration and exploitation, petroleum exploration, planetary exploration, marine geophysics, and engineering geophysics.

Ceramic Engineering

The ceramic engineer studies the physical and chemical properties of the raw materials and products of the ceramic industry and fundamentals of ceramic processing. Ceramics are inorganic nonmetals which are subjected, either in their production or use, to high-temperature environments. Such materials include rocket nozzles, electrical insulators, precision molds for metallurgical industry, and porcelain and glass of all types. Ceramic engineers work not only in the industries producing ceramic products but also in industries which make extensive use of ceramic materials—such as aerospace, nuclear, and electrical.

Metallurgy

Metallurgy is the science and art of processing and utilizing metals and alloys. The field has two main areas of specialization.

Extractive Metallurgy.  Studies of the scientific and engineering principles utilized in recovering metals from their ores and in refining them to the desired purity. The subject includes mineral processing as well as smelting, leaching and electrochemical methods of extracting and refining metals and requires using the most recent advances in chemistry and physics.

Physical Metallurgy.  Primarily studies the relationships between the chemical and physical structure of materials and their properties. The improvement and control of properties of materials for advanced applications is a broad field within which primary emphasis can be directed toward fundamental physics, chemistry or engineering. Because of the ever-increasing demand for improved or better characterized materials, fundamental and applied research in the field is extremely active, providing a wide choice of rewarding career opportunities.

CURRICULUM FOR THE DEGREE AND ITS PROGRAMS

Students in all programs in materials science and engineering must complete a total of 180 units.

Lower Division  Required: Mathematics 1A–1B–1C, 51A–51B–51C; Chemistry 1A–1B; Physics 4A–4B–4C–4D–4E; Engineering 1, 36, 45; 28 units of electives.  Note: Physics 4E and 8 units of mathematics, if not taken in the lower division, may be taken in the junior year without any delay in progress toward the degree provided a total of 90 units has been completed in the first two years.

Upper Division  Required: Civil Engineering 110, 130; Electrical Engineering and Computer Sciences 101**; Materials Science and Engineering 100, 101, 102, 103, 107, 108, 109, 109L, 121, 121L, 141, 141L, 142, and 41 units of electives.  Note:
The following are sequences of courses selected to aid the student in the choice of technical electives in some possible fields of interest.

Options  Students interested in either the metallurgy or ceramic engineering options

* The program includes 69 units of elective courses at least 28 of which must be in upper division technical courses. Electives should be selected so as to satisfy the College requirement of 27 units in humanities and social sciences and to meet individual educational objectives. The 27 units must include a two-quarter sequence from an approved list and at least 9 units must be completed in upper division courses.

** May be satisfied by Engineering 17 taken in the lower division.
should state their preference so that an appropriate faculty adviser can be assigned. A variety of elective course programs are available in either option.

GRADUATE STUDY IN MATERIALS SCIENCE

Qualified holders of the bachelor's degree in fields such as ceramic engineering, metallurgy, physics, chemistry and various fields of engineering can all successfully undertake graduate study in materials science.

The graduate program emphasizes research. Techniques such as transmission electron microscopy, field ion microscopy, X-ray diffraction topography, mass spectrometry, precision electrical conductivity measurements, micro-probes X-ray emission spectroscopy, differential thermal analysis, precision calorimetry and cryogenic and high temperature mechanical testing are used for fundamental characterization of materials. Research topics include study of the mechanical, chemical, surface, thermodynamic, electrical, and magnetic properties of materials, and study of the kinetics, thermodynamics, and simulation of the processes by which materials are produced.

GRADUATE STUDY IN ENGINEERING GEOSCIENCE

This program is directed toward graduate education and research in applied geophysics. The course of study leads to the M.S., Ph.D., and D.Eng. degrees and is designed for students with undergraduate degrees in geophysics, engineering geology, physics, or mathematics. An M.S. program is available for persons currently in industry or government who wish to undertake graduate work in the geosciences. The program currently stresses study in mineral and oil exploration, engineering seismology, and applications of geophysical techniques in geological engineering and mapping, ocean engineering, and ground water hydrology.

Through the cooperation of the Department of Geology and Geophysics, students are encouraged to take courses in that department to complete requirements for the major Engineering Geoscience. Courses in the Department of Geology and Geophysics that may constitute part of the major in Engineering Geoscience are: Geophysics 121A–121B, 122A–122B, 204A–204B, 208, Geology 106, and 150.

MECHANICAL ENGINEERING

Mechanical engineering includes the science and art of the formulation, design, development, and control of systems and components involving thermodynamics, mechanics, fluid mechanics, mechanisms and the conversion of energy into useful work. The mechanical engineer requires a thorough preparation in mathematics, physics, chemistry, manufacturing processes, properties of materials, mechanics, fluid mechanics, thermodynamics, as well as intensive design and laboratory experience. His program of study includes basic subjects common to all engineering fields, fundamental subjects important to all mechanical engineers and specialization in one or more phases of mechanical engineering. Undergraduate specialization is provided in the choice of technical electives which may be selected from the subject areas of applied mechanics, automatic controls, electro-mechanical, energy conversion, fluid mechanics, heat and mass transfer, materials processing, mechanical design, naval architecture, nuclear, refrigeration and cryogenics, thermodynamics, and aerospace, biomedical, environmental and petroleum engineering. The curriculum has recently been revised to make it one of the most flexible in the nation.

Because of the widening range of technical problems and the limited amount of specialization available in the undergraduate curriculum, qualified students should consider graduate study to enlarge their scientific and technological capability. Further details on undergraduate and graduate fields of emphases in mechanical engineering are available in the ANNOUNCEMENT OF THE COLLEGE OF ENGINEERING.
CURRICULUM FOR THE BACHELOR'S DEGREE

A total of 180 units is required, including:

**Lower Division** Mathematics 1A–1B–1C, 41, 51C; Chemistry 1A–1B; Physics 4A–4B–4C–4D; Engineering 1, 28 or 29, 36, 45; 36 units of electives.**

**Upper Division** Mechanical Engineering 102A–102B, 104A–104B, 105A–105B, 106A–106B, 107A–107B; Electrical Engineering and Computer Sciences 100A–100B; Civil Engineering 130; 44 units of electives.**

**Mechanical Engineering Options** The following groups of technical electives are presented to aid undergraduates to focus their choices on specific professional goals. Each group contains more courses than can be taken within the standard allowance of technical electives, and there is no requirement that all electives selected be from any single group.

- **Aerodynamics and Fluid Mechanics.** Engineering 116, 117; Mechanical Engineering 133, 134, 147, 151, 159, 162, 164, 175; Civil Engineering 138, 166A; Physics 132, Astronomy 101.
- **Applied Mechanics.** Engineering 115, 116, 117, 118; Mechanical Engineering 133, 134, 162, 172, 173, 174, 175, 282A, 185; Mathematics 104A.
- **Automatic Controls.** Engineering 116; Mechanical Engineering 133, 134, 135, 172, 175; Electrical Engineering and Computer Sciences 119, 128A–128B.
- **Energy Conversion.** Engineering 117; Mechanical Engineering 110, 145, 146, 147; Physics 132.
- **Environmental Engineering.** Engineering 150, 151, 152; Mechanical Engineering 110, 142, 146, 173, 174, 198; Civil Engineering 140; Geography 146; Architecture 110.
- **General Mechanical Engineering.** Engineering 117; Mechanical Engineering 133, 134, 147, 151, 159, 185.
- **Heat and Mass Transfer.** Engineering 117; Mechanical Engineering 151, 155, 159.
- **Materials Processing and Manufacturing Management.** Mechanical Engineering 110, 121, 123, 133, 151; Industrial Engineering and Operations Research 120, 154, 166, 176, 180; Business Administration 140, 141, 142, 154; Economics 103A–103B, 121A–121B.
- **Naval Architecture.** Naval Architecture 151, 152A–152B, 153, 154A–154B; Civil Engineering 131, 138; Mechanical Engineering 133, 159, 162, 175; Mathematics 120A–120B–120C.
- **Nuclear Engineering.** Nuclear Engineering 102, 165; Mechanical Engineering 151, 155, 159; Physics 124, 137A–137B; Mathematics 120A–120B–120C.
- **Petroleum Engineering.** Mechanical Engineering 148A–148B; Civil Engineering 116, 118; Chemistry 110A–110B.
- **Refrigeration and Cryogenics.** Mechanical Engineering 110, 141, 142, 151, 155, 159.

* All students who have a strong interest in either theoretical studies or computer applications should take Mathematics 51A–51B in place of Mathematics 41.

** Electives include: (a) courses for the social sciences and humanities requirement of which students are expected to complete a total of 27 units; the 27 units must include a two-quarter sequence from an approved list and at least 9 units must be completed in upper division courses; (b) also include 20 units of upper division technical electives in engineering, physical sciences, mathematics, or statistics. To provide added depth in one or more areas of mechanical engineering, all students must complete at least 12 units of upper division mechanical engineering courses (out of the 20 units required).
GRADUATE STUDY

Both master’s and doctoral programs are available, and the student may choose either a scientific emphasis in particular areas or integrated studies directed to professional objectives. Specialization is offered in the following areas: (1) applied mechanics, (2) fluid mechanics, (3) mechanical design, (4) thermal systems. Details on topics of study within each area of specialization are available from the ANNOUNCEMENT OF THE COLLEGE ENGINEERING.

NAVAL ARCHITECTURE

The Department of Naval Architecture offers courses in the fundamentals of marine-vehicle design and the theories of ship structures and ship hydrodynamics.

There is no undergraduate major, but undergraduate courses are offered, and students interested in naval architecture may elect courses in this department as an option within the mechanical engineering major, described on page 238.

Graduate study is offered in the areas of ship structures and ship hydrodynamics, leading to both the master’s and doctor’s degrees. The graduate student normally must take Naval Architecture 240A–240B–240C, and 241A–241B–241C. Other courses are chosen according to the student’s background and objectives. With sufficient undergraduate preparation, a student may earn a master’s degree in three quarters of study. Further details on graduate programs (including the program in ocean engineering) are available from the department upon request.

NUCLEAR ENGINEERING

The Department of Nuclear Engineering offers a broad program of instruction and research at the graduate level in the applied aspects of nuclear processes and nuclear radiations. The department does not have an undergraduate curriculum, but it does offer several undergraduate courses for students in other engineering curricula as well as undergraduate double major programs (see below).

Graduate study leading to the masters’ and doctor’s degrees is offered with the following fields of emphasis: nuclear reactor theory and reactor engineering in nuclear fission, thermal and fast-breeder reactors for applications in stationary power plants, propulsion, and for process heat; nuclear fuel management studies; chemical and material aspects of nuclear technology; radiation protection including the biological and environmental effects of nuclear radiations; direct conversion of thermal energy in thermonuclear and magnetohydrodynamic devices; thermonuclear fusion.

Programs for the master’s and doctor’s degrees include, in addition to course work, direct participation in research under the supervision of faculty members of the department. For details on degree requirements please consult the ANNOUNCEMENT OF THE COLLEGE OF ENGINEERING and the Colleges and Schools section of this catalogue.

ENGINEERING: SPECIAL PROGRAMS

Double Major Programs of Study

The Double Major Program is designed for students who wish to undertake study in two major areas of engineering in order to qualify for employment in either field or for positions in which competence in two fields is required. Students may prepare for a bachelor’s degree combining study in any of the following areas:

- Materials Science and Engineering/Civil Engineering
- Materials Science and Engineering/Electrical Engineering and Computer Sciences
- Materials Science and Engineering/Mechanical Engineering
Materials Science and Engineering/Nuclear Engineering
Nuclear Engineering/Civil Engineering
Nuclear Engineering/Electrical Engineering and Computer Sciences
Nuclear Engineering/Industrial Engineering and Operations Research
Nuclear Engineering/Mechanical Engineering.

These curricula include the core courses in each of the major fields. They involve normal course loads and can be completed in four years. Both majors are shown on the student's transcript of record. For complete information about programs of study under the Double Major see the ANNOUNCEMENT OF THE COLLEGE OF ENGINEERING.

Environmental Engineering

The College of Engineering offers a series of courses in environmental engineering open to all junior and senior engineering students and to qualified students in other fields. The courses are intended to provide a sound introduction to the identification of environmentally related problems in such areas as air pollution, water pollution, solid waste disposal, and nuclear power generation.

These courses, listed on page 209 of this catalogue as the Engineering 150 series, are taught on an interdepartmental basis and bring together a number of faculty with expertise and interests in one of the problems.

For those students interested in applying their engineering background to the solution of specific environmental problems, graduate study is strongly recommended. At the present time it is possible to undertake graduate study in water quality management, solid waste management, ocean engineering, and urban transportation planning in the Department of Civil Engineering; air pollution control in the Departments of Mechanical Engineering and Civil Engineering; and radiation safety in the Department of Nuclear Engineering.

System Science and Public Systems

The interdepartmental undergraduate program in Systems Science and Public Systems is intended to prepare students for professional work or graduate study in a disciplinary area that is certain to acquire increasing importance in the years ahead. Besides providing a foundation in systems science, including the mathematical modeling, analysis, design and simulation of large and complex systems, the program involves the study of one or more types of public systems, appropriate to the interests of the student and the department of the college in which he is enrolled. Among the possible types of public systems are the following: urban systems, energy systems, health care systems, political systems, justice and legal systems, information systems, transportation systems, economic systems, communication systems, social systems, educational systems.

A student enrolled in the SSPS degree program is enrolled in one of the departments of the College of Engineering, e.g., Civil Engineering, Electrical Engineering and Computer Sciences, Industrial Engineering and Operations Research, Materials Science and Engineering, or Mechanical Engineering. He is expected to satisfy the following:

1. College requirements applying to all students of the College of Engineering.
2. Departmental requirements for SSPS students, including a minimum of 30 units of upper division courses in the department, and other requirements.
3. SSPS Program requirements, including four core courses in systems science, 20 units of systems science courses, 20 units of courses in public systems, and 6 units of 198 or 199 project courses.

More specific information about the SSPS Program is available from the Office of the Dean of Engineering, or any of the participating departments.

Three hours of lecture and one hour of consultation per week. Prerequisite: Mathematics 1A or 11A (may be taken concurrently). Students will not be given credit for both Engineering 1 and Computer Science 2. General purpose digital computers. The concepts of algorithm, computer languages, flow charts. Information storage, processing, retrieval. FORTRAN and ALGOL. Applications of computers to numerical and statistical problems, root finding, simultaneous equations, correlation. Nonnumerical applications, alphabetic data processing, sorting, matching.

The Staff (Mr. Morton in charge) (F, W, Sp)

2A–2B–2C. Contemporary Technology. (4-4-4)

Four hours of lecture and demonstration per week. Open without prerequisites to all students, but designed for those not specializing in engineering who have already had all or part of Contemporary Natural Science 1. Any one or more quarters qualify for credit toward the natural sciences requirement of the College of Letters and Science.

2A. Technology and Society. Role of technology in the solution of social problems. Case studies of examples of technological systems such as communications, data processing, energy generation and distribution, materials, and military technology. The place of technology in general education. Introduction to technical literature. Mr. Smith (F)

2B. Resources Management and Engineering. Earthquakes, ocean resources, pesticides, water quality and supply, space exploration and construction, geologic hazards, urban planning, public response to engineering problems. (W)

2C. Raw Materials and Environmental Science. Study in depth of one aspect of technology, the environment: air, underground, underwater, space. (Sp)

3. Applications of Nuclear Energy. (4)

Four hours of lecture per week. Prerequisite: none. Not open to students majoring in engineering. Radioactivity and nuclear reactions; applications of radioisotopes in medicine and industry; radiation effects and dosimetry; reactor principles; licensing and effluent release in power reactors; non-military applications of nuclear explosives; controlled fusion research; particle accelerators; nuclear energy in the future. (F)

Mr. Prusin, Mr. Ruby (F, Sp)

17. Introduction to Electronics. (4)

Three hours of lecture on one hour discussion per week. Prerequisite: Physics 4B. An introductory course in the principles of electronic circuits and systems. Circuit fundamentals, important passive and active electronic devices, active circuits and system building blocks. Analysis of the important internal and external characteristics of electronic clocks used in analog and digital systems.

Mr. Oldham, Mr. Schwarz (F, W, Sp)

28. Introduction to Engineering Design. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: Mathematics 1A—may be taken concurrently. Importance of graphical presentations in the engineering design process. Freehand sketching in preliminary design. Fundamentals of orthographic projection with applications to three-dimensional design problems in various branches of engineering. Graphical analysis and presentation of data and the results of engineering calculations. Graphical mathematics and empirical equations. Computer graphics.

Mr. Hauser, Mr. Cunningham, (F, Sp)

29. Introduction to Engineering Systems. (4)

Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: Mathematics 1C, Physics 4A, Chemistry 1A. Analysis of professional engineering problems; students formulate analytical models, apply physical principles and hypotheses, and draw conclusions from the models. Technical content based upon first year science and mathematics; emphasis upon engineering problem solution. Mr. Hauser (W)


Three hours of lecture per week. Prerequisite: Physics 4A and Mathematics 1C. A vectorial treatment of the principles of statics of particles and rigid bodies. Application to problems of equilibrium of two-dimensional and three-dimensional systems. Work and potential energy, the principle of virtual work, stability of equilibrium.

Mr. Berger, Mr. Goldsmith, Mr. Hurlbut, Mr. Robben, Mr. Schaaf (F, W, Sp)

41. Machine and Assembly Languages. (4)

Three hours of lecture per week plus individual computer usage. Prerequisite: course 1 or one-quarter course in FORTRAN. Students will not be given credit for both Engineering 41 and Electrical Engineering and Computer Sciences 153, or for both Engineering 41 and Computer Science 103. Number representations in computers. Machine language programming. Assembly language programming. Rudi­mentary compiling. Loaders. File processing. Rudy­mentary 1/O. Debugging techniques.

Mr. Gill (F, W, Sp)

45. Properties of Materials. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Physics 4B. Applications of basic principles of physics and chemistry to the selection and use of engineering materials, with particular emphasis on mechanical behavior of metals, concrete, and ceramics and upon the electrical properties of semiconducting materials.

Mr. Parker, Mr. Firtz, Mr. Williamson, Mr. Muller (F, W)

47. Supplementary Work in Lower Division Engineering. (1–3)

Prerequisite: limited to students who must make up a fraction of a required lower division course. May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in a lower division engineering course may complete the work under this heading. May be repeated for credit.

Mr. Zuckay (F, W, Sp)

§91A. Topics in Electrical Engineering and Computer Sciences. (1)

One hour of lecture per week. Prerequisite: consent of instructor. Limited to freshman electrical engineering and computer science students in the "cluster" advising program. Topics of interest to EECS freshmen on the role of the electrical engineer.

Mr. Wiegel (W)

§91B. Computer Programming Seminar. (1)

One hour biweekly and individual study. Prerequisite: course 1 or 101 or Computer Science 2 or equivalent; consent of instructor. Offered on the passed/not passed basis only; may be repeated three times for credit. Individual study and practice in
computer programming, to maintain and extend pro-
gramming skills, learn new programming languages,
or explore applications to other course work, optional
problems, or individual ideas. Progress reports to
instructor. Biweekly meetings.
Mr. Morton, Mr. Wiesner, Mr. Pollack (F, W, Sp)

Upper Division Courses

100. Materials and Methods Used in
Manufacturing. (3)
Three 1-hour lectures per week. Prerequisite: not
to open to students in Engineering. Introductory study
of the materials and production processes of impor-
tance in contemporary technology, with demonstra-
tion of basic processes such as machining, forming,
casting, and welding. Mr. Pickus (F, W)

101. Applications of Computers. (4)
Three hours of lecture per week. Prerequisite: Mathe-
ematics 1IC. Students who have completed En-
gineering 1 or Computer Science 2 may not receive
credit for Engineering 101. Large-scale digital com-
puters. Programming, flow-charting, computable pro-
cedures. Comprehensive presentation of one problem
oriented language; survey of other compiler lan-
guages. Machine solution of complex problems, sur-
vey of computer applications. Introductory course
for upper division students interested in using com-
puters. The Staff (F, Sp)

102. Introduction to Operations Research. (4)
Three hours of lecture and two hours of labora-
tory per week. Prerequisite: Mathematics 31A.
General introduction to the models and techniques
of operations research as they pertain to engineer-
ing system problems. Examples will be drawn from
the various engineering disciplines to illustrate tech-
niques, models, and optimization of engineering
systems.
Mr. Shephard, Mr. Jewell, The Staff (F, W, Sp)

110. History and Impact of Technology on Society. (3)
Two hours of lecture and one hour of discussion
per week. Not acceptable as a technical elective in
Engineering. Growth of technological societies; the
industrial revolution; recent history with stress on the
past-war period; current attitudes and concerns of
society with respect to technology; the role of scien-
tists and engineers in governmental decision making;
case studies of contemporary problems.
Mr. Whinnery, Mr. Stonebraker (Sp)

111. System Simulation. (3)
Three hours of lecture per week. Prerequisite:
course 1 or equivalent. An introduction to systems
analysis by simulation. Nomenclature. Generation of
pseudo-random numbers. Fortran as a simulation
language. Study of one discrete (GPSS) and one
continuous (CSMP) simulation language. Validation of
simulation results. At least one extensive complex
simulation example. Mr. Stonebraker (Sp)

115. Methods of Linear Algebra. (3)
Three hours of lecture per week. Prerequisite: Mathe-
ematics 51A. Methods of solving systems of linear
equations; application of orthogonal transformations
to the design and analysis of engineering systems.
Mr. Hoyt (F, W)

117. Methods of Engineering Analysis. (3)
Three hours of lecture per week. Prerequisite: Mathe-
ematics 51C. Methods of theoretical engineering
analysis; techniques for analyzing partial differen-
tial equations and the use of special functions
related to engineering systems.
Mr. Berger, Mr. Schaaf, Mr. Pagni (F, W, Sp)

118. Application of Numerical Methods to
Engineering Problems. (3)
(Formerly ME 172B)
Two hours of lecture and one 3-hour laboratory
per week. Prerequisite: Mathematics 51C. Application
of digital computers to solution of engineering
problems, using computer language, by compiler languages, of linear
algebraic equations, roots of polynomials, interpolat-
ing polynomials, ordinary differential equations, error
analysis. Digital computer time available for course
work.
Mr. Auslander (W)

150. Environmental Engineering: Air Pollution. (3)
Three 1-hour lectures per week. Prerequisite: Chem-
istry 1B, Physics 4C, Math 51C. An introduc-
tion to the technology of air pollution dealing with
air pollutants, effects, sources, combustion processes,
control technology, and abatement.
Mr. Sawyer, Mr. Thomas (Sp)

151. Environmental Engineering: Water Pollution
Control. (3)
Three hours of lecture per week. Prerequisite: Chem-
istry 1B, Mathematics 51C, Physics 4C. An overview
of the environmental problems and tech-
nical solutions in the management of surface,
ground, and marine waters. Consideration is given
to water conditioning and to the nature, treatment,
and environmental efforts of municipal and indus-
trial wastewater.
Mr. Kaufman, Mr. Pearson, Mr. Shrock (F, W)

152. Environmental Engineering: Solid Waste
Management. (3)
Three hours of lecture per week. Prerequisite: Engi-
neering 45. Introduction to the practice and
issues of solid waste management. Technology of
collection, treatment, salvage, and disposal. Applica-
tion of systems analysis and operations research.
Institutional, legal, social, and environmental
aspects. Case studies.
Mr. Golute, Mr. Hurlbut (Sp)

153. Environmental Engineering: Consequences of
Nuclear Technology. (3)
Three hours of lecture per week. Prerequisite: Chem-
istry 1A–1B or Engineering 3 or Contemporary
Natural Science 1A–1B–1C, or equivalent. Power
demands and needs. Nuclear power: growth, advan-
tages, production and handling of radioactive and
thermal wastes. Reactivity; properties, biological
and ecological effects. Consequences and avoidabil-
ity of nuclear accidents. Reactor siting considerations:
demographical, geological, meteorological. Standards
and regulations. Unusual nuclear applications.
Mr. Kaplan (W)

160. Energy and Power. (4)
Four hours of lecture per week. Prerequisite: up-
per division standing in Engineering or Letters and
Science; Physics 4A, 4B; Mathematics 1A, 1B.
Sources, conversion, transmission, and requirements
for energy in human society, concentrating on elec-
tric power. Thermodynamic principles. Fossil fuel;
nuclear fission and fusion, and hydroelectric power
generation. Geothermal, tidal, and solar power. Di-
rect energy conversion. Ecological and social prob-
lems.
Mr. Birdsall, Mr. Branch, Mr. Grossman (W)
197. Supplementary Work in Upper Division Engineering. (1-3)

Prerequisite: limited to students who must make up a fraction of a required upper division course. May be taken only with permission of the Dean of the College of Engineering. Students with partial credit in an upper division engineering course may complete the work under this heading. (May be repeated for credit.) Mr. Zackay (F, W, Sp)

Graduate Courses

200. Applied Geophysics. (4)
Three hours of lecture per week and four afternoon field trips. Prerequisite: graduate or upper division standing in a technical field. Geophysical methods applied to mineral exploration, geological engineering, geological mapping and ground water hydrology. Seismic reflection and refraction, resistivity, magnetic, gravity, and electromagnetic surveying. Approximately two weeks and one field exercise will be devoted to each method. Mr. Morrison (F)

219. Service Failures and Analyses. (3)
Three hours of lecture per week. Prerequisite: at least two quarters of graduate study in engineering. This course is based upon case histories of actual service failures. It includes failures of metallic, ceramic, and plastic materials caused by mechanical or corrosive conditions. Failures are correlated with design factors and with the microstructure of the materials. Mr. Parker (Sp)

220. High Strength Steels. (3)
Three 1-hour lectures per week. Prerequisite: graduate standing in Engineering. A basic course correlating engineering properties with chemical composition and microstructure. The properties, application, treatments, and uses of engineering steels. Influence of fabrication methods and environmental factors on behavior of structural components. Mr. Zackay (Sp)

230A-230B. Engineering Analysis. (4-4)
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: Mathematics 51C. Methods of theoretical analysis of typical engineering systems. Application of complex variable theory, orthogonal expansions and special functions to solve partial differential equations arising in engineering problems. Mr. Grief, Mr. Carroll, Mr. Schaaf 230A (F); 230B (W)

230C. Engineering Analysis. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 230A-230B. Theoretical analysis of typical engineering systems by means of linear operators, linear integral equations, finite difference methods, perturbation methods, and asymptotic expansions. Mr. Berger (Sp)

230E. Engineering Analysis. (3)
Three 1-hour lectures per week. Prerequisite: course 230A or Mathematics 185 or Electrical Engineering and Computer Sciences 119 or Mechanical Engineering 117 or equivalent. The principal purpose of the course is to acquaint students with the use of the Fourier transform. Emphasis is placed on two dimensional transforms applied to problems of sampling, radiation, arrays and optics. The Hankel, Z, and Hilbert transforms are also developed and applied to linear systems under discussions. Mr. Bhattacharyya (F)

272. Application of Digital Computer Methods to Engineering Problems. (3)
Two hours of lecture and 1-3 hour laboratory per week. Prerequisite: knowledge of Fortran and an introductory course in basic numerical methods (e.g., ME 172B, Engineering 118). Application of digital computer techniques to the numerical solutions of partial differential equations with special emphasis to equations related to engineering systems, e.g., vibration studies, trajectories, aerodynamics, heat flow, elasticity; error analysis; stability of numerical methods. Mr. Holt (Sp)

290A. Radiation Effects in Semiconductors. (2)
Two hours of lecture per week. Prerequisite: Electrical Engineering and Computer Sciences 230 or Nuclear Engineering 220. The interaction of high energy particles with matter. Energy transfer mechanisms. Material effects. Review of relevant energy and temperature theory of semiconductors. Methods of defect observation in semiconductors. Models of important isolated defects. Models for heavy particle damage clusters. Ionization effects. Effects on semiconductor devices. Mr. Olander, Mr. Oldham (F)

290I. Techniques in Discrete Dynamic Systems Analysis. (4)
Three hours of lecture per week. Prerequisite: Civil Engineering 225A or Mechanical Engineering 223 or Applied Mechanics 273A; knowledge of computer programming. Analytical and numerical methods useful for analyzing complex discrete dynamical systems will be discussed. Emphasis on the use of modern computational techniques to obtain eigenvalues, response and stability, system response. Damped discrete systems and integration methods are included. Mr. Mote (F)

290J. Techniques in Continuous Dynamic System Analysis. (4)
Three hours of lecture per week. Prerequisite: Civil Engineering 225A or Mechanical Engineering 223 or Applied Mechanics 273A, knowledge of computer programming. Analytical and numerical techniques of solution in continuous dynamical systems will be discussed. Lectures discuss philosophy and basis of specific techniques, and problems emphasize their implementation. Discretization, eigenvalue problems, boundary value problems, and numerical optimization techniques will be explained. Mr. Mote (W)

298. Group Studies or Seminars. (1-8)
Advanced group studies or seminars in subjects which are interdisciplinary in the various fields of engineering or other sciences associated with engineering problems. Topics which form the basis of seminars will be announced at the beginning of each semester. Mr. Pask (F, W, Sp)

IDS 108. Computers and Society. (3)
See Interdepartmental Studies for the complete description of this course.

IDS 180. Economic and Biological Feedback Systems. (3)
See Interdepartmental Studies for the complete description of this course.

CHEMICAL ENGINEERING (See page 139)
CIVIL ENGINEERING

Lower Division Courses

10. Engineering Survey Measurements. (4)
Three hours of lecture per week. Prerequisite: Math 1A, 1B, 1C, CE 15 or E1 (may be taken concurrently). Standards, units, calibration; measurement of distance, elevation, angles; systematic and random error analysis in measurements; adjustment of measurements; weighting, principles of least squares, directions; traverse computations; horizontal and vertical curves.
Mr. Anderson, Mr. Moffitt (F, Sp)

15. Application of Computers in Civil Engineering. (2)
Two hours of lecture per week. Prerequisite: students who have completed Engineering 1 or Computer Science 2 may not receive credit for course 15. Introduction to digital computer programming. Computer solution of civil engineering problems.
Use of standard programs, subroutines and interpreting languages.
Mr. Chopra, Mr. Taylor, Mr. Wilson (F, W)

21. Plane Surveying. (4)
Two 3/4-hour lectures and one 3-hour laboratory per week. Prerequisite: Trigonometry. Not open to students in Engineering. Principles and practice of surveying, including use of tape, transit, level, sli-dade; calculations of traverse, areas, volumes, curves; stadia and plane table mapping.
Mr. Anderson, Mr. Moffitt (F, W, Sp)

Upper Division Courses

100. Control Surveys. (4)
Two 1/2-hour lectures and one 3-hour laboratory per week. Prerequisite: course 10; course 21 with approval of instructor. Lectures, laboratory instruction on vertical control, precise leveling; horizontal control; triangulation, trilateration, traverse; electronic distance measurements; least square adjustment of control survey observations; state coordinate system; astronomical observations for azimuth and latitude. Photogrammetry and supplemental control surveys are also presented.
Mr. Anderson, Mr. Moffitt (F)

101. Elementary Photogrammetry. (4)
Two 1/2-hour lectures and one 4-hour laboratory per week. Prerequisite: plane surveying or survey measurements, course 10, or consent of instructor. Nature of photogrammetry; precision cameras; geometry of photograph; ground control, flight planning; stereoscopy and parallax; radial line plot; mosaics; oblique photographs; stereoscopic plotting instruments.
Mr. Moffitt (W)

102. Route Surveying. (4)
Two 1/2-hour lectures and one 3-hour laboratory per week. Prerequisite: course 10. Simple, compound, reverse, and transition horizontal curves; vertical parabolic curves; reconnaissance, preliminary, and location surveys; computations of earthwork and related quantities; field work.
Mr. Anderson, Mr. Moffitt (Sp)

105. Higher Surveying and Geodesy. (3)
Two 1/2-hour lectures per week. Prerequisite: course 100. Methods of geodetic surveying; geodetic triangulation; geometry of spheroid; computation of geodetic position; figure of the earth; gravity observations; geodetic leveling.
Mr. Moffitt (W)

107. Airphoto Analysis and Interpretation. (4)
Two 1-hour lectures and one 4-hour laboratory per week. Prerequisite: senior standing in engineering or geology. Principles of photo reading, analysis and interpretation applied to soils, slopes, geological forms and structures, selection of materials for engineering construction.
Mr. Anderson (W)

110. Properties of Structural Materials. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Engineering 45 and course 130 (may be taken concurrently). Determination of properties of structural materials. Experiments for evaluating behavior under simple conditions.
Mr. Partz (W, Sp)

111. Character of Structural Materials. (4)
Three hours of lecture and three hours of laboratory per week. Prerequisite: 110 or equivalent. Principles relating internal structure to physical, chemical, and mechanical behavior of important structural materials such as hydraulic cements, concrete aggregates, soils, structural steel and aluminum alloys, wood and polymers. Mr. Mehta, Mr. Williamson (F)

113. Concrete and Concrete Materials. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 110 (may be taken concurrently). Composition and properties of concrete. Concrete materials. Proporioning of concrete mixes. Selected experiments on physical and mechanical properties of cement pastes, mortars, and concretes.
Mr. Polivka (W)

114. Soil Properties and Their Engineering Application. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 121. Selected lectures and experiments on physical and mechanical properties of soils and their application in design problems. Preparation of engineering reports on the results.
Mr. Houston (F, W)

115. Asphalt and Asphalt Mixtures. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: senior standing in civil engineering. Physical properties of asphalts, aggregates and their combinations; principles and practices in the design, construction, and control of asphalt mixtures; laboratory tests for asphalts, aggregates and mixture design including specimen preparation and stability and durability evaluation.
Mr. Monismith (F)

116. Introduction to Fluid Flow in Rocks. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 165A or Mechanical Engineering 105B (either of which may be taken concurrently). Theory of the basic properties of rocks that control the flow of fluids through porous media.
Mr. Witherspoon (W)

118. Engineering Geology. (2)
One hour of lecture and one 3-hour laboratory per week. Prerequisite: none. Minerals and rock types; principles of physical and structural geology; influence of geological features on engineering works. Field trips.
Mr. Brekke, Mr. Goodman, Mr. Witherspoon (F, Sp)

118L. Engineering Geology Field Trips. (1)
Laboratory to be arranged. Prerequisite: course 118 (should be taken concurrently). Field trips in addition to CE 118. Field trips to demonstrate principles and problems in engineering geology.
Mr. Brekke, Mr. Goodman, Mr. Witherspoon (F, Sp)
119. Introduction to Geological Engineering. (3)

Two hours of lecture and one 3-hour laboratory per week. Prerequisite: course 118, or Geology 5A, or consent of instructor. Geological and geophysical exploration of rock masses for civil engineering structures; application of geological data in engineering of underground openings, and dams, and reservoirs. Field trips to construction sites.

Mr. Brekke (W)

121. Soil and Foundation Engineering. (4)

(Formerly numbered 121A–121B)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 130. Soil formation and identification, Physical and mechanical properties of soils. Bearing capacity of soils and lateral earth pressures on structures. Site investigations, design of substructures, construction problems in foundation engineering.

The Staff (Mr. Mitchell in charge) (F, W, Sp)

122. Soil Mechanics and Foundation Design. (3)

Three 1-hour lectures per week. Prerequisite: course 121. Principles of foundation design; ultimate bearing capacity of soils; theory of consolidation and its applications in predicting the settlement of structures; allowable bearing pressures; methods of minimizing settlements; effect of settlement on structures; lateral pressures on walls.

Mr. Lysmer (F, Sp)

123. Soil Mechanics and Foundation Engineering. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: graduate standing in Civil Engineering or permission of instructor. Soil mechanics problems in foundation engineering. Selected topics in soil mechanics and experiments on physical and mechanical properties of soils, including their application in design problems.

Mr. Duncan, Mr. Houston (F)

128A. Structural Systems I. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: Architecture 120. Analysis and design of frame buildings; response to vertical and horizontal loading; approximate methods of proportioning roof, floor, wall, beam, and column elements in wood, reinforced concrete, and steel.

The Staff (F, W)

128B. Structural Systems II. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 128A. Analysis and design of multistory frame buildings. Approximate methods of proportioning long-span floor systems and special problems in design of high-rise buildings.

The Staff (W, Sp)

128C. Structural Systems III. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 128B. Analysis and design of long-span systems. Approximate methods for proportioning elements of frame, arch, cable, and shell systems.

The Staff (F, Sp)

129. Introduction to Industrialized Building Systems. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 133 or course 128B. Planning, design, production, and construction of industrialized building systems.

Mr. Bresler, Mr. Lin (Sp)

130. Mechanics of Materials. (4)

Three 1½-hour lectures per week. Prerequisite: Engineering 36. Elastic and ultimate resistance of materials; stress and deformation analysis for bars, shafts, and beams; combined stresses; columns; elements of design for wood and metal members.

Mr. Pister, Mr. Popov (F, W, Sp)

131. Introduction to Structural Analysis. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 130. Analysis of forces and displacements in statically determinate and indeterminate elastic structures by force and displacement methods. Formulation in matrix notation. Introduction to the plastic analysis of structures.

Mr. Eberhart, Mr. Clough (F, W, Sp)

133. Theory of Reinforced Concrete Design. (4)

Three hours of lecture and three hours of laboratory per week. Prerequisite: course 133. The analysis and design of reinforced concrete structures.

Mr. Baron, Mr. Raphael (F, Sp)

134. Elements of Metal Structures. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 134. Analysis and design of metal structural members, connections, and fabrication.

Mr. Bresler (F, Sp)

Advanced Structural Analysis. (3)

Three 1-hour lectures per week. Prerequisite: course 131, 133. Advanced topics in the design of structural systems in reinforced concrete, prestressed concrete, and composite materials. The design of typical floor systems in reinforced concrete. Consideration of deflection, torsion, prestressed concrete concepts, materials, methods, losses, creep, shrinkage, continuous beam design.

Mr. Raphael, Mr. Lin (W)

136. Advanced Structural Analysis. (3)

Three 1-hour lectures per week. Prerequisite: course 131. Elastic and plastic analysis of statically determinate structures. Dynamic analysis of structures simulated by single-degree or lumped parameter multi-degree of freedom systems.

Mr. Powell, Mr. Scordelis (F)

137. Synthesis and Design of Structural Systems. (4)

Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: courses 133, 134. Planning and design aspects of structural systems; sources of stress and strain; design criteria; layouts of structural systems; optimization, formal and informal methods of analysis.

Mr. Baron, (W)

138. Introduction to Flight Structures. (3)

Three 1-hour lectures per week. Prerequisite: course 130. Stress, deformation and stability analyses of flight structures; torsion on bending of typical sections; buckling and post buckling strengths of thin sheet elements; stress and stability consideration of sandwich components; thermal stresses and thermal buckling; high-temperature creep effects.

Mr. Taylor (W)

139. Introduction to Mechanics of Solids. (4)

Three 1½-hour lectures per week. Prerequisite: course 130 or Physics 105A. Stress-strain relations for elastic and inelastic materials; plastic flow, creep, relaxation, thermal effects; solution of problems in elasticity and inelasticity.

Mr. Stackman (Sp)

140. Water Resources Engineering. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 165B (may be taken concurrently). Estimates of population and
municipal, industrial, and agricultural water requirements. Hydrology of surface and ground water sources. Planning and design of water distribution systems and waste water and storm water collection systems, including impoundments, aqueducts, and pumping stations. Mr. Selleck (F, Sp)

142. Design of Water Quality Management Systems. (3)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 140. Lectures and discussions of the nature of engineering organizations; role of design in engineering practice; and concepts of systems, process, and functional design. Parallel problem assignments illustrating the application of design principles to typical units of water and waste water treatment systems. Mr. Pearson (W)

143. Applied Ecology. (3)
Two hours of lecture and one 2-hour laboratory per week. An introduction to some aspects of ecology for those with little or no biological training. Effects of pollution in ecosystems and organisms. Relevant biology for interpretation of changes in ecosystems. Real ecosystems will be observed and difficulties in validation of measurements shown. Mr. Horne (F)

144. Environmental and Sanitary Engineering. (3)
Three 1-hour lectures per week. Prerequisite: for public health, science, and engineering majors. The biochemical cycles of synthesis and decay, energy resources. The hydrological cycle, drinking water quality collection, treatment, and use. Domestic and industrial waste characteristics, collection, treatment, reclamation and disposal. Water pollution control. Air quality and air pollution control. Mr. Oswald (W)

145. Chemistry of Waters. (3)
Three 1-hour lectures per week. Prerequisite: Chemistry 1B. A consideration of the inorganic components in water in terms of water quality. Emphasis is placed on the application of chemical principles employed to modify the concentration of the major anions, cations, and dissolved gases comprising the inorganic constituents. Mr. Thomas (F)

146A. Water Resources Chemistry. (3)
One 1-hour lecture and two 3-hour laboratory periods per week. Prerequisite: Chemistry 1B. A systematic consideration of the gravimetric, volumetric and colorimetric analytical techniques involved in the analysis of the major inorganic constituents found in waters. Several introductory experiments are included relative to water quality control. Mr. Jenkins; Mr. Thomas (F)

146B. Water Resources Chemistry. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 146A. Parallels course 146A but emphasis is placed on the analysis and treatment of waters containing organic constituents. Mr. Jenkins (W)

147. Organic Chemistry of Water and Waste Water. (3)
Three 1-hour lectures per week. Prerequisite: Chemistry 1B. A consideration of the organic components as a factor determining the quality of waste waters. Nomenclature and reactions of pertinent organic compounds are emphasized. Included are special topics such as biochemical degradations and cycles, pesticide pollution, detergent pollution, and air pollution fallout. Mr. Thomas (W)

160. Hydrology. (3)
Two 1½-hour lectures per week. Prerequisite: consent of the instructor. Circulation of water on the earth's land masses, the hydrologic cycle, elements of climatology and meteorology, interrelation between precipitation and runoff, ground water flow, flood analysis and applications of hydrology in engineering design. Mr. Todd (W)

161. Water Resources Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: course 165B. Laboratory experiments that illustrate principles of hydraulic machinery, wave forces, and flow in open and closed conduits. Mr. Johnson (F, Sp)

165A. Elementary Fluid Mechanics. (3)
Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 104A (may be taken concurrently). Principles of mechanics applied to the statics and dynamics of incompressible fluids. Mr. Johnson (F, W)

165B. Elementary Fluid Mechanics for Civil Engineers. (2)
Two 1-hour lectures per week. Prerequisite: course 165A. Principles of fluid mechanics applied to open channel flows, forces on submerged objects and laws of similarity, hydraulic machinery. Mr. Johnson (W, Sp)

165L. Hydraulic Engineering Laboratory. (1)
One 2-hour laboratory per week. Prerequisite: must be taken concurrently with course 165B. Laboratory experiments which illustrate principles of hydraulic measurements and open channel flow. --- (W, Sp)

166A. Advanced Hydraulics. (3)
Three 1-hour lectures per week. Prerequisite: course 165B. Uniform flow, advanced topics; backwater curves; side-channel spillways; surges, suddenly and gradually varied flow; water hammer and surge chambers; similarity: Froude models, distorted models, flood routing. Mr. Harder (F)

166B. Advanced Hydraulics. (3)
Two 1-hour lectures and one 3-hour design period per week. Prerequisite: course 166A. Open channel transitions and junctions; energy dissipators and scour prevention; weirs and drop structures, tailwater effects; movable weirs and gate structures; culverts and drop spillways; design of individual structural elements. Mr. Harder (W)

166C. Advanced Hydraulics. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 166B. Flow through porous media; limits of Darcy's law; uplift and drainage; line of creep; sediment motion and its principal aspects; rip-rap design; cavitation; design of a complete spillway or flood channel. Mr. Harder (Sp)

*168. Design of Open Channel Flow Systems. (3)
Two 1-hour lectures and one 3-hour laboratory and design period per week. Prerequisite: course 166B. Hydraulic and systems design and analysis applied to open channel systems. Occasional field inspection trips. Mr. Harder (Sp)

170. Introduction to Transportation Engineering. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: courses 10 and 15 or
171. Introduction to Traffic Engineering. (4)
Three 1-hour lectures and one 3-hour laboratory per week. **Prerequisite:** course 121. Street and highway traffic problems; principles of design of thoroughfares on the basis of operational characteristics; traffic regulation and control.

173. Highway Design and Construction. (4)
Three hours of lecture and one 3-hour laboratory per week. **Prerequisite:** course 121, 140, 170. Design, drainage, and construction of highways and streets including intersections, interchanges, and pavements.

180. Concrete Construction. (3)
One 1-hour lecture and one 3-hour seminar each week. Lectures and seminars. Consideration of broad aspects of concrete construction; technical requirements; selection of materials; control of quality; practices in the construction of dams, highways, airfields, canals, bridges, buildings, hydraulic structures.

181. Engineering Construction. (4)
Three 1-hour lectures and one 3-hour laboratory per week. The construction industry: its development, components, organization and importance, construction methods and practices, applications and limitations; factors involved in selection of plant equipment and material, principles of planning, organization and operating construction forces, and estimating costs.

182. Polymers in Construction. (3)
One hour of lecture and three hours of seminar per week. **Prerequisite:** Engineering 45, Architecture 120, or equivalent elementary introduction to materials. Consideration of broad aspects of polymers in construction, particularly urban housing structures; technical requirements and performance specification; selection of materials; relationship of mechanical properties to microstructure; fire safety; weatherability; manufacturing techniques, use of sealants and coatings on structures.

190. Engineering Reports. (3)
One 1-hour lecture and two 1-hour exercise and analysis periods per week. **Prerequisite:** junior standing in engineering. Principles of communication with verbal, mathematical and graphic symbols in application to written and oral reporting needs in technical fields; conventions of style and format; practice, and analysis of individual problems in writing and speaking.

192. The Art and Science of Civil Engineering Practice. (1)
One 1-hour lecture per week. **Prerequisite:** senior standing in civil engineering. A course of lectures by distinguished engineers designed to provide the student with an appreciation of the role of science and technology in conceiving projects, balancing the interplay of conflicting demands, and utilizing a variety of disciplines to produce unified and efficient systems.

§193. Applications of Probability and Statistics in Civil Engineering. (4)
Three hours of lecture and one 2-hour problem session per week. **Prerequisite:** Mathematics 51A–51B–51C. Applications of probability theory, methods of statistics, and Bayesian decision theory in analysis and design of civil engineering systems; analysis and interpretation of uncertainty in system properties, capacity and demand and its relationship to design specifications and civil engineering economic decisions.

Five hours of lecture per week. **Prerequisite:** upper division standing. Credit will not be given for both course 194 and Industrial Engineering 120. Principles of economic and management techniques applied to the planning, design, construction, and operation of civil engineering systems; professional relations; contracts and specifications.

198. Directed Group Study for Advanced Undergraduates. (1–6)
**Prerequisite:** senior standing in engineering. Group study of a selected topic or topics in civil engineering.

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. For students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis. **Prerequisite:** in charge (F, W, Sp)

Graduate Courses

201A. Physical Oceanology. (3)
Three hours of lecture per week. **Prerequisite:** course 165B or consent of instructor. The basic dynamics of open oceanic circulation with investigations of wind-driven and density-driven currents, water masses, and oceanic circulation models. The illustrations and research projects utilized in these courses stress the practical or applied engineering approach to oceanic problems.

201B. Chemical Oceanology. (3)
Three hours of lecture per week. **Prerequisite:** course 145 or equivalent or consent of instructor. Chemistry of sea water examined with respect to (1) its interaction with the atmosphere, lithosphere, and biosphere; (2) the origin and evolution of sea water; and (3) the application of marine chemistry to engineering problems in related fields of oceanology.

201C. Geological Oceanology. (3)
Three hours of lecture per week. **Prerequisite:** Geology 105, course 121A, or consent of instructor. Types, distribution, mineralogy, and physical properties of modern marine sediments from both the continental and deep seas are discussed stressing the interrelationship among the sediments and various marine environments.

203A. Surface Water Hydrology. (3)
Two 1/2-hour lectures per week. **Prerequisite:** consent of instructor. Occurrence and movement of water over the surface of the earth, streamflow measurement and characteristics, floods and flood forecasting, frequency analysis of precipitation and runoff, analysis of the flood hydrograph, and flood routing.

Mr. Todd (F)
203B. Ground Water Hydrology. (3)
Two 1½-hour lectures per week. Prerequisite: consent of instructor. Occurrence and movement of subterranean water, flow through naturally occurring porous materials, hydraulics of wells, fluctuations in ground water elevations, quality of underground waters, legal aspects of ground water. Mr. Todd (W)

203C. Advanced Applied Hydrology. (3)
Two 1½-hour lectures per week. Prerequisite: course 203A or 203B. Application of principles of hydrology in solution of practical engineering problems such as artificial recharge, sea water intrusion, flood forecasting, and hydrograph synthesis. Analytical methods, models, and analogs for study of advanced problems. Basin management and development. Mr. Todd (Sp)

204. Regional Development Engineering. (4)
Three and one-half hours of lecture and one-half hour of laboratory per week. Prerequisite: graduate standing in College of Environmental Design. A course designed to acquaint the environmental planner with those engineered systems which impinge upon his professional activities, including: systems related to the use and management of water, gas, electricity and solid wastes; transportation systems; and surveying and mapping systems by which control is made possible. Mr. Kennedy (W)

205A. Coastal Engineering. (3)
Three 1-hour lecture and demonstration periods per week. Prerequisite: course 165B. Fundamental principles of the theory and realities of waves, tides, storm surges, currents and temperature distribution in the ocean, and application of this information to some coastal engineering problems. Mr. Wiegel, Mr. Johnson (F)

205B. Coastal Engineering. (3)
Three 1-hour lecture and demonstration periods per week. Prerequisite: course 205A. Application of the basic fundamentals of physical oceanography to the problems of coastal engineering, such as beach erosion, harbor design, offshore structures; use of model studies in such design. Mr. Johnson, Mr. Wiegel (W)

206A. River Hydraulics and Sedimentation. (3)
Three 1-hour lectures per week. Prerequisite: course 166B or consent of instructor. Basic equations. Nonsteadiness in open channels with friction. Mr. Harder (F)

*206B. River Hydraulics and Sedimentation. (3)
Three 1-hour lectures per week. Prerequisite: course 206A. Principles of hydraulics of the alluvial channel. —(W)

*206C. River Hydraulics and Sedimentation. (3)
Three 1-hour lectures per week. Prerequisite: course 206B. Application of the hydraulics of the alluvial channel to the solution of river problems.—(Sp)

207. Advanced Hydraulic Design. (3)
Three 1-hour lectures per week. Prerequisite: course 166B. Design of diversion works, distribution systems (such as cooling water systems and ocean outfall sewers), special hydraulic structures. Mr. Wiegel (Sp)

208. Advanced Hydraulic-Structures Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: consent of instructor. Laboratory investigation of structures employed in river, harbor, flood, beach, and wave action control. Mr. Johnson (Sp)

209. Turbulent Mixing and Dispersion in the Hydrologic Environment. (2)
Two 1-hour lectures per week. Prerequisite: knowledge of differential equations. Concept and mathematics of Fickian diffusion processes. Theories of turbulent mixing and longitudinal and transverse dispersion in porous media, open channels, natural streams and estuaries. Application to coastal problems. Mr. Fischer (W)

210. Water Resources: Quality. (3)
Three 1-hour lectures per week. Prerequisite: courses 140, 141 and 165A. Concepts, rationale, theory, institutions, and engineering aspects of water quality management in the ground and surface water environments. The capacity of soil and water environments to alter the quality of water. Mr. Pearson, Mr. Kaufman, Mr. Selleck (F)

211. Water Treatment: Theory and Design. (3)
Three 1-hour lectures per week. Prerequisite: course 140 and 165A, 145 (may be taken concurrently). Theory and practice of water treatment for public supply by operations and processes such as aeration, flocculation, sedimentation, filtration, softening, ion exchange, chlorination, and fluoridation. Mr. Kaufman, Mr. Selleck, Mr. Pearson (W)

212. Waste Water Treatment: Theory and Design. (3)
Three 1-hour lectures per week. Prerequisite: course 140, 165A, 145 (may be taken concurrently). Theory and design of municipal wastewater treatment processes including the unit operations and processes of flotation, sedimentation, activated sludge, and biological filtration including biological process kinetics. The design of solids handling systems; digestion filtration, centrifugation, incineration, and terminal disposal facilities. Mr. Pearson (Sp)

213. Water Resources Chemistry: Instrumental Methods. (3)
One hour of lecture and six hours of laboratory per week. Prerequisite: course 146A, course 146B, consent of instructor. Theory and application of electrochemistry, spectrometric methods, and chromatography to problems of sanitary engineering. Experiments on redox potential measurements, corrosion control, infrared, visible, UV, atomic absorption fluorescence spectroscopy; electrophoresis, gas, liquid, paper gel, ion exchange and thin layer chromatography. Mr. Jenkins, Mr. Thomas (F)

214. Aquatic Chemistry. (2)
Two hours of lectures per week and three 3-hour laboratories per quarter. Prerequisite: course 145, course 146A, or consent of instructor. The application of equilibrium and kinetic models and physical chemical principles to a description of the composition and behavior of natural waters and of water treatment and waste-water treatment processes. Mr. Jenkins (W)

215A. Advanced Sanitary Engineering Laboratory. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 145, 146A, 210. Unit operations and processes for municipal and industrial water treatment. Lectures and experiments on gas transfer, flocculation, sedimentation, softening and deionization. Mr. Kaufman, Mr. Pearson, Mr. Selleck (W)
215B. Advanced Sanitary Engineering Laboratory. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 145, 146A, 210, 211. Unit operations and processes for municipal and industrial water and waste treatment, lectures and experiments on water waste and slurry filtration, aerobic and anaerobic biological systems.
Mr. Jenkins, Mr. Kaufman (Sp)

216. Industrial Waste Control. (3)
Three 1-hour lectures per week. Prerequisite: courses 210, 211, 212 (may be taken concurrently). Theory and design of industrial unit operations and processes to minimize in-process product loss and waste as well as of operations and processes for terminal waste treatment to reduce pollutant emissions to the environment. Mr. Pearson (Sp)

217. Reaction Kinetics in Water Processing. (2)
Two 1-hour lectures per week. Prerequisite: graduate standing. Analysis and prediction of reactor conversion of homogeneous and dispersed phase chemical reactions, discussion of problems of initial mixing between fluid streams, application of concepts to water and waste water treatment processes. Mr. Selleck (F)

218A. Atmospheric Pollution. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 146A, 146B. Nature of materials which contaminate the atmosphere: gases, fumes, vapors, and dusts. Properties of the normal atmosphere and its capacity to dilute contaminants. Methods of air analysis and continuous air monitoring. Mr. Tebbens (W)

218B. Atmospheric Pollution. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 218A. Control of atmospheric pollution by such engineering means as scrubbing, filtration, and other source-suppression methods. Consideration of air as a dispersing medium for waste effluents. Administrative and legal concepts of air pollution control. Mr. Tebbens, Mr. Thomas (Sp)

219. Solid Waste Management. (2)
Two hours of lecture per week. Prerequisites: permission of instructor and graduate standing. Considers major aspects of Solid Waste Management, including transportation and disposal methods. Emphasis placed on interrelationship of management practices, source modification, environmental constraints, and recycling. Also discussed are planning and institutional problems.
Mr. Kaufman, Mr. Golheke (F, Sp)

220A. Statically Indeterminate Structures. (4)
Three 1½-hour lectures per week. Prerequisite: course 131. Analysis of indeterminate structures by force (flexibility) methods and by displacement (stiffness) methods; relaxation and distribution procedures; methods suited for digital computer solutions. Virtual work, real and complementary energy. Classical theorems of Clapeyron, Betti, Castigliano, Maxwell, Mohr, and Muller-Breslau.
Mr. Scordelis (F, Sp)

220B. Statically Indeterminate Structures. (3)
Two 1½-hour lectures per week. Prerequisite: course 220A. Comprehensive presentation of the fundamental principles of structural analysis formulated in matrix algebra language. Consideration of efficient means for analysis of complex structures, with reference to digital computer procedures. Introduction to the finite element method of analysis of problems of continuum mechanics.
Mr. Clough (W)

221. Advanced Structural Theory. (4)
Three 1½-hour lectures per week. Prerequisite: course 131. The application of classical numerical, and approximate methods of stress analysis to the study of continuous frameworks, truss structures, plates, and shells. Methods of analysis discussed include formalized algebraic procedures, numerical methods, energy procedures, and informal pictorial procedures. The methods are illustrated for static and dynamic loads and for elastic and inelastic ranges of structure behavior. The methods are particularly suited for interpretation of structural behavior and for use in preliminary studies or initial design.
Mr. Baron (F)

222. Experimental Structural Mechanics. (3)
Two hours of lecture and one 3-hour laboratory per week. Prerequisite: graduate standing in engineering. Dimensional analysis and the theory of models. Prediction of static, dynamic, ultimate, and thermal response of structures by true-scale and distorted models. The use of models in structural design. Introduction to stress analysis, including measurement of static and dynamic response by resistance gages, accelerometers, photomechanics, and moire.
Mr. Godden (W)

224. Finite Element Analysis of Structural Systems. (3)
Three hours of lecture per week. Prerequisite: course 220B, course 290G and course 230. Application of the finite element method to Civil Engineering problems; including stress analysis of two- and three-dimensional solids, plate bending, shells, flow and consolidation.
Mr. Wilson, Mr. Taylor (Sp)

225A. Dynamics of Structures. (3)
Two 1½-hour lectures per week. Analysis of stresses and deflections in structures due to the application of dynamic loads. Approximate and "exact" methods for determining the response of buildings, bridges, frames, to earthquake accelerations, wind gusts, moving loads, bomb blasts.
Mr. Clough, Mr. Chopra (F, W)

225B. Dynamics of Structures. (3)
Two 1½-hour lectures per week. Prerequisite: course 225A. Development of techniques for analysis of the response of complex structures to dynamic loads.
Mr. Clough, Mr. Penzioni (Sp)

226. Random Vibrations of Structural Systems. (4)
Four and one-half hours of lecture per week. Prerequisites: course 225A or equivalent. Probability density functions, one and several variables, Gaussian distributions, random walk concepts, random processes, covariance function, power spectral density; input-output relations for linear systems; fatigue considerations, Palmgren-Miner criterion; random vibrations caused by earthquakes, sea waves, wind turbulence.
Mr. Penzioni (F)

227. Structural Design for Dynamic Loads. (3)
Two 1½-hour lectures per week. Prerequisite: course 225A. Consideration of structural design problems in which dynamic load effects are of major importance. Special emphasis will be given to the design of earthquake and blast resistant structures, but moving load problems and machine vibration isolation problems will also be considered.
Mr. Bertero (Sp)
228. Advanced Study of Cementitious Materials. (3)
Two 1½-hour lectures per week. Prerequisite: course 111 or equivalent. Composition of different types of portland cements, chemistry of hydration, structure of hydrates and its influence on strength, shrinkage, and durability. Chemistry of expanding cements, aluminous cements and special portland cements.
Mr. Mehta (W)

229. Analytical Design Techniques. (3)
Three hours of lecture per week. Prerequisite: Interdepartmental Studies 131 or equivalent. Variations in imbedding and boundary value problems in structural mechanics. Non-classical imbeddings—Eigenvalue problems. Dynamics programming in structural optimization. System identification processes in Civil Engineering: Material characterization, diffusion, wave propagation, etc. Mr. Distefano (W)

Three 1½-hour lectures per week. Prerequisite: course 130. Special topics in bending of beams including: beams on elastic foundations, beam column, vibration, stability, thermal stresses, curved beams. Two dimensional problems including thick-walled cylinders, foundations; inelastic effects including creep.
Mr. Kelly, Mr. Popov (F)

231. Introduction to Mechanics of Solids. (4)
Three 1½-hour lectures per week. Prerequisite: course 130. Behavior of elastic, plastic and viscoelastic solids; stress and strain; derivation of the constitutive equations for linear elastic and viscoelastic materials. Yield theories for materials that behave plastically.
Mr. McNiven, Mr. Sackman (W)

232. Theory of Structural Stability. (3)
Two 1½-hour lectures per week. Prerequisite: course 230. Elastic and inelastic stability of columns and frames; equilibrium, energy and dynamic methods of analysis, non-conservative problems; beam-column, torsional instability; stability of arches and rings.
Mr. Penzien, Mr. Popov (Sp)

233. Theory of Plates and Shells. (3)
Three 1-hour lectures per week. Prerequisite: course 230. Classical plate theory; anisotropic plates; vibration and buckling of plates; large deflection of plates; membrane and general theory of cylindrical shells, and shells of revolution.
Mr. Pister, Mr. Taylor (W) 

234. Analysis of Flight Structures. (3)
Three 1-hour lectures per week. Prerequisite: course 138. Material properties; buckling of composite structures; ultimate strength; crippling; fatigue; nonlinear creep; influence coefficients.
Mr. Kelly (Sp)

235. Two-Dimensional Problems in Linear Solids. (4)
Three 1½-hour lectures per week. Prerequisite: course 231 and Engineering 230A. Extension, flexure, vibration and buckling of thin plates; linear and nonlinear behavior, refined theories; variational principles; solution methods of complex variables, integral transforms, singularities; approximate methods; applications to viscoelastic and nonhomogeneous plates; thermal stress problems.
Mr. Pister, Mr. Taylor (Sp)

236. Theory of Thin Shells. (4)
Three 1½-hour lectures per week. Prerequisite: course 231 and Engineering 230A. General theory of thin shells; cylindrical shells, shells having the form of a surface revolution, hyperbolic paraboloids and other shells of double curvature; approximate methods of analysis; anisotropic shells; buckling and vibration; limit analysis.
Mr. Popov (Sp)

237. Three-Dimensional Static Problems in Linear Solids. (3)
Mr. McNiven (Sp)

238. Three-Dimensional Dynamic Problems in Linear Solids. (3)
Three 1-hour lectures per week. Prerequisite: course 231 and Engineering 230A. Study of the displacement equations of motion and the Helmholtz displacement potentials. Dilational and rotational waves in an infinite domain; wave reflection, refraction and dispersion due to boundaries. Rayleigh and Love Wave. Waves in granular and viscoelastic media.
Mr. McNiven (W)

239. Mechanics of Nonlinear Solids. (4)
Three 1½-hour lectures per week. Prerequisite: any one of courses 235, 236, 237, 238, 239. Elements of tensor analysis; deformation and stress; balance equations; mechanical constitutive equations for solids; variational principles; thermodynamical principles; propagation of discontinuity surfaces; solution of quasi-static and dynamic problems for structural materials; relation to experimental results.
Mr. Kelly, Mr. Pister, Mr. Lubliner, and Mr. Sackman. Three-quarter sequence beginning (F)

Three hours of lecture per week. Prerequisite: any one of courses 235, 236, 237, 238, 239. Elements of tensor analysis; deformation and stress; balance equations; mechanical constitutive equations for solids; variational principles; thermodynamical principles; propagation of discontinuity surfaces; solution of quasi-static and dynamic problems for structural materials; relation to experimental results.
Mr. Kelly, Mr. Pister, Mr. Lubliner, and Mr. Sackman. Three-quarter sequence beginning (F)

*241. Theory of Design. (3)
Mr. Baron (W)

*242. Analysis and Design of Structural Systems. (3)
Three 1-hour lectures per week. Prerequisite: course 221. Structural analysis related to structural behavior and design. The ready interpretation of structural action for purposes of design. Sources of stress and participation strains and the interpretation of their relative importance. Various kinds of loads, environmental conditions, and structural systems are considered.
Mr. Baron (Sp)

243A. Advanced Reinforced Concrete. (4)
Three hours of lecture per week. Prerequisite: course 133 or equivalent. Structural properties of plain and reinforced concrete including time-dependent behavior, cracking, strength and serviceability criteria in design of reinforced concrete members.
Mr. Bresler (F)
243B. Advanced Reinforced Concrete. (4)

Three hours of lecture per week. Prerequisite: course 243A or equivalent. Design of reinforced concrete structures—limit-state approach. Design of reinforced concrete structures—recent advances in application of yielding-line theory.

Mr. Bertero, Mr. Bresler, Mr. Lin (Sp)

244. Advanced Prestressed Concrete. (4)

Four and one-half hours of lecture per week. Prerequisite: course 135 or equivalent. Structural behavior and design of prestressed concrete elements and systems—continuous beams, frames, slabs, members under combined axial loads and flexure, torsion, fatigue strength, partial prestress.

Mr. Lin (W)

245. Design of Concrete Shells. (4)

Three 1/2-hour lectures per week. Prerequisite: basic courses in reinforced concrete and in statically indeterminate structures. Application of shell theory, approximate methods, and computers to the design of shell and folded plate structures. Determination of reinforcement or prestressing requirements. Study of existing experimental results including ultimate strength tests. Design project involving shell construction.

Mr. Scordelis (Sp)

246. Design of Steel Structures. (4)

Three 1/2-hour lectures per week. Design of advanced bridge systems, plate girders, composite design, orthotropic decks, prestressed steel construction, suspension systems, domes and tubular structures.

Mr. Bouwkamp (Sp)

247. Analysis and Design of Concrete Dams. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 140. Selection of location and type; stability analysis, stress analysis of gravity arch, multiple-arch, dome, and slab-butts dam; problems imposed by construction conditions and use of mass concrete.

Mr. Raphael (F)

248A. Inelastic Design of Structures. (3)

Three hours of lecture per week. Prerequisite: course 220A; course 230 is desirable. Inelastic behavior of structures. Simplified plastic theory. Limit analysis; fundamental theorems. Structures subjected to proportional actions; estimation of deflections; minimum weight design. Effects of generalization actions; shakedown theorems. Factors affecting bending carrying capacity.

Mr. Bertero (W)

248B. Inelastic Design of Structures. (4)

Four hours of lecture per week. Prerequisite: course 248A. Inelastic analysis and design of structural members subjected to combined stresses due to bending, shear and axial forces and bending and torsion. Design of connections, design of multistory frames, arches and grids. Limit analysis and design of plates and shells.

Mr. Bertero (F)

249. Advanced Concrete Technology. (3)

Three 1-hour lectures per week. Prerequisite: course 110 or equivalent. Composition and properties of concrete materials; cements, aggregates, admixtures. Properties of fresh and hardened concretes, conventional and special.

Mr. Polivka (Sp)

250. Transportation Policy and Planning. (2)

Two 1-hour lectures per week. Prerequisite: graduate standing in engineering. Analysis of transportation demand and supply in contemporary economic, social, political, and legal settings. Comparative evaluation of transportation modes in meeting transport demands. Analysis of transportation policy and planning as instruments of social and environmental guidance.

Mr. Zettel (F, W)

251. Traffic Stream Characteristics. (3)

Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Study of traffic stream characteristics and flow analysis for planning design and operations of streets and highways. Stream characteristics include flow, speed, density and headways. Flow analysis includes flow interrelationships, headway distributions, traffic performance at intersections, and capacity investigations.

Mr. May (F)

253. Transportation Engineering. (4)

Four hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Technological characteristics of air, highway, rail, and other modes of transportation; integration of modal components into transportation systems; terminal requirements for individual modes and interface problems among modes; forecasting and planning studies; techniques for evaluating alternative plans. Mr. Kennedy, Mr. Homburger (F)

253L–253M. Transportation Engineering Laboratory. (1–1)

One 3-hour laboratory per week. Prerequisite: courses 252, 253 (may be taken concurrently). 253L is prerequisite to 253M. Analysis of land-use data, traffic patterns, and transportation networks to develop traffic models, predict future traffic demands, and design future networks. Use of computer programs in urban traffic forecasting and planning.

W. Homburger, Mr. Kanafani (W, Sp)

254. Transportation Demand Analysis and Forecasting. (3)

Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Analysis of alternative forecasting techniques. Economic demand theory applied to transportation services. Use of demand models for forecasting. Packing problems, choice of mode, and efficient prices for transport services.

Mr. Kanafani (W)

255. Traffic Engineering. (3)

Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Analyses of human and vehicular characteristics as they affect highway traffic flow; traffic regulation; accident cause and prevention; techniques for facilitating and increasing flow on existing traffic systems; planning new traffic systems; parking and other terminal problems.

Mr. May (W)

257. Applications of Queueing Theory to Transportation. (3)

Three hours of lecture per week. Prerequisite: Statistics 133. Deterministic queueing models. Strategy for design and control for queueing systems with multiple services and/or several types of customers. Application to highway intersections, airport terminals, and traffic bottlenecks. Diffusion approximations to stochastic queues. Exact solution of simple stochastic queueing systems. Mr. Newell (W)

258. Geometric Design of Highways. (3)

(Formerly 251)

Three hours of lecture per week. Prerequisite: course 251. Location and design of various types and classes of highways. Emphasis on theory and practice in design of alignments, highway cross sections, intersections, interchanges, multilane expressways and freeways, and arterial highways in urban areas.

Mr. Hurdle (W)
259. Mass Transit Engineering. (3)
Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Analysis and evaluation of mass transit systems, their operation and design. Technology of transit vehicles and structures. Impact on urban land use. Public policy and financing problems.
Mr. Homburger, Mr. Kennedy (W)

260A. Air Transport Engineering. (3)
Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Nature of civil aviation; aircraft characteristics and performance related to planning of terminal facilities. Air traffic control and navigation systems related to planning terminal facilities. Factors to be considered in selection of airport sites.
Mr. Horonjeff (W)

260B. Air Transport Engineering. (3)
Three hours of lecture per week. Prerequisite: course 260A or consent of instructor. Planning of the airport complex; factors affecting airport capacity; models for analysis of airport capacity; geometric design of runways and taxiways. Analysis of facilities for passengers and cargo; noise and noise control.
Mr. Horonjeff (Sp)

261. Feasibility Analysis of Transportation Systems. (3)
Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Objectives and criteria for choice of transportation investments. Problems of estimating benefits and costs; treatment of intangibles and uncertainty; selection of discount rates. Transportation investment planning in developing economies.
Mr. Zettel (Sp)

262. Simulation of Transportation Systems. (3)
(Formerly 256)
Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Development of computer simulation models for the analysis of the performance of complex, multivariable, time-dependent transportation systems, with application to surface and air systems.
Mr. May (Sp)

263. Highway Traffic Control. (3)
Three hours of lecture per week. Prerequisite: courses 251 and 257. Capacity and delay at isolated fixed-cycle and vehicle-actuated traffic signals. Traffic signal synchronization for single highways. Network control of urban streets, ramp control of freeways, route control.
Mr. May, Mr. Newell (Sp)

264. Traffic Flow on Transportation Networks. (3)
(Formerly numbered 252)
Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Elementary theory of transportation networks. Shortest route, minimum network cost, and equilibrium models. Application to trip distribution and traffic assignments.
Mr. Newell (Sp)

265. Pavement Design. (4)
Two 2-hour lectures per week. Prerequisite: graduate standing in engineering. Theories, principles, and practices in the structural design and construction of highways and airport pavements including stabilization, design of rigid and flexible pavements, accelerated traffic and loading tests, and the design of asphaltic mixtures.
Mr. Horonjeff (F)

266A. Construction Scheduling and Resource Allocation. (3)
Three hours of lecture per week. Prerequisite: course 194 or LEOR 120. Planning, scheduling, and allocation of resources for construction projects. Material will include Critical Path Methods of network diagramming and calculation; consideration for allocating constrained resources; and variation of schedules to optimize costs. Computer and non-computer solutions will be presented.
Mr. Crandall (W)

266B. Construction Organization and Management. (3)
Three hours of lecture per week. An introduction into the business aspects of construction management including organization and financial concerns during entry into business and for continued operations. Topics include: legal, financial, labor relations, accounting practices as they affect decision making in the construction industry.
Mr. Crandall (Sp)

266C. Construction Services Marketing. (3)
Three hours of lecture per week. Business development for the contractors and the engineering-constructor enterprise in its broad sense. Proposals, bids, bidding strategy, pre-qualification, letters, communications of ideas, brochures, change orders, contractual terms and conditions, and negotiations.
Mr. Gerwick (F)

266D. Management of International Construction. (3)
Three hours of lecture per week. Prerequisite: course 181 or course 194. Organization and management of major construction projects. International and multinational construction. Financial considerations, procurement, logistics, construction geography, personnel, relations with host area, environmental considerations, communications, management controls. Construction under adverse climatic conditions including desert, tropical, mountain, and arctic regions.
Mr. Gerwick (Sp)

266E. Applications of Operation Research to Construction Management. (2)
Two hours of lecture per week. Prerequisite: course 266A. Analysis of risk relating to bid strategy, optimization of scheduling costs, aggregate and borrow optimization and decision theory. Relevant problems from the construction industry will be reviewed.
Mr. Crandall (W)

267A. Advanced Foundation Construction. (3)
Two 1-hour lectures per week. Prerequisite: course 133 or course 134, and course 121. Evaluation of soil and structural problems connected with construction of deep foundations for major high-rise buildings. Integration of cost, scheduling, political environmental, and management factors. Application to current major projects.
Mr. Gerwick (F)

267B. Advanced Concrete Construction. (3)
Three hours of lecture per week. Prerequisite: course 135 and course 150. Selection and evaluation of construction methods and planning for pre- and post-tensioned concrete, lightweight, high strength, and architectural concrete, precasting and segmental construction. Application to buildings, bridges, pressure vessels, pollution control structures and cryogenic containment.
Mr. Gerwick (W)

267C. Construction of Harbor, Coastal, and Ocean Structures. (4)
Four hours of lecture per week. Prerequisite: course 121, course 133, course 134. Construction methods and equipment for construction of piers, caissons, breakwaters, underwater pipelines, ocean structures, and offshore installations.
sons, wharves, marine terminals, outfall sewers, power plant intakes and discharges, submarine oil and gas pipelines, offshore platforms, Arctic Ocean structures sub-sea and deep ocean facilities. Mr. Gerwick (Sp)

267D. Advanced Construction Estimating. (3)

Three hours of lecture per week. Prerequisite: course 280A. Estimates used by heavy, engineering, building, and specialty contractors. Preparation of cost estimates including planning of methods and program evaluation of labor, material equipment, subcontract, and indirect costs. Rational assessment of risk and profit margins. Value engineering.

Mr. Gerwick (W)


Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. An advanced course concerned with asphalt paving especially for highway and airport pavements; emphasis is placed on physical properties of asphalts, aggregates and their combinations and the relationship of these properties to proper design and construction or pavements.

Mr. Monismith (Sp)

270A. Advanced Soil Mechanics and Foundation Engineering. (3)

Two 1½-hour lectures per week. Prerequisite: course 123, or 121 and 114, or equivalent. Advanced theories of soil mechanics including consolidation, settlement analysis, stress distribution, lateral pressures, bearing capacity, and their application in foundation engineering.

Mr. Mitchell (F)

270B. Advanced Soil Mechanics and Foundation Engineering. (3)

Two 1½-hour lectures per week. Prerequisite: course 123, or 121 and 114, or equivalent. Detailed study of the shear strength of cohesionless and cohesive soils, strength determining factors, methods for strength measurement, slope stability and stability analysis techniques.

Mr. Duncan, Mr. Seed (W)

270C. Advanced Soil Mechanics and Foundation Engineering. (3)

Three hours of lecture per week. Prerequisite: course 123 or 121 and 114 or equivalent. Design of anchored bulkheads; supporting capacity, design and installation of pile and pier foundations; mat foundations; cofferdams.

Mr. Mitchell, Mr. Seed (Sp)

270L. Advanced Soil Mechanics Laboratory. (3)

One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 270A, 270B. Lectures and individual experimental studies of advanced aspects of soil properties and their applications to design. Consolidation, strength testing, pore water pressure measurement, dynamic soil tests, field strength and pile loading tests, pavement design procedures, advanced instrumentation and measurement techniques.

Mr. Houston (Sp)

271. Seepage Through Soils. (2)

Two 1-hour lectures per week. Principles governing the flow of water through soils and their applications in civil engineering.

Mr. Seed (W)

272. Soil and Site Improvement. (4)

Four hours of lecture per week. Prerequisite: graduate standing. Soil stabilization using compaction, lime, cement, asphalt, and chemicals for use in foundations, embankments, dams, slopes, highways, and airfields; design and construction with stabilized soils; principles of pavement design; in-place soil treatment methods; development of marginal lands; solid waste utilization.

Mr. Mitchell (W)

273. Soil Behavior. (4)

Three hours of lecture per week and one 3-hour laboratory/demonstration per week. Prerequisite: course 121 or consent of instructor. Clay mineralogy, soil formation and composition, sedimentary processes, colloidal phenomena in soils, ion exchange, soil water; analysis of mechanical behavior in terms of physical chemical principles, compressibility, strength and deformation, conduction phenomena.

Mr. Mitchell (F)

274. Introduction to Soil Dynamics. (3)

Two 1-hour lectures plus two 1½-hour computational laboratories per week. Prerequisite: knowledge of FORTRAN programming. However, the students need not be experienced programmers. The simple damped oscillator. Wave propagation in elastic media, Dynamic field and laboratory tests. Dynamic soil properties. Foundation vibrations. Numerical methods for dynamic analysis.

Mr. Lysmer, Mr. Seed (W)

275. Soil Dynamics—Earthquake Engineering. (3)

Two 1-hour lectures plus two 1½-hour computational laboratories per week. Prerequisite: course 274 or equivalent course in dynamics. Faulting: rock motions; influence of soils on ground motion characteristics: computation of response using lumped mass, finite element and wave propagation analysis; causes of soil failure during earthquakes; soil liquefaction; soil settlement; soil-structure interaction lateral pressures during earthquakes; slope stability problems.

Mr. Seed, Mr. Lysmer (Sp)

276. Earth Dams. (2)

Two 1-hour lectures per week. Prerequisite: course 271 and 270B or consent of instructor. Principles of earth dam design; types of failures; design procedures; practical considerations in design and construction.

Mr. Seed (Sp)

277. Theoretical Soil Mechanics. (4)

Three 1-hour lectures plus two 1½-hour computational laboratories per week. Prerequisite: knowledge of FORTRAN programming. Theories and numerical methods for consolidation, subgrade reaction, laterally loaded piles. Stress analysis by the finite element method. Limit analysis by the theory of perfect plasticity.

Mr. Lysmer (F)

280A. Theoretical Rock Mechanics. (3)

Two 1½-hour lectures per week. Prerequisite: graduate standing. Elements of elasticity, rock properties and behavior; theory of failure for brittle, jointed, and anisotropic rocks; time effects; theory of in-situ and laboratory testing.

Mr. Goodman (F)

280B. Applied Rock Mechanics. (3)

Three 1-hour lectures per week. Prerequisite: course 280A or consent of instructor. Rock mechanics applied to analysis of rock slopes, abutments, foundations, and underground excavations. Initial stresses in rock masses; model studies, computer methods, stereographic projection, and vector analyses.

Mr. Goodman (W)

280L. Experimental Rock Mechanics. (3)

One 1-hour lecture and two 3-hour laboratories per week. Several periods will be held at engineering field laboratory and in-situ testing of rocks to determine state of stress, deformability, and strength properties.

Mr. Goodman (Sp)
281. Advanced Engineering Geology. (3)
One hour of lecture, one hour of discussion, and one field or laboratory exercise per week. Prerequisite: graduate standing in engineering and a course in geology or engineering geology. One lecture, one discussion section, and one field or laboratory exercise each week on engineering properties of rocks and geological structures, geological mapping, and geological factors bearing on construction. Individual reading assignments and tutorials.
Mr. Brekke, Mr. Goodman, Mr. Witherspoon (F)

Two 1½-hour lectures per week. Prerequisite: Engineering 230A is recommended. Application of fluid mechanics to the steady state and non-steady state flow of fluids through porous media, boundary value problems relating to idealized and real rock systems.
Mr. Witherspoon (F, W)

287A–287B. Analytic Photogrammetry. (4–4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 101 or equivalent. Comparator measurements and refinement; orientation matrices; analytic solutions for strips and blocks using collinearity and collinearity conditions; constraints from auxiliary sensors.
Mr. Anderson (beginning W)

288A–288B. Analogue Stereorestitution Instruments and Stereotriangulation. (4–4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 101 or equivalent. Design of components of first- and second-order stereorestitution instruments; interior, relative, absolute orientation; map compilation; control extension in first-order instruments; independent model extension; adjustment to ground control; analysis of systematic and random errors.
Sequence beginning F Mr. Moffitt

289. Adjustment Computations. (4)
Four-hour lecture per week. Prerequisite: course 10. Brief review of matrix algebra and computer programming. Introduction to probability theory and error propagation; derivation of the method of least squares adjustment with application to surveying and photogrammetry problems.
Mr. Anderson (F)

290A. Methods of Analysis of Structural Systems. (4)
Three 1½-hour lectures per week. Prerequisites: course 130, Mechanical Engineering 104A. Introduction to analysis of equilibrium stability and vibration of discrete and simple continuous systems (strings, cables, beams, columns) by means of matrix methods, calculus of variations, differential equations, Fourier series, and Fourier integrals.
Mr. Taylor (F)

290G, Applications of Digital Computers to Structural Problems. (3)
Three hours of lecture per week. Prerequisites: course 22A and a course in FORTRAN programming. Introduction to numerical methods and digital computer coding techniques appropriate to the solution of problems in Structural Engineering. Computer programs are developed for matrix operations, solution of equations, numerical integration, least square techniques, and the analysis of frames and systems.
Mr. Wilson (W)

290L. Water Resources Development. (2)
One 2-hour lecture per week. Prerequisite: graduate standing. The engineering, economic, legal, social and political factors underlying major decisions in water resources development.
Mr. Todd (Sp)

290N. Applications of Digital Computers to Hydraulic and Sanitary Engineering Problems. (3)
Two 1½-hour lectures per week. Prerequisite: graduate standing. Use of computers in hydraulic and sanitary engineering; numerical analysis.
Mr. Harder (F)

290R. Current Topics in Geological Engineering. (1, 2, or 3)
One to three hours lecture per week. Prerequisite: consent of instructor. Detailed discussion of topics of particular interest or too recent to have been incorporated into other courses. Content will change from year to year and course can be repeated.
Mr. Goodman, Mr. Witherspoon (F, W, Sp)

290S. Administration of Transportation Functions. (2)
Two hours of lecture per week. Prerequisite: course 253 or consent of instructor. Seminar on problems and processes of administering activities unique to transportation. Organization and management of planning, design and operational functions. Processes of formulation of transportation policies, practices, and standards.
Mr. Zettel (Sp)

290T. Advanced Topics in Transportation Theory. (2)
Two hours of lecture per week. Prerequisite: course 257 or consent of instructor. Selected topics in transportation or traffic flow theory with emphasis on advanced mathematical techniques. Recent developments in transportation science.
Mr. Newell (F)

290V. Traffic Flow Theory. (3)
(Formerly numbered 256)
Three hours of lecture per week. Prerequisite: Statistics 133, course 251, or consent of instructor. Logical foundations and mathematical representation of traffic flow; interrelation between microscopic and macroscopic equations of motion for highway traffic; stochastic properties of traffic at low and moderate densities. Car-following and fluid theories of traffic flow at high densities.
Mr. Newell (W)

290Z. Models Related to Air Transportation. (2)
Mr. Horonjeff, Mr. Kanafani (Sp)

298. Group Studies, Seminars, or Group Research. (1–8)
Advanced study in various subjects, through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.
Mr. Eberhart (F, W, Sp)

299. Individual Research. (1–12)
Prerequisite: graduate standing. Research or investigation in selected advanced subjects.
Mr. Eberhart in charge (F, W, Sp)
601. Individual Study for Master's Students. (1-8)

Individual study of the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.

Mr. Eberhart (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for Ph.D. (and other doctoral degrees). May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

Mr. Eberhart (F, W, Sp)

IDS 131. Systems, Graphs, and Combinatorics in Design. (4)

See Interdepartmental Studies for the complete description of this course.

*ELECTRICAL ENGINEERING AND COMPUTER SCIENCES

Upper Division Courses

100A–100B. Electrical Circuits, Electronics, and Instrumentation, (3–3)

Two hours of lecture and one 3-hour laboratory per week. Prerequisite: Physics 4B. Course 100A is prerequisite to 100B. This course is not for students in Electrical Engineering.

100A. Transient and steady-state analysis of circuits; network theorems; analogs and duality; introduction to electronic circuits; associated laboratory experiments.

Mr. Whinnery, Mr. Wiesner (F, W)

100B. Electronic circuits and models; amplifiers, feedback, and oscillators; analog and digital instrumentation and systems; associated laboratory experiments.

Mr. Whinnery, Mr. Wiesner (W, Sp)

101. Electronic Circuits and Instrumentation Systems, (4)

Three hours of lecture and one hour recitation per week. Prerequisite: Physics 4B. An introduction to electronics for nonmajors. Theory and applications of electronics and electrical circuits. Vacuum tube and semiconductor devices, Basic concepts of electronic instrumentation and control systems.

Mr. Whinnery (F)

104A–104B. Electric Circuits. (4–4)

Three 1-hour lectures and two 1-hour discussion sections per week. Prerequisite: Mathematics 51A and 51C; course 104A is prerequisite to course 104B.


Mr. Desoer, Mr. Kuh (F, W, Sp)


2-ports. Network theorems; substitution, superposition, Thevenin, reciprocity.

Mr. Desoer, Mr. Kuh (W, Sp)

105. Analog and Digital Electronic Circuits, (4)

Four hours of lecture per week. Prerequisite: Engineering 17. Introduction to analog and digital electronic circuits; bipolar transistor models; single-stage and cascaded amplifiers; the differential pair and integrated operational amplifiers; frequency response, feedback concepts; instability and frequency compensation; oscillators, sweep and timing circuits.

Mr. Gray (F, W, Sp)

105L. Electronic Circuits Lab. (1)

One 3-hour laboratory per week. Prerequisite: course 105 (must be taken concurrently). An electronic circuits laboratory to accompany EECS 105. Bipolar transistor characteristics, single-stage and cascaded common-emitter and emitter-coupled amplifiers, operational amplifiers, oscillators, sweep and timing circuits.

Mr. Gray (F, W, Sp)

106. Machine and Assembly Languages, (4)

Three hours of lecture per week plus consulting service. Prerequisite: Engineering 1 or one-quarter course in FORTRAN. Students will not be given credit for both course 106 and Engineering 41, or for both course 106 and course 153, or for both course 106 and Computer Sciences 103. Number representations in computers. Machine language programming, Assembly language programming. Rudimentary compiling, Loaders. File processing. Rudimentary I/O. Debugging techniques.

Mr. Gill, Mr. Hoffman (F, W, Sp)

107. Programming Techniques and Data Structures, (4)

Three hours of lecture per week plus individual computer usage. Prerequisite: Engineering 1 or one-quarter course in FORTRAN. Students will not be given credit for both course 107 and 153, or for both course 107 and Computer Science 103. Arrays, lists, stacks and other data structures. Applications to recursion and processing of algebraic expressions. Searching and sorting techniques. Rudimentary SNOBOL.

Mr. Gill (F, W, Sp)

108. Basic Electronics Laboratory, (2)

One 4-hour laboratory per week. Prerequisites: Engineering 17 and course 104A. Experimental investigation of fundamentals of electronic devices and circuits.

Mr. Muller (F, W, Sp)

114A–114B. Power Systems Analysis, (3–3)

Three hours of lecture per week. Prerequisite: course 114A. Course 100B or course 104B; course 114B, course 114A. 114A: Introduction to electric power systems with emphasis on the transmission network. Analysis of steady-state load flow and optimization. Synchronous machine modeling. 114B: The control problem. Transient stability analysis including effects of fast-acting excitors and governors. Short circuit analysis by method of symmetrical components.

Mr. Hopkin (sequence beginning F)

*Administrative reorganization of the Department of Computer Science is being implemented for Fall 1973. Students in the College of Letters and Science interested in the major or other degree programs should contact the department office or the Office of Student Services in the College of Letters and Science concerning possible curricular changes.
115. Semiconductor Circuits Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: course 104A. Experimental study of bipolar and field-effect transistors, computer-aided design and project activity with cascaded, low-pass amplifiers; feedback amplifiers; frequency selective amplifiers; harmonic and relaxation oscillators.
Mr. Pederson (F, W, Sp)

116. Microwave Communication Systems. (4)
Two 1¼-hour lectures per week. Prerequisite: course 117A. Systems concept, electromagnetic fields and power flow, microwave amplifiers and oscillators, principles of solid state microwave devices, antennas, propagation of radio waves, noise and specific microwave communications systems. Mr. Angelakos (Sp)

Three hours of lecture and one hour of recitation per week. Prerequisite: course 104A, Mathematics 51B, 51C. 117A is prerequisite to 117B, 117B is prerequisite to 117C. Planes wave in uniform media. The relation of lumped circuits to field concepts. Static electric and magnetic fields and properties of matter. Calculation of resistance, capacitance and inductance. Waveguides, resonant cavities, periodic structures. Introduction to antennas. Wave propagation in inhomogeneous and anisotropic media. Mr. Welch 117A (F, W, Sp); 117B (F, W, Sp); 117C (F, W, Sp)

118. Fundamentals of Discrete Systems. (3)
Three hours of lecture per week. Prerequisite: Engineering 1 or 101 or Computer Science 2, or equivalent knowledge of FORTRAN. Basic concepts and techniques for the analysis of systems in which the input, output and state range over finite sets, with illustrative examples drawn from information processing, control and other areas of application.
Mr. Zadeh (W)

119. Linear Systems Analysis. (4)
Two 1¼-hour lectures and one 1-hour recitation per week. Prerequisite: course 104B. Analysis of linear electrical, mechanical and electromechanical systems. Description by differential equations and vector differential equations and analysis of system behavior. Concept of state. Fourier and Laplace transform methods of analysis. Consideration of stability of feedback systems.
Mr. Polak, Mr. Wong, Mr. Sakrison (F, W, Sp)

123. Circuit Theory and Design. (4)
Four hours of lecture per week. Prerequisite: course 104B. Selected topics on network analysis, approximation, synthesis, and design. Passivity and positive real functions. Continuous (passive and active) and digital filters. Computer-aided circuit analysis and design.
Mr. Kuh (F, Sp)

124. Analysis of Signals, Noise, and Modulation. (5)
Four hours of lecture and one hour of discussion per week. Prerequisites: Mathematics 51A and 51C (course 104B is recommended for EECS majors). Basic methods of signal analysis applicable to data processing and communication. Fourier series and Fourier Transforms; thorough discussion of Transform Properties; sampling theorem; Fast Fourier Transform. Introductory description of random signals and noise. Analysis of AM and FM.
Mr. Sakrison, Mr. Turin, Mr. Wong (F, W, Sp)

128A–128B. Feedback Control. (4–4)
Three 1-hour lectures and one 3-hour laboratory per week.
128A. Prerequisite: course 119. Analysis and synthesis of linear feedback control systems.
Mr. Bergen, Mr. Hopkin, Mr. Polak (Sp)

130. Electronics of Solids. (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: Physics 4D, 4E, 137A; Mathematics 51C. Description of solids, the crystalline state, energy band structure and conduction properties of semiconductors and metals, dielectric properties of insulators, optical effects.
Mr. English, Mr. Oldham, Mr. Wang (F, Sp)

131A. Semiconductor Devices. (3)
Three hours of lecture per week. Prerequisite: course 130 or equivalent. Properties of holes and electrons. Physics of pn junctions and of bipolar, junction field-effect and MOS field-effect transistors. Device models for linear and nonlinear applications.
Mr. Muller, Mr. Van Dozer (F, W)

131B. Solid-State Devices. (3)
Three hours of lecture per week. Prerequisite: course 130 or equivalent. Physics of solid-state devices, silicon surfaces, MOS transistors and charge-coupled elements. Schottky barrier and tunnel diodes. Junction breakdown, voltage regulators, memory elements, IMPATT devices and SCR's. Gunn effect, luminescent and laser diodes, Elastic-wave devices and Josephson Junctions. Mr. Muller, Mr. Wang (W)

132. Communication Systems Laboratory. (2)
Four hours of laboratory per week. Prerequisite: course 124 recommended. Measurement of frequency spectra. Experimental evaluation and comparison of single- and double-sideband AM, FM and PCM systems, including measurements of relationships among signal-to-noise ratios, bandwidths, and threshold phenomena.
Mr. Turin (F, W, Sp)

133A. Power System Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: course 114A. Transient and steady-state stability of a synchronous generator and load. Series and parallel capacitors. Interconnection of several machines. Transient stability improvement using switched capacitors, switched loads, excitation forcing from shaft angle, velocity and acceleration signals, and supplementary governor signals.
Mr. Smith (W)

133B. Power Control Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: course 114A (133A is not prerequisite to 133B). Techniques for measuring power system state, including nodal frequency and power flow, and generator shaft angle, velocity and acceleration. Nonlinear functions of system state for optimal control of actuators, including governors, exciters, and regulators.
Mr. Smith (Sp)
134. Solid-State Electronics Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: course 130. Experiments for measuring physical parameters and observing and interpreting fundamental phenomena in solid-state materials and devices.
Mr. Muller, Mr. Oldham, Mr. White, Mr. Wang, Mr. Van Duzer (F, W, Sp)

135. Microwave Laboratory. (2)
One 4-hour laboratory per week. Prerequisite: course 117A. Experiments illustrating the fundamental principles in the operation of active and passive microwave devices. Particular consideration is given to the special methods of measurement and special techniques which must be employed at microwave and optical frequencies.
Mr. Angelakis, Mr. Welch (W, Sp)

136. Introduction to Quantum Electronics. (3)
Three hours of lecture per week. Prerequisite: Physics 4D, course 117A or Physics 110A. The laser principle and survey of basic laser systems; optical resonators; interactions between atomic systems and resonators; modulation and detection of lasers; other applications.
Mr. Whinnery (Sp)

137. Introductory Solid-State Devices. (3)
(Formerly numbered 126)
Three hours of lecture per week. Prerequisite: Physics 4C, Math 1C, Engineering 17. Basic operation of solid-state devices used in computers (logic elements, memory and display), communications and control systems. Integrated circuits with emphasis on digital electronics; other semi-conductor devices. An alternative to 131A-131B for students in computers, communications, control, networks, etc. Mr. Young, Mr. English, Mr. Muller (W, Sp)

138. Superconductor Electronics. (3)
Three hours of lecture per week. Prerequisite: course 117A, 130, Physics 137B (may be taken concurrently). Basic superconductor phenomena and microscopic description. Electrodynamics applied to circuit elements. Josephson junctions with application to detection, switching, and ultra-sensitive measurements. Thermodynamic concepts. Theory of superconductors in strong fields. Type II superconductors and use in magnets and power transmission.
Mr. Van Duzer (W)

140. Nonlinear Electronic Device Models and Circuits. (4)
Four hours of lecture per week. Prerequisite: courses 104B, 105. Development of nonlinear circuit models of electronic devices: pn junction diodes, bipolar junction transistors, Field effect transistors; effects of modeling complexity and accuracy of performance prediction, charge storage in devices. Application in electronic circuit simulation and the study of regenerative and nongenerative transistor circuits.
Mr. Pederson (F)

141. Linear Integrated Circuits. (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: courses 104B and 105. Integrated circuit elements and devices; the design of IC operational amplifiers; computer-aided analysis for bias state and bandedge frequency response; feedback amplifier theory and design; noise performance; frequency selective circuits, potential and active instability.
Mr. Pederson (F, W)

145. Digital Integrated Circuits. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: courses 104B, 105. The design of digital integrated logic circuits with emphasis on speed, fan-in, fan-out, logic levels and power. Both bipolar and MOS (Metal Oxide Silicon) integrated logic circuit families are treated. The organization of these circuits into MSI (Metal Silicon Insulator) and LSI (Large Scale Integration) arrays for logic and memory application is discussed.
Mr. Pederson (F, W, Sp)

147. Processing and Design of Integrated Circuits. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 105. Fabrication of integrated circuits, mask layout and diffusion processing. Integrated circuit components, device structure and characterization, parasitic effects. Design of integrated circuits with emphasis on device-circuit interaction. Bipolar and MOS transistors will be fabricated and evaluated in the laboratory.
Mr. Hodges, Mr. Muller (F)

148. Introduction to Information Processing. (4)
Three hours of lecture per week. Prerequisite: none. An introduction to techniques of digital information processing, with emphasis on the basic and applied aspects of information organization, information retrieval and general information processing systems.
Mr. Zadeh (Sp)

149. Information Processing Techniques. (4)
Mr. Zadeh (Sp)

150. Logic Design and Components of Digital Computers. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: Engineering 1 or equivalent knowledge of FORTRAN or ALGOL. Engineering 17 or equivalent circuit experience. Characteristics of components for and methods of describing, analyzing, and designing digital systems; switching-circuit algebra, graphical methods and introduction to minimization; experiments with pulse trains, gating units, registers; assembly of simple systems from standard high-speed components.
Mr. Baskin, Mr. Morton, Mr. Pederson (F, W, Sp)

150S. Electronic Logic Circuits. (1)
One hour lecture per week. Prerequisite: course 150 must be taken concurrently. Supplementary study of electronic logic circuits for students unfamiliar with large-signal transistor techniques.
Mr. Morton, Mr. Pederson (F, W, Sp)

151A–151B. Components of Computing Systems. (4–4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 150 or 105. (151A and 151B may be taken in either order.) Study of components of computing systems, including logic networks; high-speed memory, buffer and register circuits; bulk storage devices; computer terminals and graphic input-output systems. Overall function and internal details of components and associated considerations of design.
Mr. Morton, Mr. Walsh (W, Sp)
152A. Computer Systems. (3)
Three hours of lecture per week. Prerequisite: course 150. Students will not receive credit for both Computer Science 110 and course 152A. Application of logic design techniques to arithmetic, control, and input-output functions. Algebraic specifications, number systems, and implementation of high speed arithmetic functions. Study of the design of a digital computer: instruction sets, I/O techniques, micro-processing, and system organization. Mr. Baskin (F, W)

152B. Computer Systems. (3)
Three hours of lecture per week. Prerequisite: course 152A. Advanced topics in computer systems organization with emphasis on hardware-software trade-offs, real-time systems, terminal-oriented systems, time-sharing, multi-processing, and interactive graphics. Several recent systems and their underlying concepts will be examined. Mr. Baskin (Sp)

153. Programming Methods. (5)
Three hours of lecture per week. Prerequisite: Engineering 1 or 101 or Computer Science 2 or a thorough knowledge of FORTRAN or ALGOL. Students will not be given credit for course 153 and any of the following: Computer Sciences 103, Engineering 41, course 106 and 107. Basic programming techniques: machine language programming, assemblers, arrays, lists, searching and insertion, sorting, string processing languages, recursion, algebraic expressions, input-output fundamentals, computer arithmetic. Mr. Gill (W)

154. Design and Implementation of Programming Languages. (4)
Three hours of lecture per week. Prerequisite: course 153, or course 106 and 107, or Engineering 41 and course 107, or Computer Sciences 103. Students will not be given credit for both Computer Science 106 and course 154. Design and implementation of programming languages; assemblers, methods for description of syntax; declaration; parsing techniques; code generation. At least one nonalgebraic language will be considered in detail. Extensive programming practice. Mr. Hodges (W)

Four hours of lecture per week. Prerequisite: Engineering 41; courses 107, or 153 or equivalent. Course 152 with emphasis on hardware not required. Credit will not be given to students who have taken Computer Science 109. System programs for batch processing, time-sharing, and multi-programming. Basic concepts: loading, linking, scheduling, resource allocation, files, interrupts, control of storage, memory protection, security and privacy, reliability, interprocess communication. Mr. Stonebreaker (Sp)

159. Language Processing Laboratory. (2)
Two hours of laboratory per week. Prerequisite: course 153 or Computer Sciences 103. Fundamental computer programming techniques used in writing language processors such as assemblers and FORTRAN, ALGOL, and PL-1 compilers. Symbol tables, formatting, character expanding and compressing, the Bauer-Samelson algorithm, recursive methods. (F, W)

160. Communication Theory and Analysis. (4)
Four hours of lecture per week. Prerequisite: course 124, Statistics 134A. In-depth analysis of communication in the presence of noise, based on concepts presented in course 124. Digital communication over additive noise channels: optimum demodulators and signal sets. Pulse modulation; geometric interpretation of nonlinear modulation, exchange of bandwidth for signal-to-noise ratio. Optimum linear filtering. Mr. Sulakson, Mr. Turin, Mr. Wong (Sp)

163. Finite-State Machines. (3)
Three hours of lecture per week. Prerequisite: None. Analysis and synthesis of finite-state machines. Equivalence and minimization. Diagnosing, homing, and machine identification experiments. Finite-memory and information-lossless machines. Acceptors and regular expressions. K-definite acceptors. Mr. Blum, Mr. Gill, Mr. Spira (F, W)

164. Algorithms and Machines. (4)
Three hours of lecture per week. Prerequisite: None. Students will not receive credit for both Computer Science 132 and course 164. Models approximating digital computers. Algorithms and Turing machines. Post systems. Recursive functions. Unsolvability. Equivalence of computational models. Applications to computers and information processing. Mr. Blum and Mr. Gill (F)

170. Plasma and Beam Dynamics. (3)
Two 1/2-hour lectures per week. Prerequisite: course 117A, Physics 4E. Basic concepts of plasma and beams. Single particle motion in electric and magnetic fields; guiding center drift motion, invariants; applications to plasma containment, beam focusing electron and ion guns. Fluid approximations; applications to fusion waves in magnetized plasma. Mr. Birdsell, Mr. Lieberman (W)

171. Properties of Plasmas. (2)
One 4-hour laboratory per week. Prerequisite: course 117A, Physics 4E. This is a laboratory course to illustrate the physical and electromagnetic properties of ionized gases, techniques of measurement of these properties, and methods of creation of laboratory plasmas. There will also be experiments on vacuum systems and high current switching. Mr. Birdsell, Mr. Lieberman, Mr. Lichtenberg (Sp)

175. Applied Electron and Ion Optics. (4)
Three hours of lecture per week. Prerequisite: Physics 4 series, Math 51 series. Course 117A recommended. Electron and ion sources. Formation, focusing and deflection of electron and ion beams. Beam interactions with matter: information generation (x-rays, secondary emission, backscattered electrons and ions), material processing (resist exposure, ion implantation for semiconductor device fabrication). Resolution, current density limits. Either a project or laboratory is also associated with the course. Mr. Everhart, Mr. Wiesner (W)

Three hours of lecture per week. Prerequisite: course 104B. Course 181A is not prerequisite to course 181B.

181A. Device physics and signal processing properties of neurons, properties of muscles, communication among neurons and properties of very simple neural networks. Mr. Lewis (F)

181B. Applications of engineering analysis techniques to neuromuscular control systems, with special emphasis on orientation, navigation, and communication. Mr. Lewis (W)
183A–183B. Bioelectronics Laboratory. (3–3)

183A: one hour of lecture and four hours of laboratory per week; 183B: six hours of laboratory per week. 
Prerequisite: course 181A or consent of instructor. For engineering students wishing to apply their knowledge of instrumentation, measurement, and analysis to biological problems, this laboratory provides direct experience with living preparations illustrating basic properties of sensory and neuromuscular control systems, with emphasis on independent design of experiments, especially in 183B.
Mr. Lewis (W, Sp)

184. Introduction to Ecological Systems. (4)

Two hours of lecture and one class project per week. 
Prerequisite: Mathematics 12B or 51C, course 104A or consent of instructor. Physical ecology for engineers. Lectures emphasize global ecology and current attempts to apply systems analysis and state-space approaches to energetics, logistics, dynamics and stability of ecosystems, with special emphasis on man in the biosphere.
Mr. Lewis (Sp)

186. Neural Integration of Sensory Information. (3)

Three hours of lecture per week. 
Prerequisite: a course in fundamentals of cell physiology or neurophysiology, such as EECS 181A, 183A or Physiology 101A or Zoology 104. Analysis of mechanisms that abstract sensory information and encode for neural transmission to the higher centers. Focus on neuronal integration involving lateral inhibition, slow potential mechanisms, iterative processing, and the relation to surface potentials, culminating in system modelling and simulation.
Mr. Werblin (Sp)

198. Directed Group Studies for Advanced Undergraduates. (1–5)

Prerequisite: course 105. Group study of selected topics in electrical engineering, usually related to new developments.
The Staff (Mr. Kuh in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 37. For students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)

Graduate Courses

1204. Electron Optics. (4)

Three hours of lecture per week. 
Mr. Everhart, Mr. Wiesner (Sp)

1205. Applications of Electron Interactions with Matter. (4)

Three hours of lecture per week. 
Prerequisite: courses 175, 117A, Physics 137A, or consent of instructor. Electron penetration into matter, Energy loss mechanisms, scattering of neutrons, backscattering, range concepts, Information generation, including photons, secondary electrons, electron-beam-induced currents, etc. Interaction with thin samples—characteristic energy losses, angular scattering, etc. Applications to scanning and transmission electron microscopy. Mr. Everhart, Mr. Wiesner (Sp)


Three hours of lecture per week. 
Prerequisite: course 117A–117B or Physics 110A–110B–110C; 210A is prerequisite to 210B, 210B is prerequisite to 210C. Advanced treatment of classical electromagnetic theory and its application to engineering problems. Microscopic and macroscopic Maxwell's equations, fundamental theorems, waves in dispersive and anisotropic media, interaction of fields and moving charges, interactions between coupled waves, boundary value and source problems, models of dielectrics and other physical systems.
Mr. Mei, Mr. Neureuther 210A: (F, Sp) 210B: (W); 210C: (Sp)

216. Microwave Antennas. (4)

Three 1-hour lectures per week. 
Prerequisite: course 210A. Application of Maxwell's equations to single antennas and antenna arrays used in transmission and reception of radio waves. Classical technique and numerical methods are emphasized.
Mr. Neureuther (W)

217. Microwave and Optical Distributed Networks. (4)

Three hours of lecture per week. 
Prerequisite: course 117A–117B. Relations between field theory and network theory; applications of network theorems and the measurement techniques to microwave guides, cavity resonators, filters and ferrite devices; optical waveguides, resonators and other circuit elements; other important distributed systems.
Mr. Whinnery (Sp)

222. Techniques of Linear System Theory. (4)

Four hours of lecture and two hours of recitation per week. 
Mr. Desoer (F, W)

223A–223B. Foundations of Network Theory. (3–3)

Three hours of lecture per week. 
Prerequisite: course 104B. Characterization and modeling of basic circuit elements; frequency and time-domain properties of passive, active reciprocal, non-reciprocal, linear, nonlinear n-ports; topological formulation of network equations, generalized loop, cut set, hybrid and state variable analysis; feedback theory and sensitivity.
Mr. Chua, Mr. Kuh 223A (F, W); 223B (W)

225. Nonlinear Networks. (3)

Three hours of lecture per week. 
Prerequisite: course 223. Qualitative analysis of nonlinear and time-variable networks: formulation of the state equations; stability, power gain, and oscillation studies.
Mr. Chua, Mr. Keller (Sp)

226A. Computational Methods for Dynamic Optimization. (4)

Three hours of lecture per week. 
Prerequisite: courses 222 and 227A. Variational and mathematical programming techniques for optimal control and related problems, Convergence conditions, Un-
226B. Optimization Techniques in Mathematical Programming and Control, (4)

Three hours of lecture per week. Prerequisite: courses 222 and 227A. Course 226A and Mathematics 104A are recommended. A unified study of necessary and sufficient conditions of optimality including the Pontryagin Maximum Principle, the Discrete Maximum Principle, Kuhn-Tucker and F. John Theory. Computational methods; steepest descent, quasilinearization, genetic algorithms and families of feasible directions algorithms. Miscellaneous topics in optimal control.

Mr. Polak (W)

227A. Optimization and Control. (3)

Three hours of lecture per week. Prerequisite: course 222 (may be taken concurrently). Finite-dimensional optimization techniques including linear and nonlinear programming with applications to design problems. Optimal control including Maximum principle. Dynamic Programming.

Mr. Desoer, Mr. Varaiya (F, W)

227B. Identification and Optimization. (3)


Mr. Varaiya (Sp)

228. Digital Control. (3)

Three 1-hour lectures per week. Prerequisite: courses 128 and 222. Analysis, synthesis and critical study of digital control systems. General application of both the z-transform and the state-space approach for discrete systems. Study of various nonlinearities in digital control systems, including quantization effects. Application of Popov and Lyapunov stability methods to PWM and FFM feedback systems. Application of discrete theory of biocomputers systems.

Mr. Jury (Sp)

229A. Nonlinear Control. (3)

Three hours of lecture per week. Prerequisite: course 222 (may be taken concurrently). Analysis and design of nonlinear and time-varying feedback systems. Behavior near equilibrium points and input-output behavior are studied by Lyapunov and functional analysis methods.

Mr. Hopkin (F, Sp)

229B. Nonlinear Control Systems. (3)

Three hours of lecture per week. Prerequisite: course 222. A unified treatment of oscillations in nonlinear systems. Existence theorems for periodic solutions in quasilinear systems are given. The methods used in the quasilinear case are generalized to systems containing a large nonlinearity. The results are used to study the classic equations of van der Pol, Duffing, Mathieu, etc., and to obtain counter examples to Aizerman’s conjecture.

Mr. Hopkin (Sp)

230. Physics and Chemistry of Semiconductors. (4)

Three hours of lecture per week. Prerequisite: Physics 121, Physics 137B or Physics 115 concurrently; course 130 or Physics 140 or Physics 141A-141B. Effective mass. Conductivity tensor, high field conductivity. Magnetic effects. Optical properties. Electrons, holes, and defects as chemical entities. Thermodynamics of defects—mass action. Equilibrium in binary compounds. Diffusion. Phase diagrams.

Mr. Van Duzer, Mr. Oldham (W)

231. Solid-State Devices. (4)


Mr. Muller, Mr. Wang (Sp)

235. High-Frequency Solid-State Devices. (4)

Three hours of lecture per week. Prerequisite: courses 117A-117B; 130. Interactions between electromagnetic fields and charged particles in solids. Coupled mode theory, parametric interactions, carrier waves in semiconductor systems and families of nonlinear filters. Avalanche multiplication of carriers. Applications to high-frequency solid-state devices including Gunn effect, avalanche diode, and acoustic amplifiers.

Mr. White (F)

236A–236B. Quantum and Optical Electronics. (3–3)

Three hours of lecture per week. Prerequisite: courses 117A–117B, Physics 115 or equivalent. The laser principle; analysis of specific laser systems such as gas lasers, ion lasers and solid-state lasers of the ruby type; laser dynamics; optical resonators and transmission systems; selected applications of coherent optics.

Mr. Schwarz 236A (W); 236B (Sp)

237. Quantum Electronics of Solids. (4)

Three hours of lecture per week. Prerequisite: course 117B, course 136 or equivalent, Physics 115 or equivalent. Optical properties of solids; electro-optic and magneto-optic effects; second-harmonic generation and parametric amplification; diffraction of laser beams by acoustic and spin waves; energy-handling and optical properties of semiconductor lasers; microelectronic devices; recent developments in integrated optics and distributed lasers.

Mr. Wang (F)

238. Electronics of Superconductors. (3)


240. Nonlinear Analog Integrated Circuits. (3)

Three hours of lecture per week. Prerequisite: course 141. Analysis and design of oscillators, mixers, multipliers and large signal amplifiers; high frequency analysis; distortion in amplifiers at low and high frequencies; computer-aided analysis; discrete component and integrated circuit realization.

Mr. Meyer (Sp)

241. Linear Integrated Circuits. (3)

Three hours of lecture per week. Prerequisite: course 141. Analysis and optimized design of monolithic operational amplifiers and wide-band amplifiers; methods of achieving wide-band amplification; gain-bandwidth considerations; analysis of noise in integrated circuits and low noise design.

Mr. Meyer (W)

243. Analysis and Design of Discrete-State Circuits. (3)

Three hours of lecture per week. Prerequisite: course 140, 141 or 145. Device modelling, charge
control; transient analysis of transistor switching; analysis and synthesis of discrete-state circuits, the counting property; triggering methods; analysis and design of monostable and astable circuits; computer analysis of switching waveforms. Mr. Pederson (F)

245. Digital Integrated Circuits. (3)
Three hours of lecture per week. Prerequisite: course 145. Advanced studies of digital circuit design and performance with emphasis on integrated logic families and their characteristics. Noise, transmission delays, speed and reliability. The design of A/D and D/A conversion circuits and semiconductor memory cells. Mr. Hodges (Sp)

251A–251B. Digital Systems Engineering. (3–3)
Two 1½-hour lectures per week. Prerequisite: course 151A–151B. The design of digital equipment including engineering considerations of components, logical circuits, memories, and peripheral equipment. Analysis of problems in reliability and signal propagation. Design automation and the use of computers as design tools.
Mr. Morton 251A (F); 251B (W)

252. Computer Systems Design. (4)
Three hours of lecture per week. Prerequisite: course 152A–152B and either course 107 or 153. Studies in computer organization emphasizing design principles and tradeoffs as related to cost, performance, reliability, availability, and data privacy and security. Emphasis on relationships between applications methodology and system architecture. Exposition of material through case studies of experimental systems and term projects.
Mr. Baskin (F, Sp)

Two 1½-hour lectures per week. Prerequisite: (1) Algebraic and machine languages (e.g., course 153 or Computer Science 101). (2) Automata or language theory (e.g., courses 162, 163, 263, or 267). Analysis and synthesis of programming languages and computer operating systems. Syntax and semantics of programming languages. The use of procedure, iteration, replication, and recursion. List processing techniques. Monitor and executive systems. The special problems of multiprogram and real-time systems.
Mr. Baskin (Sp)

255. Advanced Topics in Operating Systems. (4)
(Formerly numbered 290E)
Three hours of lecture per week. Prerequisite: course 155 or Computer Sciences 109. Recent developments in operating systems including multiprogramming, time-sharing and real-time systems; scheduling and resource allocation; addressing, virtual memory, paging, and segmentation; protection and privacy; measurement and modeling; synchronization and input-output; reliability; program design techniques.
Mr. Fabry (W, Sp)

256. Computer Graphics. (3)
Three hours of lecture per week. Prerequisite: course 152B or equivalent. Basic concepts of interactive computer graphics, e.g. light pen and tablet techniques, display list manipulation, graphic order sets, interrupt handling techniques. A study of several state of the art experimental systems in terms of hardware and software systems organization concepts and the methodology used in addressing the application area.
Mr. Baskin (Sp)

260A. Introduction to the Theory of Signals and Noise. (3)
Three hours of lecture per week. Prerequisite: course 119 or 124; Statistics 134A–134B or 200A. Second order stochastic processes. Correlation and linear operations. Wide sense stationarity and spectral density. Spectral representation. Rauhnen-Loeve expansion, Prediction and filtering. Mr. Turin (F, W)

260B. Stochastic Processes in Electrical Engineering. (3)
Mr. Wong (Sp)

261. Statistical Communication Theory. (4)
Four hours of lecture per week. Prerequisite: course 260A. Statistical formulation of digital and analog communication and radar detection and estimation. Nonsequential and sequential decision rules. Digital communication over the gaussian channel with and without feedback. Radar ranging. Parameter modulation; analog communication over the gaussian channel. Rate distortion bounds.
Mr. Sakrison, Mr. Turin (Sp)

264. Linear Sequential Circuits. (3)
Three hours of lecture per week. Prerequisite: Mathematics 113A–113B. Analysis and synthesis of linear sequential circuits in their forced and autonomous regimes. Applications in computation, counting, error-correction and detection, and generation of pseudo-random sequences.
Mr. Gill (Sp)

265A. Introduction to Information Theory. (3)
Three hours of lecture per week. Prerequisite: Statistics 134B or 200A or 200F. Fundamental concepts and results in Shannon information theory. Information rate of stochastic sources; capacity and proof of coding theorems for noisy memoryless channels, both discrete and gaussian; introduction to parity check codes and source coding with fidelity criterion.
Mr. Thomasian (W)

265B. Topics in Information Theory. (3)
Three hours of lecture per week. Prerequisite: course 265A, in certain years course 260A may also be required. Topics such as source coding with fidelity criterion, analysis of error probability with optimum coding, decoding methods, continuous channels with input constraints or unknown parameters.
Mr. Thomasian (Sp)

266. Error-Correcting Codes. (3)
Two 1½-hour lectures per week. Prerequisite: Mathematics 113A–113B. The construction of burst error correcting codes, BCH and other codes based on the theory of finite fields. Topics such as algebraic decoding, weight enumeration, convolutional codes, applications to the design of disk memories and deep space probes.
Mr. Berlekamp (Sp)

267. Theory of Formal Languages. (3)
Two 1½-hour lectures per week. Models of algorithmic languages relevant to programming and natural languages. Relation between language and grammar. Finite state languages, context-free languages, pushdown automata, context sensitive languages, and linear bounded automata. Other languages obtained from various types of automata.
Mr. Blum, Mr. Gill (Sp)
Three hours of lecture per week. Prerequisite: course 163 and Computer Science 130 or their equivalents. Introduction to the theory of algorithms. Capabilities and limitations of computers. Recursion theory. Priority arguments. Machine-independent theorems on speed of computation.
Mr. Blum (beginning) (W)

Two 1½-hour lectures per week. Prerequisite: course 117A–117B or Physics 110A–110B. 270A is prerequisite to 270B, and 270B to 270C. Theory and applications of plasmas including particle orbit theory, oscillations and waves, radiation, stability and containment, diffusion, and plasma diagnostics; analysis of various controlled fusion experiments.
Mr. Birdsall, Mr. Lieberman, Mr. Lichtenberg.
Sequence beginning (F)

286. Neurophysiology of the Visual System. (3)
Three hours of lecture per week. Prerequisite: courses 181A or 181B or 186 or 183A; Physiology 101, 201, Zoology 225. Recent developments in analysis of visual function through electrophysiological techniques, processing of visual information with regard to form, color, temporal sequences, abstraction and coding of visual information through the retina, and at progressively higher neural centers.
Mr. Werblin (W)

290. Advanced Graduate Study in Electrical Engineering.
Current and advanced topics in electrical engineering, primarily for advanced graduate students.

290A. System Theory. (2) Two hours lecture per week. The lectures are oriented towards advanced students and deal with recent developments in system theory and related areas.
Mr. Bergen, Mr. Desoer, Mr. Gill, Mr. Kuh, Mr. Thomasian, Mr. Varaiya, Mr. Zadeh (Sp)

290B. Wave Propagation and Electromagnetic Probing of the Atmosphere. (4) Three hours of lecture per week. Prerequisite: courses 117A–117B–117C or Physics 110A–110B–110C. The effect of the atmosphere on the propagation of electromagnetic waves will be studied as a function of the frequency of the wave and the altitude through which the wave propagates.
Mr. Silver (W)

290C. Advanced Circuit Theory. (1–3) One to three hours of lecture per week. Prerequisite: course 225. Current research topics in electrical circuits, networks, and systems. Typical subjects include feedback theory and sensitivity, computer-aided circuit design, modeling of nonlinear devices and systems, large-scale systems, nonlinear n-ports, and synthesis of nonlinear networks. To be taken on a pass/fail pass basis.
Mr. Chua, Mr. Kuh (Sp)

290D. Nonlinear Feedback Systems. (3) Three hours of lecture per week. Prerequisite: courses 222 and 229A. Input-output properties of nonlinear feedback systems, with emphasis on multiple-input multiple-output case. Convolution systems. Linearization of nonlinear systems. Slowly varying systems. Small gain and passivity theorems with applications to circuits and control problems. Recent results for the literature.
Mr. Desoer (Sp)

Mr. Mei (F)

290G. Robots. (2) Two hours of lecture per week. Prerequisite: course 290T—Symbol Manipulation and Artificial Intelligence, or consent of instructor. Design of machines which exhibit intelligent behavior. Perception and modeling of three dimensional scenes. Computer control of external manipulators. Robot problem-solving strategies including the use of tools.
Mr. Coles (Sp)

290H. The Computer-Aided Analysis and Design of Integrated Circuits. (3) Three hours of lecture per week. Prerequisite: course 141 or 145. The review and development of computer-aided circuit and system theory and analysis, and device modeling; sparse matrix techniques; basic components and performance of automated design packages for integrated circuits.
Mr. Pederson (W)

290I. Topics in the Theory of Random Processes and Communication. (2) Two hours lecture per week. Prerequisite: course 260A. Mr. Wong (W)

290J. Biological Systems. (3) Three hours of lecture per week. Prerequisite: course 119. Current and advanced topics in the application of systems theory and related forms of engineering analysis to problems in biology and medicine. Subjects may include ecosystem analysis, neuromuscular systems, sensory systems, communication, or similar topics.
Mr. Lewis (W)

290K. Bioelectronic Instrumentation. (3) Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Study of biological measurement techniques, transducers, signal detection and amplification, signal processing, application of computers, nuclear magnetic resonance, microwave optics, electrophysiology, and microscopy, and other techniques for biological measurements. Bioelectronic feedback responses as conditions of human activity.
Mr. Singer (W)

290L. Topics in Advanced Computer Systems. (4) Three hours of lecture per week. Prerequisite: courses 152A, 252, and consent of instructor. The course will relate to advanced computer systems; system modeling analysis, design, and organization. Topics will be chosen from a set including: Fault Tolerant Computing Microprogramming, Parallel Processing and Pipelining, Program Modeling Computer Arithmetic, etc.
Mr. Ravnmoorth (W)

290M. Selected Topics in Pattern Recognition. (2) Two hours of lecture per week. Prerequisite: none. Problem definition, measurement extraction, preprocessing, normalization, feature selection, theory of classification, fuzzy classification, context analysis, scene analysis versus classification, and limiting factors. Emphasis on problem-oriented pattern recognition.
Mr. Wong (F)

290N. Theoretical Studies of Parallel Computation. (2) Three hours of lecture per week. Prerequisite: consent of the instructor. Various aspects of parallel computation will be discussed. Some mathematical formulations of parallel computational processes and structures, particularly program schemata models, will be introduced. Properties such as equivalence, termination, determinacy, and the amount of parallelism will be defined within these models.
Mr. Baskin (W)

290O. Techniques for Security and Privacy in Computer Systems. (3) Three hours of lecture per week. Prerequisite: course 107 or 153. Techniques for increasing security and protecting privacy of data in computer systems; authentication methods; threat monitoring; data base compartmentalization; some encryption methods;
models of secure systems; problems of statistical inference. Cost tradeoffs among various countermeasures. Related topics such as physical security and administrative rules. Mr. Hoffman (W)

290P. Topics in Solid-State Electronics. (2) Two hours of lecture per week. Prerequisite: course 130; 230 or 231. Advanced treatment of topics chosen from research areas such as: space-charge effects in solids, high electric field effects, quantum phenomena, elastic wave interactions, surface effects on semiconductors.

Mr. English, Mr. Muller, Mr. Oldham, Mr. Wang, Mr. White (Sp)

290Q. Plasma Computational Physics. (3) Three hours of lecture per week. Prerequisite: course 170 or Physics 142, some computer skills. Theory and design of plasma simulation using many-particle and fluid models on computers. Applications to extension of linear and non-linear theory and to laboratory experiments on oscillations, waves, instabilities, heating, and diffusion in 1, 2, and 3 dimensions.

Mr. Birdsell, Mr. Langdon (F)

290R. Microwave Acoustics. (4) Three hours of lecture per week. Prerequisite: courses 117B, 130. Introduction to the propagation of elastic waves in crystals at microwave frequencies for isotropic and anisotropic media. Transduction, attenuation and amplification of elastic waves. Mr. White (F)

290S. Topics in Quantum Electronics. (4) Three hours of lecture per week. Prerequisite: course 117A and Physics 115, or the equivalent, and graduate standing. Topics in nuclear and electron magnetic spin resonance phenomena. Nuclear and electron spin resonance description, resonance instrumentation, spin echo, optical spin echo (with lasers). Problems of detection of resonance phenomena in noise. Coherent detection, signal averaging, computer processing of periodic signals.

Mr. Singer (Sp)


Mr. Pollack (W)

290U. Nonconventional Electron Microscopy. (3) Three hours of lecture per week. Prerequisite: course 130, 204 and Physics 115 or consent of instructor. Advanced discussion of specialized topics related to nonconventional electron microscopy, different topics to be discussed in successive years. Sample topics are: (1) Electron beam interactions with biological tissue and physical materials, including solid-state devices; (2) detailed study of certain electron optical instruments; (3) automatic processing of microscopic data.

Mr. Wiesner, Mr. Everhart (Sp)


Mr. Smith (Sp)

290W. Pattern Classification. (2) Two hours lecture per week. Prerequisite: Statistics 200A or equivalent. Selected topics in pattern classification; representation of patterns, selection of measurements, decision procedures. Mr. Wong (Sp)


Mr. Welch (W)

290Y. Combinatorial Computing. (3) Three hours of lecture per week. Prerequisite: consent of instructor. Formulation and solution of combinatorial problems, especially those arising in the analysis and design of systems. Methods of combinatorial optimization, such as branch-and-bound, network flows, matroid programming. Analysis of relative complexities of algorithms.

Mr. Lawler (W)

290Z. Topics in Automata Theory and Languages. (3) Three hours of lecture per week. Prerequisites: courses 162 and 163. Recent developments in the areas of automata, languages, computability and complexity.

Mr. Blum, Mr. Gill, Mr. Spira, Mr. Zadeh (Sp)

§291B. MOS Integrated Circuits. (3)

Three hours of lecture per week. Prerequisite: courses 145 or 131A–131B or 247. Technology and design of metal-oxide-semiconductor large-scale integrated digital circuits. Device characteristics, fabrication processes, static and dynamic circuit design; logic design, memories, layout, reliability. Considerations for system design using MOS LSIs.

Mr. Hodges (W)

§291C. Principles of Data Management Systems. (2)

Two hours of lecture per week. Prerequisite: course 153 or equivalent. Data, file, and storage structures in data management systems. Query classification. Survey of some important existing systems. Detailed examination of one experimental system.

Mr. Katzenelson, Mr. Stonebraker (W)

298. Group Studies, Seminars, or Group Research. (1–8)

Advanced study in various subjects through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation. The Staff (F, W, Sp)

299. Individual Research. (1–12)

Investigation of electrical engineering problems. The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1–8)

Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other doctoral degrees). May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)
INDUSTRIAL ENGINEERING AND
OPERATIONS RESEARCH

Upper Division Courses

120. Principles of Engineering Economy. (4)
Three 1 ½-hour meetings per week. Prerequisite: completion of 90 units of an approved engineering curriculum. Credit cannot be received for both course 120 and Civil Engineering 194. Economic analysis for engineering decision-making: economics of the firm; capital sources and their effects: economy study models; alternative, replacement and future-demand investments; risk and uncertainty; income-tax effects; computer and linear programming techniques, critical path methods.
Mr. Oliver, Mr. Lapsley,
Mr. Keachie (F, W, Sp)

150. Production Systems Analysis. (4)
Two 1 ½-hour lectures and one 2-hour problem session per week. Prerequisite: course 160. Operations analysis of integrated production systems; use of operating models and quantitative methods of operations research.
Mr. Grassi (F)

153. Facilities Planning and Design. (4)
Two 1 ½-hour lectures and one 2-hour discussion per week. Prerequisite: course 150. Consideration of mathematical models for layout, line balancing and conveyor systems. Analysis of integrated materials control systems involving functions of storing, recalling, delivery, inventory and computer control. Design of automated warehousing and order-picking systems and system simulation.
Mr. Grassi (W)

154. Industrial Data Processing Systems. (4)
Two 1 ½-hour lectures and one 1-hour laboratory session per week. Prerequisite: Engineering I. Introduction to data acquisition, storage, retrieval, and processing of information pertinent to the design, analysis, and operation of industrial systems. Students will elect a term project for development and evaluation as a data processing application; computer time available.
Mr. Lapsley (Sp)

162. Linear Programming. (5)
Two 1 ½-hour lectures, and one 2-hour problem session per week. Prerequisite: upper division standing. An introduction to linear programming with emphasis on formulation, the simplex method, duality theory, post-optimization problems, and applications to industrial systems.
Mr. Oliver, Mr. Glassey, Mr. Gale (F, W, Sp)

164. Introduction to Inventory Theory. (3)
Two 1-hour lectures and one 1-hour problem session per week. Prerequisite: Statistics 134B (may be taken concurrently) or 100A or 133. An introduction to deterministic and stochastic models of inventory, with emphasis on computation, interpretation, and application of steady-state results.
Mr. Jewell (Sp)

165. Reliability and Quality Control. (4)
Three hours of lecture and 1 hour of discussion per week. Prerequisite: Mathematics 51A or 51C. A survey of models and techniques useful in reliability, safety, and quality control developed by means of examples. Basic rules and symbolism for fault tree construction. Binomial and exponential acceptance sampling plans. Operating characteristic curve. Quality control charts and their uses. Economics of control charts.
Mr. Barlow (W)

166. Network Flow Models and Critical Path
Scheduling. (4)
Two 1 ½-hour lectures and one 1-hour discussion per week. Prerequisite: Mathematics 51A or 51C. Network optimization models, with emphasis on formulation and industrial application. Topics covered will be: flows on networks; maximal and optimal flows; transportation and dynamic flow networks; shortest and longest routes; formulations, time only cost-time critical path scheduling; computer solutions, economics interpretations.
Mr. Jewell (W)

167. Introduction to Queueing Theory. (4)
Two 1 ½-hour lectures and one 1-hour discussion per week. Prerequisite: One of Statistics 134B (may be taken concurrently) or 100A or 133. Definition and connection between delay, number in the system, and the busy period. The Poisson process and inter-event times. Steady-state solution of simple queues. The M/G/1 queue. Cost models and optimization. Elementary priority rules. Applications to inventory control, machine repair and traffic.
Mr. Wolf (F, Sp)

170. Human Performance Mechanisms. (4)
Three 1-hour lectures and one 2-hour laboratory per week. Introduction to the study of man as a component in engineering and industrial systems. An outline of the main anatomical, physiological, and psychological performance mechanisms, with emphasis on design-oriented models and data. Laboratory projects illustrate the main analytic and measurement techniques.
Mr. Crossman (F, Sp)

171. Social Organization of Work Systems. (4)
Three hours of lecture and one 2-hour project session per week. An introduction to the social organization of production and service systems, with review of relevant scientific approaches, models, and data. Reciprocal influences between technology, individual motivation, and social structure. Socio-technical system analysis and design. Individual projects based on field data.
Mr. Crossman (W)
172. Work Methods and Measurement. (3)
Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: course 170, Statistics 134A, or permission of instructor. Process, operation, and work systems analysis, design, and standardization. Plant layout, motion-time systems, work sampling, and statistical quality control. Mr. Lapsley (W)

Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: Mechanical Engineering 134. Introduction to the analysis and synthesis of manned systems for control, computation, and communication. Effects of environment. Design projects will be undertaken. Mr. Grossman (Sp)

176. Work, Incentives, and Organization. (4)
Two 2-hour lectures per week. Theory and design of jobs and corresponding organizations, with emphasis on motivation and adaptation to the currently changing structure of our industrial society. Lecture, cases and discussion. Topics include influence of technology, socio-economic factors, specific aspects of the labor relations, safety, health. Mr. Keachie (F)

178. Health and Safety. (3)
Three 1-hour lectures per week. Prerequisite: any one of courses 170, 171, 172, or 176 (may be taken concurrently). Human factors in health and safety of workers. Man-machine, socio-technical, and economic considerations, including physical condition monitoring, job design, work standards, incentives, accident psychology. Safe plant and product criteria, control, and legal aspects. Mr. Keachie (W)

178L. In-Plant Laboratory. (1)
One hour of laboratory per week. Prerequisite: course 178 (may be taken concurrently). Industrial plant inspections to supplement course IEOR 178 Health and Safety. Weekly hour sessions supplemented by analysis and reports. Mr. Keachie (W)

180. Synthesis and Design of Industrial Systems. (4)
Two 2-hour lectures per week. Prerequisite: course 150 and one of course 162, 167, or Mechanical Engineering 102A. Application of systems analysis and industrial engineering to the analysis, planning, and/or design of industrial or governmental systems. Consideration of technical and economic aspects of equipment and process design. Students work in teams under faculty supervision. Topics vary yearly. Mr. Grasso (Sp)

198. Directed Group Study for Advanced Undergraduates. (1–5)
Prerequisite: senior standing in engineering. Group studies of selected topics. Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. For students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis. Mr. Shephard in charge (F, W, Sp)

Graduate Courses

220. Engineering Economic Analysis. (4)
Four hours of lecture per week. Prerequisite: graduate standing. Economic Models of Technology; Minimum Cost and Maximal Revenue (Benefit); Valuation of Resources and Outputs (Accounting Prices); Consumer Preferences-Utility-Demand; Economic Criteria-Objectives of Private and Public Enterprise; Investment-Capital Budgeting; Models of Economic Systems for Technological Planning. Mr. Shephard (F)

240. Policy-Level Problems in Industrial Engineering. (4)
Two 2-hour meetings per week Prerequisite: graduate standing. Past and current factors which influence policy-level problems and decisions in industrial engineering practice. Case studies arising from, and currently affecting industrial engineering practice. Mr. Grassi (F)

249. Industrial Development. (4)
Two 2-hour lectures. Prerequisite: graduate standing or permission of instructor. Analysis of the development of an industry or project in the student's field of engineering, architecture, or applied science with regard to practical technology and the cultural-economic characteristics of the area or country. Mr. Keachie (Sp)

251. Production Systems and Facilities. (4)
Two 1½-hour lectures and one 1-hour laboratory per week. Prerequisite: course 162 or 167. Advanced study of topics related to production system analysis, design, operation and control with emphasis on model construction and the use of computers. Mr. Grassi (W)

254. Process Planning and Scheduling. (4)
Two 2-hour lectures per week. Prerequisite: course 162, Statistics 147, knowledge of Fortran programing, Mathematical and computer methods for planning, scheduling, and control of production and service systems; statistical techniques in forecasting; optimization of facilities utilization. Mr. Glassey (Sp)

262A. Linear Programming. (4)
Three hours of lecture an one 2-hour recitation per week. Prerequisite: Mathematics 111. Basic graduate course in linear programming. The simplex method and its variants. Convergence proofs. Duality theory, Geometry of linear programs. Parametric programming. Special structures such as decomposition and upper-bounded variables. Introduction to matrix games and quadratic programming. Mr. Gale, Mr. Adler (F, W)

262B. Nonlinear Programming. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: course 262A or 162 and a course in linear algebra. Math 104A recommended. Basic graduate course in nonlinear programming. Properties of convex sets and functions, unconstrained minimization, Kuhn-Tucker theorem, Lagrange multipliers, saddle-point problems and duality. Applications and algorithms, with emphasis on methods for which convergence proofs exist and computational experience has been favorable. Mr. Adler (Sp)
263A. Applied Stochastic Processes. (4)
(Formerly numbered 263)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: Statistics 134B (may be taken concurrently) or Statistics 200A. Study of renewal theory and Markov chains with application to applied problems in replacement and other stochastic systems. Emphasis on asymptotic behavior.
Mr. Wolff, Mr. Ross (F, W)

263B. Applied Stochastic Processes. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: course 263A. Study of Markov renewal processes, continuous time Markov chains, branching processes, and discrete time martingales with application to applied problems in replacement, queueing, and other stochastic systems. Emphasis on asymptotic behavior.
Mr. Barlow (Sp)

264. Inventory Theory. (4)
Two 1½-hour lectures and one 1-hour problem session per week. Prerequisite: either 162 or 262A; Statistics 154B or Statistics 200A or equivalent; Mathematics 104A or advanced calculus. Structure of optimal inventory policies, methods for finding such policies in deterministic and stochastic models. Planning horizon theorems, parametric production planning, stochastic ordering, single critical level policies, (s, S) policies, myopic policies. Bayesian models, dependence of optimal policies on various parameters.
Mr. Barlow (W)

265. Reliability Theory. (4)
Two 1½-hour lectures and one 1-hour problem session per week. Prerequisite: course 263A (may be taken concurrently). A first graduate course in the mathematical theory of reliability; properties of distributions with monotone failure rate; extreme value distributions; coherent structures; optimum maintenance problems; allocation of redundancy.
Mr. Ross (W)

266. Network Flows and Graphs. (5)
Two 1½-hour lectures and one 2-hour problem session per week. Prerequisite: course 162. Survey of solution techniques and problems that have formulations in terms of flows in networks: Maximum flow, minimum cost flow, multiterminal and multicommodity flows. Relationship with linear programming, transportation problems, electrical networks and critical path scheduling.
Mr. Adler, The Staff (W, Sp)

267. Advanced Queueing Theory. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: course 263A. Review of elementary queueing models; Markovian and M/G/1 queues. "L < W" and other conservation laws. Fluctuation theory and GI/G/1 queues. Approximations and bounds for single and multiple channel queues, priorities.
Mr. Wolff (W)

268. Applied Dynamic Programming. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: graduate standing. Dynamic programming formulation of deterministic decision processes problems, analytical and computational methods of solution, application to problems of equipment replacement, resource allocation, scheduling, search and routing. Brief introduction to decision making under risk and uncertainty.
Mr. Glassey, Mr. Ross (F, W)

269. Integer Programming and Combinatorial Optimization. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: course 262A or 266. Course 266 is usually taken before 269, but it is not a strict prerequisite for students who have taken course 262A. Typical applications of integer linear programming; convergent dual and primal cutting-plane algorithms; group-theoretic methods; branch-bound methods; total unimodularity and the transportation problem; matching theory; introduction to matroid theory; applications of matroids to graph theory and mathematical programming.
Mr. Karp (F)

270. Engineering Psychology. (4)
Two 1½-hour lectures and one 2-hour discussion per week. Prerequisite: course 170. Theoretical and experimental analysis of human information-processing and skilled performance, with emphasis on quantitative models for use in manned-system design. Laboratory projects as appropriate.

271. Advanced Topics in Work Systems Design. (4)
Two 1½-hour lectures and one 2-hour projects laboratory per week. Prerequisite: course 171. Impact of technology on task performance, supervision, evaluation, and control in sociotechnical systems. Dynamics of social interaction in a technical environment. Design of organizational models to enhance emergence of stable cohesive and productive social structures. Students will undertake individual projects.
Mr. Laner (Sp)

274. Manual Control and Manned System Design. (4)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: Mechanical Engineering 134 or Electrical Engineering and Computer Science 104B. Task dynamics and man-task interaction; manual control; human operator theory; display and interface design; simulation and allied techniques. Experimental and/or design projects will be undertaken.
Mr. Crossman (F)

290A. Theory of Production. (4)
Two 2-hour lectures per week. Prerequisite: Mathematics 104A. General theory of cost and production functions with application to production planning problems. Optimization of production expansion and other production planning problems.
Mr. Shepard (Sp)

290E. Large-Scale Programming. (3)
Three hours of lecture per week. Prerequisite: course 262A and 262B or 290G (latter may be taken concurrently). Techniques for solving large-scale linear and non-linear mathematical programs. Partition, decomposition, relaxation, and resource allocation methods. Generalized upper bounding and compact inverse methods.
Mr. Adler (F)

290F. Risk Theory. (3)
Two 1½-hour lectures per week. Prerequisite: any course in stochastic processes. Introduction to mathematical risk theory, with emphasis on various models of insurance operations: utility theory, insurance and gambling; life and casualty models of claims; fair premiums; credibility theory; risk reserves; risk-sharing; objectives of the firm.
Mr. Jewell (W)
102. Thermodynamics. (4)

Four hours of lecture per week. *Prerequisite: Chemistry 1B.* Chemical thermodynamics with emphasis in thermodynamic principles important in materials science.

Mr. Searcy (Sp)

103. Phase Equilibria and Transformations. (4)

Three hours of lecture per week. *Prerequisite: course 102 or Chemistry 14, or equivalent.* Principles and mechanisms determining material microstructure. Multiphase equilibria and phase diagrams. Phase transformations: nucleation; diffusion and diffusionless growth processes.

Mr. Pask (F)

104. Thermodynamics. (4)

Four hours of lecture per week. *Prerequisite: Chemistry 14.* Application of the principles of thermodynamics to metallurgical and ceramic problems.

Mr. Hultgren (W)


Three 1-hour lectures and one 2-hour section per week. *Prerequisite: course 104, Chemical Engineering 141B or Chemistry 14.* Chemical properties of metals and metallic compounds; interaction with one another, with gases, slags, and refractories, and with the environment; production and refining of metals and nonmetals.

Mr. Evans (W)

108. Electric and Magnetic Materials. (4)

Three hours of lecture per week. *Prerequisite: senior standing in engineering or a physical science.* Conducting, semiconducting and insulating materials of practical importance; Permanent magnets, soft magnetic materials, ferrites. Understanding of properties from physical principles. Control of electric and magnetic properties by processing. Economic factors, engineering applications.

Mr. Merriam (W)

109. Physical Metallurgy. (3)

Three hours of lecture per week. *Prerequisite: Engineering 45; senior standing in engineering or a physical science.* Relationships between microstructure and engineering properties of alloys. Nature and origin of non-equilibrium microstructures. Control of microstructure through alloying, processing, and thermal treatments. Environmental factors.

Mr. Parker (Sp)

109L. Physical Metallurgy Laboratory. (1)

One 3-hour laboratory per week. *Prerequisite: Engineering 45.* Laboratory for course 109. Preparation of specimens for optical and electron microscopy; metallographic equipment; alteration of microstructures to control properties; effects of microstructural changes on mechanical, electrical, and chemical properties; microstructures and properties of commercial alloys: fracture modes. Mr. Parker (Sp)

121. Glass and Crystalline Ceramic Materials. (3)

Three hours of lecture per week. *Prerequisite: Engineering 45.* Chemistry of glass with emphasis on structure and bonding. Properties of glassy materials: strengthening of glass; glass coating of metals; and ceramic-metal joining. Properties of ceramic materials for structural application. Special ceramics for electronics, nuclear and aerospace applications.

Mr. Fulrath, Mr. Pask (W)
121L Glass and Crystalline Ceramic Materials Laboratory. (1)

One 3-hour laboratory per week. Prerequisite: course 121 is a prerequisite and can be taken concurrently. Laboratory for course 121. Laboratory exercises to supplement lectures. Compounding and melting, softening points and annealing of glass. Strength of glass, glass-ceramics, and alumina ceramics. Electronic ceramics. Adherence of glass to metals.

Mr. Fulrath (W)

122. Ceramic and Metal Powder Processing. (3)

Three hours of lecture per week. Principles of forming methods and nature of materials response in drop casting, extrusion, dry pressing, etc. Behavior of slurries and plastic masses. Sintering and vitrification. Relation of processing steps to microstructure development.

Mr. Pask (Sp)

122L Ceramic and Metal Powder Processing Laboratory. (1)

One 3-hour laboratory per week. Prerequisite: course 122 is a prerequisite and may be taken concurrently. Preparation of specimens by slip casting, extrusion and dry pressing forming methods. Sintering and vitrification. Hot pressing. Correlation of microstructure with processing parameters. Experiments with ceramic material and metal powders.

Mr. Pask (Sp)

130. Materials Engineering. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: none. Structure and properties of metallic, ceramic, and polymeric materials; application of materials to engineering problems. Topics covered include heat treatment of steel, design limitations of structures with respect to fatigue and fracture, and influence of chemical environment on mechanical properties of materials.

Mr. Zackay (F, Sp)

141. Particulate Materials. (3)

Three 1-hour lectures per week. Prerequisite: senior standing in engineering or a physical science. Characterization of solid particles and particulate systems, size distributions, rheology of particulate-fluid systems, surface properties of particulates, principles of size reduction, size separations, unit operations in solid-liquid and solid-solid separations, mixing, agglomeration of particulates.

Mr. Mika (F)

141L Particulate Materials Laboratory. (1)

One 3-hour laboratory per week. Prerequisite: course 141 is a prerequisite and can be taken concurrently. Experiments in the measurement of particle size, surface area, size distributions, the packing of powder, size reduction, mixing, agglomeration, and rheology of particulate systems.

Mr. Mika (F)

142. Materials Process Engineering. (4)

Four 1-hour lectures per week. Prerequisite: Chemistry 14. Material and energy balances in metallurgical and ceramic systems; fuels and combustion; fluid flow; heat transfer.

Mr. Evans (F)

198. Directed Group Studies for Advanced Undergraduates. (1-5)

Prerequisite: course 101 and 103. Group study of selected topics.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted by regulations listed on page 87. For students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis.

Mr. Fuerstenauf in charge (F, W, Sp)

Graduate Courses

200A–200B. Principles of Materials Science and Engineering. (4–4)

Three hours of lecture and one hour of discussion per week. Prerequisite: graduate standing in Engineering or Natural Sciences. Crystallography, lattice defects, modern imaging and diffraction methods, solid state phase relations, thermodynamics, kinetics, transport phenomena, phase transformations, alloy theory, mechanical behavior, fracture, technological materials, environmental effects.

Mr. Thomas (F, W)

201. Applications of Chemical Thermodynamics. (4)

Four hours of lecture per week. Prerequisite: course 102 or equivalent. Thermodynamics is used to predict reactions and phase transitions for inorganic materials; thermodynamics of solid solutions, non-stoichiometric solids, ionic and aqueous electrolytes; estimation of missing data.

Mr. Searcy (F)


Four hours of lecture per week. Prerequisite: course 101 or equivalent. Bonding models and semi-empirical correlation schemes are applied to analyzing and predicting structures, bond distances, and bond energies in inorganic compounds and alloys. Limitations of the models are discussed.

Mr. Searcy (W)

203. Classical Thermodynamics. (4)

Four hours of lecture per week. Prerequisite: familiarity with vector calculus and partial differential equations. Principles of the thermodynamics of equilibrium, with emphasis on the equilibrium of phases in condensed multiphase systems.

Mr. Morris (W)

204. Statistical Thermodynamics. (4)

Four hours of lecture per week. Prerequisite: familiarity with vector calculus and partial differential equations. Principles of statistical thermodynamics, emphasizing principles and methods important in materials science: alloy theory, crystal imperfections, atom migration in crystals.

Mr. Morris (Sp)

205. Diffusion in Solids. (4)

Four hours of lecture per week. Prerequisite: vector analysis, partial differential equations; course 101, 102, or equivalent. The theory of diffusion in solids; mass balance equations; thermodynamics of diffusion; atom migration in crystals; molecular theory of diffusion.

Mr. Morris (F)

207. Dislocation Theory. (3)

Three hours of lecture per week. Introduction to dislocation theory with emphasis on dislocations in metals and alloys. Interactions between dislocations and other imperfections; basic mechanisms of yielding, solution hardening, strain hardening, radiation hardening, creep.

Mr. Washburn (F)

208. Dislocation Mechanics. (4)

Four hours of lecture per week. Prerequisite: graduate standing in engineering, chemistry, physics,
210. Surface Properties of Materials. (3)
Three hours of lecture per week. Thermodynamics of surfaces and phase boundaries, surface tension of solids and liquids, surface activity, adsorption, phase equilibria and contact angles, electrochemical double layers at interfaces, theory and applications.
Mr. Fuerstenau (W)

*211. Thermal and Optical Properties of Materials. (4)
Three hours of lecture per week. Prerequisite: any undergraduate course in solid-state physics or physics of materials, e.g., Physics 140, 141, Electrical Engineering and Computer Sciences 130 or course 108. This prerequisite will be waived for students with undergraduate degrees in physics or chemistry. Applied solid-state physics of materials and materials phenomena of engineering importance, especially nonmetallic materials. Dielectrics, ferro and piezo-electrics, crystal optics and lasers, elastic constants, phonons, thermal conductivity and thermal expansion.
Mr. Merriam (W)

*212. Electrical and Magnetic Properties of Materials. (4)
Three hours of lecture per week. Prerequisite: any undergraduate course in solid-state physics or physics of materials, e.g., Physics 140, 141, Electrical Engineering and Computer Science 130 or course 108. This prerequisite will be waived for students with undergraduate degrees in physics or chemistry. Applied solid-state physics of metals, especially electronic phenomena. Metal as a free electron gas, energy bands and Fermi surfaces, magnetic materials, thermoelectric materials.
Odd years only. Mr. Merriam (Sp)

Two hours of lecture and one 4-hour laboratory per week. Prerequisite: 213A is prerequisite to 213B. 213A: Kinematical theory of electron diffraction and image contrast, Kikuchi diffraction, interpretation of electron images, characterization of defects in solids; phase identification, Scanning microscopy. Application to engineering problems. Laboratory: Specimen preparation, microscopy analysis of images and diffraction patterns. 213B: 213A continued; Dynamical scattering, effects of absorption diffraction patterns, image contrast, strain analysis, e.g., small defects (radiation damage, precipitation); special topics; high voltage microscopy, many beam effects, energy analysis and selection microscopy, dynamical studies. Laboratory: advanced topics; analysis of crystal defects.
Mr. Thomas (beginning W)

*214. Advanced X-Ray Analysis. (3)
Two hours of lecture and one hour of laboratory per week. Prerequisite: course 101. Treatment of small angle scattering and dynamical theory of diffraction by electrons and X-rays. Interpretation of intensities in terms of precipitation phenomena, lattice defects, and precision lattice parameters. Experiments in small angle scattering, X-ray topography, Kossel lines and X-ray microanalysis.
Mr. Bragg, Mr. Washburn (Sp)

215. Kinetics of Phase Transformations. (4)
(Formerly numbered 206)
Mr. Morris (W)

216. Solid State Phase Transformations. (3)
(Formerly numbered 215)
Three hours of lecture per week. Significance of crystallographic factors in homogeneous, heterogeneous, and martensitic phase transformations; role of lattice defects on transformations; relation between structure and properties.
Mr. Thomas, Mr. Zackay (Sp)

Eng. 219. Service Failures and Analyses. (3)
See Engineering course section (page 210) for complete description.

Eng. 220. High Strength Steels. (3)
See Engineering course section (page 210) for complete description.

*221. Applied Colloidal Phenomena. (3)
(Formerly numbered 231)
Three hours of lecture per week. The characterization of colloidal materials and the physical chemistry of colloid systems. Primary emphasis on the interaction of colloid particles, particularly in aqueous environments; flocculation, coagulation, and dispersion phenomena.
Mr. Fuerstenau, Mr. Mika (Sp)

223. Modeling of Metallurgical and Ceramic Processes. (3)
Three hours of lecture per week. The steady- and unsteady-state behavior of metallurgical and ceramic processes. Emphasis on the formulation of physically meaningful models and their interpretation in terms of the interaction of transport and kinetic phenomena.
Mr. Mika (W)

224. Processing of Particulate Materials. (3)
(Formerly numbered 235)
Three hours of lecture per week. Prerequisite: course 223 or equivalent. Analysis of the unit operations encountered in the processing of particulate solids. Emphasis on the development and investigation of mathematical models of such operations as comminution, classification, thickening, flotation, and agglomeration.
Mr. Mika (Sp)

225. Sintering. (3)
(Formerly numbered 276)
Three hours of lecture per week. Mechanisms and kinetics of the densification and/or development of strength during heating treatment of metallic or nonmetallic inorganic powder compacts; evaluation of the influence of process variables such as externally applied pressure, liquid phase development, and secondary phases.
Mr. Fulrath (F)

226. High Purity Materials. (3)
(Formerly numbered 233)
Three hours of lecture per week. Prerequisite: course 104. Special properties and applications of high-purity materials; principles of methods of preparation (solvent extraction, zone refining, electron-beam melting, etc.); determination of purity. (F)
227. Ceramic Processing. (3)
Three hours of lecture per week. Treatment of particulate materials, rheological behavior of solid-fluid systems in relation to ceramic forming processes; densification mechanisms. Control of process parameters to develop desired characters (structures) of materials.
Mr. Fask (W)

244. Dispersions and Composites. (3)
Three hours of lecture per week. Treatment of properties of composite materials composed of equiaxed, platelike, fibrous, or filamentary phase dispersed in a second phase usually ductile and of lower melting point. Examples will emphasize current advances in materials for high temperature or lightweight structural applications.
Mr. Bragg (W)

245. Nuclear Materials. (4)
Four hours of lecture per week. The behavior of fuel, moderator, control and structural materials in nuclear reactor environments with emphasis on the mechanism of irradiation damage and the effect of irradiation damage on the properties of materials.
Mr. Bragg (Sp)

247. Chemistry of High-Temperature Materials. (3)
Three hours of lecture per week. Prerequisite: Chemistry 110A. The chemical reactions of high-temperature materials are described (or predicted); kinetics of high-temperature reactions.
Mr. Searcy (Sp)

249. Advanced Graduate Study in Materials Science and Engineering.
290A. Particle Size Characterization. (2) One 2-hour lecture per week. Analysis of techniques for the determination of particle size, the measurement of the surface area of particulate assemblages, the characterization of particle shape.
Mr. Mika (F)

290B. Surface Chemistry of Flotation. (2) Two hours of lecture per week. Analysis of mechanisms of selective adsorption of surface-active agents in flotation systems.
Mr. Fuerstenau (Sp)

290C. Ceramic-Metal Interfaces. (2) Three hours of lecture per week. Interfacial energy, wetting and spreading, and electrochemical reactions both under equilibrium and non-equilibrium conditions in ceramic-metal systems when the ceramic is a liquid and the metal is a liquid at working temperature. Requirements for development of adherence.
Mr. Pask (F)

290D. Engineering Applications of Glass and Glass Ceramics. (2) Two hours of lecture per week. Composition and forming methods of special glasses and glass ceramics for engineering applications. Properties of these glasses and glass ceramics.
Mr. Fulrath (Sp)

290E. The Kinetics of Vaporization and Endothermic Decomposition. (2) Two hours of lecture per week. Prerequisite: graduate standing in Materials Science and Engineering or equivalent. Theory and critical experiments on the kinetics and mechanisms of congruent vaporization and condensation, incongruent vaporization, effusion through pores, adsorption and desorption controlled reactions and surface diffusion.
Mr. Searcy (F)

298. Group Studies, Seminars, or Group Research. (1-8)
Advanced study in various subjects through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.
The Staff (F, W, Sp)

299. Individual Study or Research. (1-12)
The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other doctoral degrees). May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

ENGINEERING GEOSCIENCE

Upper Division Courses

198. Directed Group Studies for Advanced Undergraduates. (1-5)
Prerequisite: consent of instructor. Group study of selected topics.
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Additional limitation: enrollment is limited to students who have demonstrated by achievement of a B average that they have a capacity for independent work. Special prerequisites will be established by the instructor guiding the work. Must be taken on a passed/not passed basis.
Mr. Morrison (F, W, Sp)

Graduate Courses

See Engineering course section (page 210) for complete description.

201A–201B. Theory and Interpretation of Potential Field Data. (4-4)
Three hours of lecture and one hour of discussion per week. Prerequisite: Physics 110A, 110B, or equivalent; upper division course in partial differential equations. The physical basis of gravity and magnetic surveying: reduction of gravity and magnetic data. Theoretical anomalies of common models; estimation of parameters of disturbing bodies; spectral analysis; design of filters for derivatives, continuation, and fields reduced to the pole.
Mr. Bhattacharyya (W, Sp)

202A–202B. Electromagnetic Propagation. (4-4)
Three hours of lecture and one hour of discussion per week. Prerequisite: Physics 110A, 110B or equivalent; upper division course in partial differential equations. Electromagnetic propagation in the earth with emphasis on the design and interpretation of electromagnetic surveys in mineral prospecting and geological mapping. Plane wave
and finite source fields above and within layered earth models; fields scattered from inhomogeneities in dissipative half spaces. Mr. Morrison (W, Sp)

203. Physical Properties of Rocks. (3)
Two 1½-hour lectures per week. Prerequisite: Geology 5A–5B or equivalent, Geology 150 or equivalent. A survey of the electrical, magnetic, thermal and rheological properties of rocks. Mr. Morrison (W)

204. Electrical, Magnetic and Gravity Methods. (5)
Five 1-hour lectures per week. Prerequisites: Engineering 200, course 201A–201B, 202A–202B. Modern engineering practice in application of electrical, magnetic, and gravity methods to solution of geological problems. Lectures, laboratory scale model experiments, and field excursions will illustrate the conduct of geophysical surveys and interpretation of the resulting data. Includes surface, borehole, and airborne techniques. The Staff (W)

290A. Electronic Instrumentation in Geophysical Engineering. (3)
Two hours of lecture and three hours of laboratory per week. Prerequisite: consent of instructor. The course treats a broad range of electronic devices common to instrumental work in geophysical engineering. The principles and the dynamic properties of the various instruments are covered. Actual laboratory experience with the techniques involved is provided by a series of experiments. The Staff (W)

298. Group Studies, Seminars, or Group Research. (1–8)
Advanced study in various subjects through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation. The Staff (F, W, Sp)

299. Individual Study or Research. (1–12)
The Staff (F, W, Sp)

601. Individual Study for Master’s Students. (1–8)
Prerequisite: graduate standing in engineering. Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Prerequisite: graduate standing in engineering. Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other doctoral degrees). May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

MECHANICAL ENGINEERING

Upper Division Courses

102A. Mechanical Behavior and Processing of Materials. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: Engineering 36, 45, and Civil Engineering 130. Elastic and plastic deformation under static and dynamic load conditions. Prediction and prevention of failure by yielding, buckling, fracture, fatigue, creep and wear. Environmental influences, residual stress effects. Selection, forming, cutting, heat treatment of materials based on design requirements. Mr. Frisch, Mr. Radcliffe, Mr. Hauser, Mr. Cunningham (F, Sp)

102B. Mechanical Engineering Design. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 102A, 104B. Application of principles of mechanics, material science, and manufacturing processes to the design of components and complete machines which must meet prescribed functional requirements. Synthesis and analysis of a major machine design project. Mr. Cunningham, Mr. Frisch, Mr. Kobayashi, Mr. Hauser (F, W)

103. Dynamics. (4)
Three 1-hour lectures and one 1-hour recitation period per week. Prerequisite: Physics 4A and Mathematics 12B. Newtonian mechanics. Principles of dynamics of particles, systems of particles, and rigid bodies, with applications especially to one-dimensional and two-dimensional problems. Mr. Lieber, Mr. Nagdhi (F, Sp)

104A. Engineering Mechanics—II. (3)
Three 1-hour lectures per week. Prerequisite: Engineering 36. A vectorial treatment of the Newtonian principles of dynamics of particles and systems of particles, with applications to one-dimensional and two-dimensional motions. Two-dimensional dynamics of rigid bodies. Methods of impulse and momentum, work and energy. Mr. Rosenzweig, Mr. Goldsmith, Mr. Lieber, Mr. Schaaf (F, Sp)

104B. Engineering Mechanics—III. (3)
Three 1-hour lectures per week. Prerequisite: course 104A. Three-dimensional kinematics and dynamics of rigid bodies. Moments and products of inertia; kinetic energy and angular momentum. Applications to three-dimensional motion of particles and rigid bodies. Mr. Leitman, Mr. Goldsmith, Mr. Lieber (F, W)

105A–105B. Thermodynamics. (4–3)
Four and one-half hours of lecture per week for 105A and three hours of lecture per week for 105B. Prerequisite: Chemistry 1B, Mathematics 51C, Physics 4C. Credit will not be given for both 105A and 112. First and second laws of thermodynamics, thermodynamic properties, reversibility, availability, reactive systems, kinetic theory and microscopic properties, energy conversion systems. 105A: Mr. Stewart, Mr. Seban, Mr. Cornet (F, Sp); 105B: Mr. Hutchinson, Mr. Cornet, Mr. Stewart (F, W)

Four and one-half hours of lecture for 106A and three hours of lecture for 106B per week. Prerequisite: course 105A, 104A or 103.
106A: Incompressible and compressible fluid behavior in engineering systems. Mr. Laird, Mr. Oppenheim, Mr. Sherman (W, Sp)
106B: Conductive and convective transport of material and energy in the single phase; thermal radiation interchange. Mr. Cornet, Mr. Trezek, Mr. Seban (F, Sp)
107A—107B. Mechanical Engineering Laboratory. (4-4)

Eight hours of laboratory per week. Prerequisite: courses 105B, 106A, 104B. Experimental investigation and analysis of the steady-state and transient behavior of mechanical engineering systems and of their thermal and dynamic processes.
The Staff (Mr. Mote in charge) 107A (W, Sp) 107B (F, Sp)

110. Mechanical Engineering Systems Design. (4)

Three hours of lecture per week. Prerequisite: courses 107A, 102B. The course is intended to introduce concepts of mechanical engineering system design by having students complete preliminary designs of a realistic mechanical engineering system and by design seminars and conferences.
Mr. Steidel (Sp)

111. Elements of Thermodynamics and Heat Transfer. (3)

Three 1-hour lectures per week. Prerequisite: Mathematics 51C, Physics 4C, Chemistry 1B. Principles of thermodynamics, thermodynamic properties and relations; applications of the first and second laws; elements of heat transfer.
Mr. Cornet (W)

112. Introduction to Statistical Thermodynamics. (4)

Three 1 1/2-hour lectures per week. Prerequisite: Physics 4C, Mathematics 51C (not open to students in mechanical engineering). Credit will not be given for both Mechanical Engineering 112 and Mechanical Engineering 155 or for both Mechanical Engineering 105A and Mechanical Engineering 112. Macrocscopic formulation of thermodynamics, elementary kinetic theory of gases, an introduction to classical and quantum statistical mechanics, applications to engineering systems.
Mr. Trezek (Sp)

121. Plasticity and Metal Forming. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: Civil Engineering 130. The theory of plasticity and solutions of metal forming problems by elementary methods of analysis. Topics such as plastic instability, friction, and ductile fracture in forming are also discussed.
Mr. Kobayashi (F)

123. Designing for Weldments and Castings. (3)

Two 1 1/2-hour lectures per week. Prerequisite: Engineering 45. An analytical survey of the basic factors that must be considered from a materials and fabrication standpoint when utilizing weldments or castings. Selection of materials and fabrication problems, service properties and reliability.
Mr. Kobayashi (Sp)

124. Molten Metals Laboratory. (1)

One 4-hour laboratory per week. Prerequisite: course 123 (may be taken concurrently). A laboratory course designed to demonstrate application of the principles of welding and casting. Fundamentals of the various processes will be investigated and their application to engineering design illustrated.
(Sp)

125. An Introduction to the Mechanical Behavior of Materials. (3)

Two 1 1/2-hour lectures per week. Prerequisite: course 102B. Introduction to brittle, ductile, and transitional fracture, fatigue, creep, and wear with emphasis on the development of design criteria for various conditions of load and environment.
Mr. Kobayashi (Sp)

127. Advanced Methods in Mechanical Design. (3)

Two 1 1/2-hour lectures per week. Prerequisite: course 102B. Application of engineering principles to the synthesis and analysis of complete machines. Conceptual designs to fulfill economic, environmental, and functional requirements. Introduction to optimization and reliability considerations in machine analysis.
Mr. Frisch (Sp)

129. Applied Stress Analysis. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 103 or 104A. Advanced kinematic analysis and synthesis of typical elements of mechanism. Velocity and acceleration analysis of linkages, gearing, and cams.
Mr. Radcliffe (F)

131. Kinematics of Mechanism. (3)

Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 103 or 104A. Kinematic and dynamic analysis of rigid body mechanism using graphical and analytical methods. Dynamics of cam driven systems. Dynamics of rotating systems. Balancing of rotors. Dynamic response of rigid body systems. Design applications.
Mr. Radcliffe (W)

133. Mechanical Vibrations. (3)

Two 1 1/2-hour lectures per week. Prerequisite: course 103 or 104A. An introduction to the theory of mechanical vibrations including the topics of harmonic motion, Rayleigh's principle, damping, mechanical resonance, transient and random excitation.
Mr. Brown, Mr. Steidel (F, Sp)

134. Automatic Control Systems. (4)

Two 1 1/2-hour and one 1-hour lecture per week. Prerequisite: Mathematics 51C; Physics 4C. Formulation of dynamic systems in state space. Linearization. Graphical representations. Causality, realizability. Feedback control systems and stability. Analysis of design and analysis in the Laplace, Fourier, and time domains. Examples from mechanical and chemical engineering.
Mr. Thal-Larsen, Mr. Takahashi (F, W)

135. Control Instrumentation and Switching Logic. (3)

Three 1-hour lectures per week. Prerequisite: Mathematics 51C; Physics 4C. Configurations and functional descriptions of instruments for measurement and control. Static and dynamic behavior. Noise and noise filtering. Fluidic and electronic devices for analog and logic information handling, OR, AND, NOR, and NAND logic elements. Introduction to design and analysis of switching control systems.
Mr. Thal-Larsen, Mr. Takahashi, Mr. Auslander (Sp)

141. Cryogenics. (4)

Three 1-hour lectures and 1-hour discussion section per week. Prerequisite: courses 105B and 106A. Thermodynamics of producing low temperature fluids and regions and their application in system. Mr. Hutchinson (W)
142. Atmospheric and Thermal Environmental Control. (4)

Three 1-hour lectures and one 1-hour discussion section per week. Prerequisite: courses 105B, 106A. Production and control of atmospheric and thermal environments for human habitation.

Mr. Hutchinson (Sp)

145. Energy Conversion Principles. (4)

Three 1½-hour lectures per week. Prerequisite: courses 105B, 106B. Thermodynamic principles of energy conversion systems. Emphasis on direct energy conversion including thermoelastic, photovoltaic, thermionic, magnetohydrodynamic and electrodynamic devices, fuel cells, and nuclear power sources.

Mr. Branch (F)

146. Combustion Processes. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: course 105B, 106B, or equivalent; course 154 recommended. Fundamentals of combustion, flame structure, flame speed, flammability, ignition, stirred reaction, kinetics and nonequilibrium processes, pollutant formation.

Mr. Branch (F)

147. Combustion Engines. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: course 105B, 106B; 146 recommended. Application of thermodynamics and fluid mechanics to combustion engines, including system performance.

Mr. Oppenheim (Sp)

148A. Petroleum Development Engineering. (4)

Three 1½-hour lectures per week. Prerequisite: senior standing in engineering. Mechanics of rock breakage; rock drilling mechanics; circulation hydraulics; zonal evaluation; well completion; completion analysis.

Mr. Somerton (F)

148B. Petroleum Reservoir Engineering. (4)

Three 1½-hour lectures per week. Prerequisite: senior standing in engineering. Flow through porous media (Darcy's law); capillary behavior; multiphase flow; fluid displacement processes-miscible-immiscible; transient flow behavior.

Mr. Fatt (W)

151. Heat Transfer. (4)

Three 1-hour lectures, one 1-hour discussion period per week. Prerequisite: courses 105B, 106B. Basic principles of heat transfer and their application. Subject areas include steady-state and transient system analyses for conduction, free and forced convection, boiling, condensation, and thermal radiation.

Mr. Pagli, Mr. Greiff (F, W)

153. Introduction to Bioengineering. (4)

Three 1½-hour lectures per week. Prerequisite: Mathematics 51C. Basic objective is to show how the analytical techniques used by engineers can be applied to the modeling of biological systems. Heat, mass and momentum transfer, thermodynamic, electrical and thermal field modeling, control systems, human locomotion and elasticity applied to modeling of various bioengineering problems.

Mr. Trezek (Sp)

155. Statistical Thermodynamics. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: course 105A. Credit will not be given for both Mechanical Engineering 112 and 155. Classical and quantum mechanical descriptions of substances and evaluation of dynamic properties of gases, liquids and solids.

Elementary kinetic theory of gases and evaluation of transport coefficients.

Mr. Sawyer, Mr. Branch (F, Sp)

156. Principles of Desalination. (4)

Two 1½-hour lectures and one 1-hour discussion per week. Prerequisites: course 105B, 106B or equivalent. Basic principles of water desalting applied to the major commercial processes depending on phase change and membrane properties; distillation, freezing, electrodialysis, and reverse osmosis.

Mr. Laird, Mr. Spiegel (F)

159. Viscous Flow. (4)

Three 1-hour lectures and one hour of discussion per week. Prerequisite: course 106A Mathematics 51C. Theoretical and empirical bases of laminar and turbulent flows.

Mr. Laird, Mr. Talbot (F, W)

162. Elementary Hydrodynamics. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: Mathematics 51C; course 116 recommended. Kinematics and dynamics of inviscid, primarily incompressible, fluid flow.

Mr. Sherman, Mr. Talbot (F, W)

164. Engineering Aero- and Hydrodynamics. (4)

Three 1-hour lectures and one hour of discussion per week. Prerequisite: course 104B and 105B. Calculation of the forces and moments acting on various types of solid bodies moving either through the atmosphere, or under water, in order to be able to evaluate the power required, the stability, and the control forces for various maneuvers.

Mr. Laitone (Sp)

172. Application of Analog Computers. (3)

(Formerly ME 172A)

Two hours of lecture and one 3-hour laboratory per week. Prerequisite: Mathematics 51C. Introductory course on application of analog computers to the simulation of systems described by ordinary differential equations. Applications in vibration studies, control systems, certain partial differential equations, biomedical studies. Use of electronic analog computer in computer laboratory.

Mr. Thal-Larsen (F)

173. Fundamentals of Acoustics. (3)


Mr. Carroll, Mr. Soroka (W)

174. Acoustical Environment Control. (3)

Two 1-hour lectures per week and one 3-hour laboratory. Prerequisite: course 104A or 103, or Architecture 110. Principles of sound generation and propagation. Reverberation and diffusion. Design criteria for sound control, prediction of noise in environments, annoyance, communication interference, and effects on man. Interrelationships between noise and vibration. Noise control in mechanical systems. Laboratory noise measurement and analysis.

Mr. Soroka (Sp)

175. Intermediate Dynamics. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 103 or 104B.
Lagrangian mechanics. Theory of constraints, virtual displacement and velocities; generalized coordinates; Lagrangian function, Hamilton's principle and Lagrange's equations of motion; first integrals; engineering applications to constrained motion of particles and rigid bodies, oscillations, gyrodynamics and electromechanical problems.

Mr. Lieber, Mr. Goldsmith (F, W)

185. Introduction to Continuum Mechanics. (4)

Four hours of lecture per week. Prerequisites: Physics 4A, Mathematics 51B. Kinematics of deformation, the concept of stress, conservation of mass and balance of linear momentum, angular momentum and energy, mechanical constitutive equations for ideal fluid, linear viscous fluid, linear elastic solid and linear viscoelastic solid. Qualitative behavior of these materials. Mr. Naghdi, Mr. Carroll (F, Sp)


(1-5)

Prerequisite: upper division standing in engineering, plus particular courses to be specified by the instructor for each group. Group studies of selected topics.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research.

(1-5)

Enrollment is restricted by regulations listed on page 57. For students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis.

The Staff (F, W, Sp)

Graduate Courses


Three hours of lecture per week. Prerequisite: graduate standing or permission of instructors. Relation of biological, physiological, and psychological factors to the physical parameters of acoustics, thermal environment, light, and vision. Engineering considerations and design procedures required for environmental controls. Tolerance limits for quality and quantity of noise, heat, cold, and light.

Mr. Soroka, Mr. Hutchinson (W)

210. Biological Control Systems. (2)

Two hours of lecture per week. Engineering analysis of biological control systems in two areas of current research effort; the application of modern control theory to complex systems illustrated by biological examples; and the reductionist approach to anatomical-physiological elements with critical engineering evaluation of dynamical and biomaterial characteristics.

Mr. Stark (Sp)

210L. Biological Control Laboratory. (2)

Six hours of laboratory per week. Experimental methods of analysis of biological control systems. Application of specialized bioengineering transducers, on-line digital computers and display and recording equipment to black box "dry" experiments on human control systems. Modelling with digital simulation will be emphasized to interpret quantitative experimental data and to show how classical and modern control theory elucidates the design features of these living systems.

Mr. Stark (Sp)

213. Physiological Fluid Mechanics. (3)

Three hours of lecture per week. Prerequisite: consent of instructor. Investigation of fluid mechanical aspects of various life systems, including the circulatory, pulmonary, and renal systems. Motion in the large and small blood vessels. Pulsatile and peristaltic flows. Analysis of prosthetic devices.

Mr. Berger, Mr. Talbot (F)

215. Energy Transfer in Biological Systems. (4)

Three 1½ hours lecture per week. Prerequisite: basic knowledge of heat transfer and thermodynamics. Introduction to biological systems, properties of biological systems, overall energy balance on the human, application of heat conduction models, application of irreversible thermodynamics; reversible thermal blocking (electrical signals in biological systems); blood flow heat exchangers; cryobiology; field computational techniques; heat and transfer.

Mr. Trezek (W)

217. Mass Transfer in Biological Systems. (4)

Four hours of lecture per week. Prerequisite: course in differential equations. General formulation of the equations governing diffusion and convection in biological tissues. Emphasis is placed on mass transfer in systems in which there is chemical or physical reaction between the diffusing species and the tissue substrate.

Mr. Pett (Sp)

220. Case Studies in Mechanical Engineering. (2)

Two hours of lecture per week. Prerequisite: course 225A or 234A, or 227 concurrently. Studies of selected problems which illustrate various methods of the design process in advanced mechanical engineering systems.

Mr. Steidel (W)

221. Machine Tool Design and Control. (4)

Two 1½-hour lectures and one hour of discussion per week. Fundamental aspects of machine tool control and control systems, optimization of machining process, machine tool dynamics and computer-aided design.

Mr. Kobayashi (Sp)

222. Metal Forming Analysis. (4)

Two 2-hour lectures per week. Prerequisite: course 121. Solution of forming problems using slip-line theory and other approximate methods.

Mr. Kobayashi (W)


Two 1½-hour lectures per week. Principles governing structure and mechanical behavior of materials with application to elasticity, plasticity, creep, fatigue, and fracture. Application of theoretically and experimentally determined material properties for quantitative prediction of service performance.

Mr. Hauser (Sp)

225A. Mechanical Behavior of Engineering Materials. (4)

Two 1½-hour lectures and one hour of discussion per week. Prerequisite: none. Treatment of elastic, plastic, and creep deformation under steady and cyclic loads with emphasis on approximate solutions which enable the prediction of service performance from simple tests. Failure due to fatigue, creep-rupture, and plastic instability will also be covered.

Mr. Finnie (F)
225B. Fracture of Engineering Materials. (4)
Two 1 1/2-hour lectures and one hour of discussion per week. Prerequisite: none. Treatment of fracture from engineering point of view. The topics covered will include: linear elastic fracture mechanics, crack propagation in fatigue, transition temperature approaches, statistical concepts of the strength of brittle solids, fracture of composites, and ductile fracture. Mr. Finnie (W)

226. Reliability in Mechanical Design. (3)
Two 1 1/2-hour lectures per week. Studies of reliability theory and practice as a mechanical engineering design criterion. Introduction of statistical methods to determine performance characteristics, availability and maintainability of mechanical systems. Mr. Frisch (Sp)

227. Optimal Design of Mechanical Elements. (3)
Two 1 1/2-hour lectures per week. Prerequisite: course 102A–102B, 127 or equivalent. Optimization of mechanical designs for normal and redundant specification showing relationships between optimizing and limiting design equations. Statistical considerations of failure theories and factor of safety. Probabilistic evaluation of manufacturing errors and reliable usage of materials. Use of reliability evaluation in analysis and synthesis of mechanical designs. Mr. Frisch (W)

228. Bearings and Lubrication. (4)
Four hours of lecture per week. Prerequisite: none. Development of techniques for the analysis and design of hydrostatic and hydrodynamic bearings. Other related topics in the field of tribology (friction, lubrication, and wear), such as boundary and elastohydrodynamic lubrication, human-joint lubrication, friction and lubrication of polymers, and rolling element bearings. Mr. Frisch (Sp)

229. Experimental Mechanics. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 129, 152 or 185; 153 or 154 (two courses total). Exposure of the basic experimental methods used in engineering mechanics. Analysis of measurement systems for static, steady state vibratory, and transient excitation including transducers for displacement, strain, velocity, acceleration, stress, and force, as well as the associated amplifiers and circuitry. Mr. Cunningham, Mr. Brown (F, Sp)

230. Photoelasticity. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 129. Two- and three-dimensional photoelasticity, photoelastic coatings. Use of the conventional polariscope and a gas laser for scattered light photoelasticity. Static and dynamic loading. Mr. Brown (W)

231. Advanced Kinematics and Mechanics. (4)
Three hours of lecture per week. Prerequisite: none. Kinematic analysis and synthesis of plane and spatial mechanisms. Emphasis on computer-aided design using modern numerical and matrix methods. Synthesis and spatial mechanisms to guide a rigid body through multiple positions with finite and infinitesimal displacement constraints. Mr. Radcliffe (W)

232. Dynamic Systems in Space. (4)
Two 1 1/2-hour lectures and one hour of discussion per week. Prerequisite: none. Modelling of dynamic systems based upon real causality. Dynamic behavior, controllability, observability, and stability of linear deterministic systems. Examples are chosen from mechanical and chemical engineering. Also, ecological and environmental systems will be discussed. Mr. Auslander (F)

233. Dynamic Systems and Control. (4)
Two 1 1/2-hour lectures and one hour of discussion per week. Prerequisite: consent of instructor. Coding for dynamical systems. Distributed parameter objects. Design and analysis of single and multi-variable feedback control systems in scalar and vector variable formulation. Frequency response concept. Application to engineering and other systems. Mr. Takahashi (W)

234. Dynamic Systems and Multivariable Control. (4)
Two 1 1/2-hour lectures and one hour of discussion per week. Prerequisite: consent of instructor. Design and analysis of direct digital control systems, probabilistic systems, nonlinear systems, adaptive and optimal control systems, with emphasis on realization by closed and open loop configurations. Mr. Takahashi (Sp)

235. Switching Control. (4)
Three 1-hour lectures per week. Design and analysis of control systems utilizing switching elements. Mechanical, fluidic, electric, electronic devices for logic operations in Boolean algebra. Coding and counting. Analog to digital and digital to analog conversion. Digital control of machine tools and other processes. Mr. Thal-Larsen (W)

236. Control Systems Design. (3)
Three 1-hour lectures per week. Prerequisite: consent of instructor. Establishment of design criteria and performance constraints which lead to the synthesis of realizable system configurations. Optimization of dynamic performance based on suitable component selection. Mr. Auslander (Sp)

237. Advanced Control Laboratory. (1)
One 3-hour laboratory per week. Prerequisite: course 134. Experimental methods in the analysis and synthesis of dynamic systems. Application to mechanical, electromechanical, chemical and other systems. Investigations include electronic analog and digital simulation, direct digital control, fluidic and electronic switching logic. Mr. Takahashi (Sp)

243. Valuation of Oil and Gas Producing Properties. (3)
Two 1 1/2-hour lectures per week. Prerequisite: basic knowledge of economics. Physical and economic factors underlying the appraisal of oil and gas producing properties. Estimation and evaluation of oil and gas reserves. Profitability analysis, optimization of expenditures. Mr. Somerton (F)

248A. Rock Mechanics. (3)
Two 1 1/2-hour lectures per week. Prerequisite: basic geology and a course in mechanics of materials. Fundamentals of rock behavior, strength, failure theories, fracture; rock behavior under confining stress and pore pressure; thermal stresses, thermo-chemical behavior; applications to reservoir behavior, hydraulic fracturing, well stimulation and rock drilling. Mr. Somerton (W)

248B. Advanced Reservoir Engineering. (4)
Three 1-hour lectures per week. Prerequisite: course 105B or 148B. Study of the detailed behavior of petroleum reservoirs using as a basis the thermo-
263A–263B. Viscous Fluid Flow. (4–4)
Three hours of lecture and one hour of discussion per week. Prerequisite: Engineering 230A, course 159 or 162. Course 263A is prerequisite to 263B. Laminar and turbulent flow of homogeneous Newtonian fluids. Exact solutions of Navier-Stokes equations. Low Reynolds number flows. Compressible and incompressible boundary layers. Stability and turbulence. Mr. Sherman (Sp)

264. Wing Theory. (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: Engineering 230A, course 162. Incompressible airfoil flow for steady flow in two and three dimensions. Cavitating and noncavitating hydrofoils. Introduction to airfoils in compressible flow, and in unsteady motion. Mr. Berger (W)

265. Introduction to Rarefied Gas Dynamics. (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: a graduate course in fluid mechanics or kinetic theory of gases. An introduction to rarefied gas dynamics, with emphasis on surface interactions, free-molecule flow, slip-flow and experimental results. Mr. Hurlbut, Mr. Willis (W)

267. Magnetohydrodynamics. (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: course 261A. The continuum theory of the interaction of conducting fluids and magnetic fields. Mr. Berger (Sp)

268. Dynamics of Reactive Fluids. (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: course 261A. Studies of processes involving mutual interaction between fluid-dynamic, chemico-kinetic, heat- and mass-transfer phenomena. Mr. Oppenheim (F)

269. Experimental Methods in Engineering Science. (4)
Three hours of lecture and laboratory per week. Prerequisites: none. The principles and techniques of physical measurement. Instrumentation resources and characteristics. Error sources and the design of experiments. Reduction of observations, Contemporary developments in experimental engineering science. Mr. Robben, Mr. Hurlbut (F)

270A–270B–270C. Geophysical Fluid Mechanics. (3–3–3)
Three hours of lecture per week. Prerequisite: graduate course in fluid mechanics such as course 263A, 261A or consent of instructor. Either 270A or 270B is a prerequisite for 270C. Both 270A and 270B are preferable prerequisites for 270C. 270A: The dynamics of rotating fluids, general properties of rotating fluids, study of models of atmospheric and oceanic motions, steady and unsteady. 270B: The dynamics of stratified fluids, study of models of atmospheric and oceanic motions and waves, diffusive flows. 270C: Oceanographic and meteorological problems. Interactions, stability, turbulence; some representative problems in dynamics of rotating and stratified fluids; thermohaline circulation. Baroclinic instability and cyclonic waves; turbulence in oceans and atmospheres. Mr. Corcos, Mr. Sherman (sequence beginning F)
271. Methods of the Calculus of Variations and Applications. (4)
(Formerly numbered AM 271)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Engineering 115 or course 175. Methods of the calculus of variations to fixed, free and movable endpoint problems without and with slide conditions and inequality constraints. Applications to stationarity and minimum principles and to problems of optimal control and design of dynamical systems. Mr. Leitmann, (Sp)

273A. Oscillations in Linear Systems. (4)
(Formerly numbered AM 273A)

273B. Random Oscillations. (3)
(Formerly numbered AM 273B)
Three 1-hour lectures per week. Prerequisite: course 104A and Mathematics 12B. Nondeterministic excitation and response of damped and undamped dynamical systems. Probability distribution functions. Mean square values, autocorrelation functions, power spectral densities. Stationary, nonstationary, and ergodic processes. Applications to discrete and continuous dynamical systems, linear and nonlinear. Mr. Brown (W)

275. Advanced Dynamics. (4)
(Formerly numbered AM 275)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 175. Axioms of mechanics, statics of constrained systems, holonomic, nonholonomic, finite, infinitesimal constraints. Principles of d'Alembert, Newton, Lagrange, Hamilton, Maupertuis, Gauss, Poisson and Lagrange brackets. Rigid body motion and holonomic constraints. Hamiltonian functions, canonical transformations, Hamilton-Jacobi theory. Infinitesimal transformations, perturbation methods. Mr. Goldsmith, Mr. Leitmann, Mr. Rosenberg (F)

*277. Oscillations in Nonlinear Systems. (4)
(Formerly numbered AM 277)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 175. Oscillations in nonlinear systems having one degree of freedom. Qualitative and quantitative methods: phase-plane, graphical, iteration, perturbation and asymptotic methods; self-excited oscillations and limit cycles. Mr. Rosenberg, Mr. Hsu (W)

*278. The Dynamics of Rockets. (4)
(Formerly numbered AM 278)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 104B or 175. Topics in exterior ballistics of rockets, approximate motion equations, solutions, refined motion equations, long-range rockets and satellite carriers, optimum trajectories, performance analysis, guided missile kinematics. Mr. Leitman (W)

281. Methods of Tensor Calculus and Differential Geometry. (3)
(Formerly numbered AM 281)
Three 1-hour lectures per week. Prerequisite: Engineering 115 or course 185. Methods to tensor calculus and classical differential geometry. The tensor concept and the calculus of tensors, the Riemann-Christoffel tensor and its properties, Riemannian and Euclidean spaces. Geometry of a surface, formulas of Weingarden and equations of Gauss and Codazzi. Mr. Naghdi (F)

282A. Theory of Elasticity I. (3)
(Formerly numbered AM 282A)
Three hours of lecture per week. Prerequisite: course 185. Fundamentals of the linear theory of elasticity (in three dimensions) and formulation of various types of boundary-value problems. Application to torsion, flexure, and two-dimensional problems of plane strain, plane stress, generalized plane stress, and bending of plates. Mr. Naghdi (Sp)

282B. Theory of Elasticity II. (4)
(Formerly numbered AM 282B)
Four hours of lecture per week. Prerequisite: course 185. General theorems including variational theorems and minimum principles, representation of the basic field equations in terms of displacement potentials (and stress functions). Three-dimensional problems of elasticity and related special theorems. Mr. Bogy (Sp)

282C. Theory of Elasticity III. (4)
(Formerly numbered AM 282C)
Four hours of lecture per week. Prerequisite: courses 185 and 281. The general theory of bending of elastic structures, with small displacements. Various approximate theories and methods of solution with application to shallow shells and shells of revolution. Nonlinear theories of shells. Mr. Hsu, Mr. Naghdi (W)

283. Wave Propagation in Elastic Media. (4)
(Formerly numbered AM 283)
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: course 185. Propagation of mechanical disturbances in unbounded and bounded elastic media. Stress waves due to periodic and transient sources, Wave reflection and transmission at bounding surfaces, Pulses in infinite and finite rods and plates. Mr. Goldsmith (Sp)

*284. Nonlinear Theory of Elasticity. (3)
(Formerly numbered AM 284)

285. Foundations of the Theory of Continuous Media. (4)
(Formerly numbered AM 285)
Four hours of lecture per week. Prerequisite: course 185. Review of principles of conservation of mass, momentum, angular momentum. The principle of balance of energy, entropy production inequality and thermodynamics of continuum, Invariance conditions and internal constraints. Nonlinear constitutive equations in classical continuum mechanics. Material symmetries. Mr. Naghdi (W)
286. Theory of Plasticity. (3)
(Formerly numbered AM 286)
Three 1-hour lectures per week. Prerequisite: course 185. Fundamentals of plasticity, concept of yield and associated constitutive equations in the theory of elastic-plastic solids including those for perfectly plastic, and elastic-perfectly plastic solids. General theorems. Application to torsion and plane problems of plasticity. Mr. Carroll (F)

287. Impact. (4)
(Formerly numbered AM 287)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 185. Collision of solid bodies. Wave propagation and contact processes produced in elastic, plastic, and visco-elastic media by impulsive or impact loading. Penetration, perforation and hydrodynamic phenomena. Response of materials to impact. Application to spheres, rods, bars, beams, plates and semi-infinite solids. Mr. Goldsmith (Sp)

*288. Theory of Elastic Stability. (4)
(Formerly numbered AM 288)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 282A. General concept of stability of elastic systems and its connection with eigenvalue problems. Special topics such as postbuckling behavior, stability of nonlinear systems, dynamical stability. Stability theory based upon the work of Trefftz, Goodier, Pearson, Hill and others. Mr. Hsu (F)

*290A. Topics in Nonlinear Oscillations. (4)
(Formerly numbered AM 290A)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 277. Oscillations in nonlinear systems having many degrees of freedom. The geometrical methods of dynamics applied to nonlinear vibrations. Definition and determination of normal modes, and of resonant oscillations in weakly and strongly nonlinear systems, and their stability. Mr. Rosenberg (Sp)

*290B. Topics in Nonlinear Continuum Mechanics. (4)
(Formerly numbered AM 290B)
Four hours of lecture per week. Prerequisite: course 285. Selected topics from recent developments in continuum mechanics, e.g., a general theory of oriented (or directed) media, non-linear theory of diffusion, theory of electrified and magnetized continua. Mr. Naghdii (Sp)

*290F. Relativistic Mechanics. (4)
(Formerly numbered AM 290F)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: courses 175 and 185. Critical examination of experiment and conceptual foundations of principle of relativity and bearing on aether concept. Tracing relativistic evolution of mechanics and development of important consequences in particle and continuum mechanics based on generalization of Hamilton's Principle. Mr. Lieber (F)

*290G. Topics in Dynamical Systems. (4)
(Formerly numbered AM 290G)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 175. Qualitative treatment of dynamics following Poincare, Birkhoff, Hill, Sundman, Whittaker, Hadamard and Levi-Civita. Study basic in bridging micro-

mechanics and macromechanics, also to ergodic theory, statistical thermodynamics, random processes, information handling, control and automation. The problem of three bodies examined in depth. Mr. Lieber (W)

*290H. Variational Principles of Fluid Dynamics and Thermodynamics. (4)
(Formerly numbered AM 290H)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: courses 175 and 185 are recommended. Formulation of variational principles of fluid dynamics and thermodynamics. Their application to selected theoretical and boundary value problems concerning motion of dissipative flows. Mr. Lieber (W)

*290J. Topics in Linear Continuum Theories. (4)
(Formerly numbered 290J)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 282B. Selected topics from recent developments in linear continuum theories, for example, linear elasticity and linear viscoelasticity and others which bear on modern concepts of material behavior. Topics may change from year to year. Mr. Bogy, Mr. Hsu, Mr. Naghdii (W)

*290K. Turbulence. (3)
Three hours of lecture per week. Prerequisite: course 265. The kinetic theory of dilute gases under conditions of extreme departure from equilibrium, with special application to aerodynamics of the transition-flow regime. Mr. Hurlbut (Sp)

*290M. Aircraft Stability and Control. (3)
Three one hour lectures per week. Prerequisite: course 264 or 164 and Engineering 230A. A theoretical study of the aerodynamic control and the dynamic stability of aircraft and missiles. The dynamics of a spacecraft re-entering a planetary atmosphere. Mr. Laitone (Sp)

290N. Corrosion. (4)

2900. Boiling Heat Transfer. (3)
Three 1-hour lectures per week. Prerequisite: course 151 and Engineering 230A. Study of two phase flow bubble growth models and analysis methods in boiling heat transfer. Mr. Schroek (W)

290P. Cryogenic and Reverse Cycle Systems. (4)
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: graduate standing. System design for cascade and other mechanical compression cycles used in producing low-temperature regions. Optimizing cryogenic system design and applications of cryogenic fluids. Mr. Hutchinson (Sp)
290Q. Numerical Methods for Heat and Mass Transfer Calculations. (3)
Three hours of lecture per week. Prerequisite: course 252. The application of numerical methods for boundary layer calculation, for boundary layer flows such as layers on surfaces, plumes, jets, and flow in conduits, accounting for radiation, rotation, and chemical reaction. Some consideration of the numerical calculation of elliptic problems. Mr. Seban (F)

290R. Introduction to Nonequilibrium Thermodynamics. (4)
Four hours of lecture per week. Prerequisite: course 155 or equivalent. General formulation of coupled transport phenomena. Detailed application to diffusion process, electrokinetic phenomena, thermoelectricity, membrane processes, thermal diffusion, and others. Mr. Spiegler (F)

290S. Advanced Natural Gas Engineering. (3)
Two 1½-hour lectures per week. Prerequisite: consent of instructor. Advanced problems in phase behavior of natural gas systems including water-hydrocarbon systems, vapor-liquid equilibrium, steady and nonsteady state flow of gas, operation of gas fields, underground storage of natural gas. Mr. Somerton (Sp)

290U. Combustion. (4)
Four 1-hour lectures per week. Prerequisite: course 155. Atomic and molecular structure, reaction mechanisms and rates, chemical equilibria, flame temperatures, nonequilibrium phenomena, ignition limits, diffusion flames and droplet burning, premixed flames, spectral properties of flames, experimental techniques, combustors. Mr. Sawyer (Sp)

290W. Perturbation Methods in Fluid Mechanics. (4)
Three hours of lectures per week. Prerequisite: Engineering 230A, course 261A, 263A, or consent of instructor. Regular and singular perturbations of initial and boundary value problems. Uniformly valid approximations to singular perturbation problems using matched asymptotic expansions and coordinate stretching techniques. Problems with several time scales. Emphasis on partial differential equations and fluid mechanical applications. Mr. Berger (Sp)

298. Group Studies, Seminars, or Group Research. (1–8)
Advanced studies in various subjects through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.

The Staff (W, Sp, F)

299. Individual Study or Research. (1–12)
Prerequisite: graduate standing in engineering, physics or mathematics.

The Staff (Mr. Leitman in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other doctoral degrees). May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Leitman in charge) (F, W, Sp)

NAVAL ARCHITECTURE

Upper Division Courses

151. Statics of Naval Architecture. (3)
Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 106A and Civil Engineering 130. Geometry of the ship's form, conditions of static equilibrium and stability of equilibrium of floating and submerged bodies; effect of damage, subdivision, freeboard, strength and launching of ships. Laboratory exercises in ship static computations including application of digital computers. Mr. Paulling (F)

152A. Ship Resistance and Propulsion. (3)
Three 1-hour lectures per week. Prerequisite: course 151 which may be taken concurrently. Elementary theory of water waves. Fundamentals of ship resistance and dimensional analysis. Estimates of resistance from model tests and tabulated data. Theories of propeller action and performance of open water propellers. Interaction between propeller and ship. Selection of an optimum propeller from series charts. Laboratory experiments in the ship model tank. Mr. Wehausen (F)

152B. Ship Dynamics. (3)
Three 1-hour lectures per week. Prerequisite: course 152A. Rigid-body dynamics of ships and other marine structures. Motions and loads in a seaway. Steering and control. Mr. Webster (W)

153. Marine Engineering. (5)
Three 1-hour lectures and one 1-hour discussion group per week; three to five field trips. Prerequisite: Mechanical Engineering 105B (recommended course 152B). A description and analysis of the important characteristics of marine propulsion and auxiliary machinery systems, especially as they interact with the design of the ship as a whole.

Mr. Webster, Mr. Paulling (Sp)

154A–154B. Ship Design. (3–3)
One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 152A.

154A. Preliminary design of a ship of the student's choice, including weight and size estimates, preparation of a line drawing and a preliminary structural design.

W

154B. A more detailed study of some single aspect of the design.

Mr. Webster, Mr. Paulling (Sp)

198. Directed Group Studies for Advanced Undergraduates. (1–5)
Prerequisite: requirements will be specified by the instructor. Group studies of selected topics which will vary from year to year.

The Staff (Mr. Wehausen in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 83. For students in good standing who wish to undertake a program of individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis.

Mr. Wehausen in charge (F, W, Sp)
240A-240B-240C. Theory of Ship Structures. (3-3-3)

Three 1-hour lectures per week. Prerequisite: course 151. Design and performance of ship structures using rational methods. Predictions of force and moment systems applied to the structure; distributions of pressures, forces, and interference; and interpretation of large-scale experiments and performance data. Mr. Pauling (F)

241A-241B-241C. Hydrodynamics of Ships. (3-3-3)

Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 159 and 162 and course 152A-152B. Theory of similarity and model testing. Boundary-layer theory and frictional resistance. Wave resistance. Air- and hydrofoil theory. Theory of propellers. Steering and stability on course. Motion of ships in calm water and waves. Mr. Wehausen (F)

242. Advanced Ship Design. (3)

One 1-hour conference plus one 4-hour laboratory period per week. Prerequisite: courses 240A-240B-240C, 241A-241B-241C. Each student will execute a design project involving part of the whole of a ship. Instead of classic, standardized or codified methods, advanced (more speculative) techniques of rational mechanics, deriving from the analyses of Naval Architecture 240 and 241 will be applied. The Staff (Mr. Webster in charge) (Sp)

290. Advanced Graduate Study in Naval Architecture.

Current and advanced topics in theory and design of screw propellers, hydrodynamics of free surfaces, ship vibrations, and other specialized studies in related areas of naval architecture.

290A. Theory and Design of Screw Propellers. (4) Three 1-hour lectures per week. Prerequisite: course 241B. Applications of modern airfoil theory to the design of marine screw propellers. Mr. Pauling (Sp)

290B. Special Topics in Ship Hydrodynamics. (3) Three 1-hour lectures per week. Prerequisite: course 241B. Approximation methods in ship hydrodynamics, formulation and solution of special boundary-value problems, statistical description of motion in an irregular seaway, topics from current literature. Mr. Wehausen (W)

290C. Dynamics of Marine Structures. (3) Three 1-hour lectures per week. Prerequisite: course 241C. Behavior of ships and other mobile marine structures in response to externally or internally generated forces. Topics include motions of ships and stable platforms in waves, steering and control of surface ships and submarines, behavior of moored and towed bodies. Mr. Pauling (Sp)

290D. Analysis of Ship Systems. (3) Three hours of lecture per week. Prerequisite: course 154A-154B (or consent of instructor.) Introduction to ship systems analysis including cost, reliability, and optimization. Applications of techniques to problems of ship routing, conventional cost, fleet selection, and cargo handling problems. Mr. Webster (Sp)

290E. Vehicles for Ocean Engineering. (3) Three hours of lecture per week. Prerequisite: graduate standing in Engineering. The construction and design of vehicles for performing engineering functions in the ocean. Topics include environment, deep ocean tasks, vehicle types, design requirements, motion stabilization, structural problems. Mr. Pauling, Mr. Webster (Sp)

298. Group Studies, Seminars, and Group Research. (1-8)

Advanced study in various subjects through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.

The Staff (Mr. Wehausen in charge) (F, W, Sp)

299. Individual Research. (1-12)

Investigation of selected advanced naval architecture subjects.

The Staff (Mr. Wehausen in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1-8)

Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Wehausen in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other Doctoral degrees). May not be used for unit or residence requirements for the Ph.D. degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Wehausen in charge) (F, W, Sp)

NUCLEAR ENGINEERING

Upper Division Courses

101. Nuclear Reactions and Radiation. (4)

Four hours of lecture per week. Prerequisite: Physics 4E. Nuclear properties, elements of nuclear structure, radioactivity, interactions of radiation in matter, neutron reactions, fission, fusion, practical consequences and applications. Mr. Kaplan (F)

102. Nuclear Instrumentation Laboratory. (3)

One hour of lecture and one 4-hour laboratory per week. Prerequisite: upper division course in nuclear physics or nuclear chemistry, which may be taken concurrently. Use of the electronics and instrumentation involved in radiation detection and analysis. Study of the interactions of radiation with matter. Mr. Prussin (F)

103. Experimental Neutronics Laboratory. (2)

(Formerly numbered 202)

Four hours of laboratory per week. Prerequisite: courses 102 and either 165 or 150B (may be taken concurrently). Calibration of control rods, pre-operational checkout, reactor pulsing, neutron noise measurements, axial flux and power determination, dosimeter calibration, characteristics of compensated ion chambers, flux shape and relaxation length in an exponential pile. Mr. Ruby (Sp)

120. Nuclear Materials. (4)

Four hours of lecture per week. Prerequisite: upper division course in thermodynamics. Behavior of nuclear materials in a reactor environment, radia-
tion damage to solids and liquids, chemical effects of fission products, swelling and structural changes, diffusion release and chemical control of radionuclides, fuel reprocessing and nuclear waste management, isotope separation. D. Olander (F)

150A-150B. Introduction to Nuclear Reactor Theory. (4-3)

150A. Four hours of lecture per week. 150B. Three hours of lecture per week. Prerequisite: Math 51C, and either course 101 or an upper-division course in nuclear physics. Neutron interactions, nuclear fission and chain reaction systems in thermal and fast nuclear reactors. Diffusion and slowing down of neutrons. Criticality calculations. Nuclear reactor dynamics and reactivity feedbacks. Fuel cycles and fuel management. Production of radionuclides in nuclear reactors. Mr. Yadigaroglu (W, S)

160A-160B. Nuclear Power Engineering (3-3)

Three hours of lecture per week. Prerequisites: Mechanical Engineering 104A or a junior level course in dynamics; Mechanical Engineering 105B or a junior level course in thermodynamics; Mechanical Engineering 106A or Civil Engineering 165A or a junior level course in fluid mechanics. Engineering analysis in the design of nuclear fission power reactors and systems. Emphasizes thermal design of reactor cores and plant components. Energy conversion. Safety evaluation, design of engineered safeguards. Radioisotopic power systems. Nuclear fusion power plant concepts. Mr. Schrock (W)

162. Radiation Protection and Control. (4)

Four hours of lecture per week. Passage of radiation through matter, dosimetry units and measurement, somatic and genetic effects of radiation on man, regulations pertaining to occupational exposure, calculation of inhaled and ingested dose, atmospheric dispersion of radioactivity, attenuation of radiation in shields. Mr. Ruby (W)

165. Introduction to Nuclear Engineering. (4)

Four hours of lecture per week. Prerequisite: Physics 4E. Radioactivity and physics of the fission process. Slow down and diffusion of neutrons. Criticality conditions for reactors. Reactor kinetics and control. Heat removal from reactors. Radiation effects and dosimetry. Economic aspects and environmental problems relating to thermal reactors and to fast reactors. Mr. Chambré, Mr. Kaplan (F, W)

199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted by regulations listed on page 87. For students in good standing who wish to undertake individual inquiry initiated jointly by the student and a professor. There are no other formal prerequisites, but the supervising professor must be convinced that the student is able to profit by the program. Must be taken on a passed/not passed basis. Mr. Grossman (F, W, Sp)

Graduate Courses

220. Radiation Effects in Nuclear Materials. (4)

Two 2-hour lectures per week. Prerequisite: upper division course in thermodynamics. Application of the principles of solid state physics and statistical thermodynamics to the analysis of fission gas behavior and radiation damage in nuclear materials. Mr. Olander (F)

221. Chemical Aspects of Nuclear Technology. (4)

Four hours of lecture per week. Prerequisite: upper division course in thermodynamics. Chemical thermodynamics; coolant-cladding interactions; reprocessing of reactor fuels; radiation chemistry of liquids and gases; disposal of radioactive wastes. Mr. Olander (W)

222. Isotope Separation. (4)

Four hours of lecture per week. Prerequisite: none. Cascade theory and separation of uranium isotopes by gaseous diffusion; chemical exchange and distillation for deuterium; electromagnetic and gas centrifugation methods; mass diffusion, thermal diffusion, isotopic analysis and mass determination by mass spectroscopy. Mr. Olander (W)

223. Fast Reactor Fuel Elements. (4)

Four hours of lecture per week. Prerequisite: course 220. Changes induced in materials of fast reactor fuel elements due to irradiation, temperature gradients, and stresses; fast neutron hardening of metals; helium production and embrittlement; swelling due to void formation; radiation creep; fuel modeling codes. Mr. Olander (W)

230. Engineering Aspects of Controlled Fusion. (4)

Four hours of lecture per week. Prerequisite: Physics 142 or Electrical Engineering and Computer Science 170. General characteristics of fusion reactors, including a review of research efforts to date. Emphasis on problems of power production, fuel and blanket recycling, effect of radiation environment on materials, and safety analysis. Prospects of breeding and of a mixed-fission-fusion economy. Mr. Pyle (Sp)

231. Thermoelectric and Thermionic Energy Conversion. (4)

Four hours of lecture per week. Prerequisite: consent of instructor. Derivation of thermoelectric properties from irreversible thermodynamics; thermoelectric properties of metals and semiconductors; power, efficiency, and geometrical configurations for thermoelectric devices; Thermionic emission from metallic surfaces; power density and efficiency for close-spaced vacuum diodes operating as energy converters. Mr. Ruby (W)

232. Magnetohydrodynamic Energy Conversion. (4)

Three 1½-hour lectures per week. Prerequisite: course 260A. Principles and applications of the direct conversion of electro-magnetic energy into mechanical, fuel and kinetic energy of an electrically conducting fluid in interaction with an electromagnetic field. General magnetohydrodynamic theory: magnetohydrodynamic power generation. Coupling of fission reactors to magnetohydrodynamic converters. Mr. Grossman (Sp)

240. Biological Effects of Radiation and Radiation Safety. (4)

Three 1½-hour lectures per week. Prerequisite: consent of instructor. Safety criteria. Effects of charged particle and gamma radiations on cells and cell growth. Mr. Wallace (Sp)

250A–250B. Nuclear Reactor Theory. (4–4)

Four hours of lecture per week. Prerequisite: Physics 124 or Physics 137A–137B or Physics 129A–129B, or course 270. Neutron transport theory; one group diffusion theory; slowing down of neutrons; thermal spectra; multigroup theory; perturbation theory and adjoint functions; heterogeneous reactors; reactivity coefficient, reactor kinetics; fuel depletion and cycling. Mr. Kaplan (W, Sp)
255. Numerical Methods of Reactor Analysis. (4)
Mr. Chambrel (Sp)

256A—256B. Advanced Reactor Analysis and Transport Theory. (3—3)
Mr. Amster (F, W)

260A—260B. Thermal Aspects of Nuclear Reactors. (4—4)
Three 11/2-hour lectures per week. Prerequisite: upper division course in thermodynamics. Fluid dynamics and heat transfer; thermal and hydraulic analysis of nuclear reactors; two-phase flow and boiling; compressible flow; stress analysis; energy conversion methods.
Mr. Pigford (W, Sp)

262. Radiation Shielding and Environmental Effects. (4)
Four hours of lecture per week. Prerequisite: upper division course in nuclear physics or nuclear chemistry. Sources of neutrons and gamma rays in reactors. Interaction of neutrons and gamma rays with shielding materials. Elements of dosimetry and radiation effects. Regulations affecting radiation exposure. Meteorological dispersion of fission products, radiation transport and attenuation in various geometries.
Mr. Rubly (W)

264A—264B. Dynamics of Nuclear Systems. (3—3)
Three hours of lecture per week. Prerequisite: course 250A—250B, Math 120A—120B—120C recommended. Response of reactor systems to time-varying sources and time-varying reactivity changes; reactor parameters from experiments employing neutron waves, pulses, and noise in both the frequency and time domains; pulsed reactors; xenon oscillations; stability analysis of zero-power reactors and of reactors with temperature feedback; optimal control of nuclear reactors.
Mr. Grossman (F, W)

265. Design Analysis of Nuclear Reactors. (4)
Four hours of lecture per week. Prerequisite: consent of instructor. Principles and techniques of economic analysis to determine capital and operating costs; fuel management and fuel cycle optimization; thermal limits on reactor performance, thermal converters and fast breeders; control and transient problems; reactor safety and licensing; release of radioactivity from reactors and fuel processing plants.
Mr. Rubly (F)

266. Two Phase Flow and Heat Transfer. (4)
Four hours of lecture per week. Prerequisite: Mechanical Engineering 105B and 151. Study of the hydrodynamics and heat transfer of two-phase flows and applications in nuclear power and propulsion systems. Emphasis is on analysis of the single and two-component gas liquid systems. Aspects of gas-solid and liquid-solid systems are also treated.
Mr. Schrock (Sp)

267. Engineering Aspects of Nuclear Reactor Safety. (3)
Mr. Yadigaroglu (W)

270. Nuclear Reactions and Interaction of Radiation With Matter. (4)
Four 1-hour lectures per week. Prerequisite: Physics 121 or Physics 137A—137B—137C. Interactions of gamma rays, neutrons, and charged particles with matter; nuclear structure and isotopes, radioactive decay; cross sections and energetics of nuclear reactions, resonance theory; fission and fusion reactions as energy sources.
Mr. Kaplan (F)

273. Neutron Scattering Theory. (4)
Four 1-hour lectures per week. Prerequisite: Physics 115 and course 270. Formal scattering theory and nuclear models that lead to the prediction of cross sections, R-matrix (Breit-Wigner) theory, wave packet analysis, partial waves. Statistical, optical and direct interaction models. Chemical binding and coherent scattering.
Mr. Kaplan (W)

290A. Radiation Effects in Semiconductors. (2)
See Engineering course listing for complete description.

298. Group Studies, Seminars, or Group Research. (1—8)
Advanced study in various subjects through special seminars on topics to be selected each year, informal group studies of special problems, group participation in comprehensive design problems or group research on complete problems for analysis or experimentation.
Mr. Grossman (F, W, Sp)

299. Individual Research. (1—12)
Investigation of advanced nuclear engineering problems.
Mr. Grossman (F, W, Sp)

601. Individual Study for Master's Candidates. (1—8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory or unsatisfactory basis.
Mr. Grossman (F, W, Sp)

602. Individual Study for Doctoral Students. (1—8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
Mr. Grossman (F, W, Sp)

IDS 124. Chemical Methods in Nuclear Technology. (3)
See Interdepartmental Studies for the complete description of this course.
The Department of English offers the undergraduate considerable flexibility in shaping a program of studies in British and American literature around a core of basic courses. English 1A–1B grounds the student in the fundamentals of composition and literary analysis; English 146A–146B–146C–146D provides an intensive survey of major authors in English from Chaucer through Yeats; English 151, the senior seminar, allows the student to bring to bear on the work of a single major author the critical techniques and learning acquired in previous years. Beyond these courses, the student is largely free to construct his own program in consultation with his adviser.

NOTE: For key to footnote symbols, see page 86.
Collateral study in art, history, literature, philosophy, and language is recommended but not specifically required.

**Major Program** The English major consists of not less than fourteen courses in English, of which at least nine must be upper division courses, and which must include: English 1A–1B, 146A–146B–146C–146D, a course in Shakespeare, and English 151 (a period or type course appropriate as background for the major author studied in 151 is strongly recommended). When possible, two quarters of 146A–146B–146C–146D are to be completed before the junior year.

**Honors Program** Students with an overall grade-point average of 3.0 or better may apply for admission to the honors program. Candidates for the A.B. with honors in English are required to write a bachelor's thesis (for which 5 units of credit are given under English H195) in their senior year. The thesis is normally an extension of the student's work in English 151 but may deal with another area already fairly familiar to him. A member of the department must agree to direct the thesis. Interested students may obtain application forms for the program in the Department of English Office.

**Preparation for Graduate Studies** Those interested in graduate studies in English at Berkeley should familiarize themselves with the regulations of the Graduate Division. The potential graduate student is strongly advised to gain a solid background in foreign languages, for the Department of English requires candidates for the Ph.D. to pass examinations in a minimum of two languages.

**Graduate Study**

The Ph.D. Program Students are admitted to graduate studies only in the fall quarter. There is no M.A. program, although an M.A. degree may be earned as part of the doctoral program. The program requires successful completion of twelve letter-graded courses, including an introductory course in literary scholarship (208), normally taken in the first or second quarter of graduate study, and a two-quarter seminar (250), before advancement to candidacy. The first two years of study are devoted to acquiring and demonstrating comprehensive knowledge of five fields of study: Medieval and Chaucer; Renaissance and Shakespeare; the Restoration and Eighteenth Century; Nineteenth- and Twentieth-Century British Literature; and American Literature. Comprehensive knowledge may be demonstrated by a series of field examinations or successful completion of wide-reading courses in each period arranged in consultation with graduate advisers. The balance of the graduate program requires passage of an oral qualifying examination of two to three hours, and the writing of a dissertation. Additional details on requirements for the doctorate in English, including language requirements, are available from the English graduate office, Room 319 Wheeler Hall.

Teacher Training Consult department office and the department's teacher training advisers; see also the Announcement of the School of Education.

Departmental Major Advisers Consult departmental office.

Subject A Students must have fulfilled the requirement in Subject A before taking any course in the Department of English.

Please Note: The quarter in which a particular course will be given, and the instructor who will give it, as specified in this catalogue, may have to be changed during the academic year. Students should consult the department's Announcement of Courses for the current academic year (available from the department office, Room 322 Wheeler Hall) for current listings of courses and instructors for each quarter. Specific offerings in the
following staff courses vary from year to year: English 108, 151, 203, 208, 250, and 270; offerings and instructors for each quarter of the current academic year are listed in the department's Announcement of Courses.

Many of the courses listed below have limited enrollments.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

1A–1B. First-Year Reading and Composition. (5–5)

Four to 4½ hours per week. Prerequisite: a passing grade in Subject A (examination or course). Prerequisite for the English major. Training in writing expository prose. (In a few sections, 1A will be offered as a continuous course with English 1B. Credit and grade will be assigned for these sections upon completion of the full sequence.)

1A. Instruction in writing and reading of expository prose.

1B. An introduction to the study of literature, with further instruction in expository writing.

The Staff (F, W, Sp)

10. Methods and Materials of Literary Study. (5)

Four to 4½ hours per week. Study of literary and critical texts, and of critical methods and theories.

The Staff (F, W, Sp)

20. Modern British and American Literature. (5)

Four to 4½ hours per week. Mr. Crews (Sp)

25. Language. (5)

Four to 4½ hours per week. Designed for sophomores, but open to students in the upper division. The origins and symbols of human speech; pattern, change, and growth in language; the interrelations of language, thought, and civilization. Emphasis on English, as written and spoken in England and America.

26. Introduction to the Study of Poetry. (5)

Four to 4½ hours per week. Lectures and discussion on poetry intended to develop the student's ability to understand and evaluate a poem. Designed primarily for students whose major is not English, but majors and prospective majors are welcome.

Mr. Anson (F)

27. Introduction to the Study of Fiction. (5)

Four to 4½ hours per week. Lectures and discussion intended to develop the student's ability to understand and evaluate fiction. Designed primarily for students whose major is not English, but majors and prospective majors are welcome.

Miss Porter (W)

28. Introduction to the Study of Drama. (5)

Four to 4½ hours per week. Lectures and discussion intended to develop the students' ability to read, understand and evaluate plays. Designed primarily for student whose major is not English, but majors and prospective majors are welcome.

Mr. Traugott (Sp)

30. Introduction to American Literature. (5)

Four to 4½ hours per week. Mr. Smith (F)

33A–33B–33C. American Studies. (5–5–5)

Four to 4½ hours per week. Open to sophomores; limited to fifteen students. Admission by interview with the three instructors during registration. An honors course in the study of American culture. The class will study significant ideas and issues, drawing on material from history, literature, political science, philosophy, and other fields. The course will emphasize discussion and the writing of essays, and will include occasional joint meetings with the staff and students of the two equivalent courses (History 33ABC, Political Science 33ABC).

Mr. McWilliams (F, W, Sp)

40. Intermediate Expository Writing. (5)

Four to 4½ hours per week. Prerequisite: course 1A–1B or equivalent, and consent of instructor.

Mr. Oliver (F)

42. Writing in Connection with the Reading of Important Books of the Nineteenth and Twentieth Centuries. (5)

Four to 4½ hours per week. Prerequisite: course 1A–1B or equivalent and consent of instructor.

Mr. Barlow (W); Mr. Paterson (Sp)

44A–44B–44C. Masterpieces of Literature. (5–5–5)

Four to 4½ hours per week. Lectures on great works of the world's literature.

44A. Classical Literature. Miss Middleton (F)

44B. Medieval and Renaissance Literature. Miss Middleton (W)

44C. Literature since the seventeenth century. Mr. Tracy (Sp)

INDEPENDENT STUDY

49. Independent Study. (1–5)

Meetings to be arranged. Open to sophomore honors students who have completed 15 or more units of English with an average of not less than B. Requires the consent of the instructor and the approval of the chairman of major advisers. Reading and regular conference with the instructor in a field that shall not coincide with that of any regular course and shall be specific enough to enable the student to write an essay based on his study. Must be taken on a passed/not passed basis.

The Staff (F, W, Sp)

Upper Division Courses

Group I: Unrestricted Courses

Open to all students in the upper division; enrollment not limited, except as noted.

COURSES IN LANGUAGE

110A–110B. The English Language. (5–5)

Four to 4½ hours per week. 110A is prerequisite to 110B.

110A. Structure of the English language. Mr. Fillmore (F)

110B. History of the English language. Mr. Casteen (W)
### COURSES IN LITERATURE

**114A–114B–114C. English Drama. (5–5–5)**
Four to 4½ hours per week.
114A. English drama to 1603. Mr. Nelson (F)
114B. English drama 1603–1700. Mr. Greenblatt (W)
114C. British and American drama from 1860 to the present. Mr. Nestruck (Sp)

**116. The English Bible as Literature. (5)**
Four to 4½ hours per week. Mr. Coolidge (F)

**117A–117B. Shakespeare. (5–5)**
Four to 4½ hours per week. A chronological survey of Shakespeare’s career. Miss Adelman (W, Sp)

**117E. Shakespeare for Nonmajors. (5)**
Four to 4½ hours per week. Miss Fox (F)

**117J. Shakespeare. (5)**
Four to 4½ hours per week. (Limited to 25 students) Studies of selected plays, with practice in various critical approaches; e.g., establishing text, relation to source, changing concepts of comedy and tragedy, influence of theatrical conditions on technique. Mr. Greenblatt (W); Mr. Friedman (Sp)

**117S. Shakespeare. (5)**
Four to 4½ hours per week. Lectures on Shakespeare and reading of his best work. Mr. Richmond (F)

**118. The Augustan Age. (5)**
Four to 4½ hours per week. Mr. D. Griffin (P)

**119. The Age of Johnson. (5)**
Four to 4½ hours per week. Mr. Bridgman (F)

**120A–120B. Medieval Literature. (5–5)**
Four to 4½ hours per week. Students may receive credit for 120A without taking 120B.
120A. Development of literary form and idiom throughout the Christian West from the first to the fifteenth centuries. Mr. Scott (W)
120B. Close study of selected classics in translation, including the Nibelungenlied and Dante’s Divine Comedy. Mr. Scott (Sp)

**121A–121B. Romantic Period. (5–5)**
Four to 4½ hours per week.
121A. Blake, Wordsworth, Coleridge and contemporaries. Mr. Ault (F)
121B. Byron, Shelley, Keats and contemporaries. Mr. Hugo (W)

**122A–122B. Victorian Period. (5–5)**
Four to 4½ hours per week.
122A. British literature from about 1840 to 1870. Mr. Miyoshi (F)
122B. British literature from about 1870 to 1901. Miss Christ (W)

**123. Nineteenth-Century British Prose. (5)**
Four to 4½ hours per week. Mr. A. Griffin (Sp)

**125A–125B. The English Novel. (5–5)**
Four to 4½ hour per week. 125A is not prerequisite to 125B.

125A. Defoe through Scott. Mr. Kneepkensmacher (W)
125B. Dickens through Conrad. Mr. Rader (Sp)

**125C. The American Novel. (5)**
Four to 4½ hours per week. Miss Porter (Sp)

**125D. The European Novel. (5)**
Four to 4½ hours per week. Mr. Hugo (F)

**125E. The 20th Century Novel. (5)**
Mr. Flanagan (W)

**128. Regional Literature: California and the West. (5)**
Four to 4½ hours per week.

130A. American Literature before 1800. (5)
Four to 4½ hours per week. Mr. Hart (W)

130B. The American Renaissance. (5)
Four to 4½ hours per week. Mr. Hutson (F)

130C. American Literature: 1865–1900. (5)
Four to 4½ hours per week. Mr. Hart (Sp)

130D. American Literature: 1900 to Present. (5)
Four to 4½ hours per week. Mr. Loewensohn (W)

**131. American Poetry. (5)**
Four to 4½ hours per week. A survey of American poetry and its background from Puritan times until the present. The special emphasis of the course will be historical, with particular attention to such poets as Bradstreet, Taylor, Frenaye, Bryant, Emerson, Longfellow, Poe, Whitman, Dickinson, Frost, Pound, Eliot, and Stevens. Mr. Breslin (F)

**133. Black Writers in America. (5)**
Four to 4½ hours per week. Black writers in the American cultural context. Mr. Barlow (F, Sp)

**149. The English Lyric. (5)**
Four to 4½ hours per week. The development of the English traditions of structure and style in lyric poetry. Mr. Oliver (W)

**152. Chaucer. (5)**
Four to 4½ hours per week. Not open to students who have taken English 155A–155B.

**154. Milton. (5)**
Four to 4½ hours per week. Mr. Coolidge (W)

**155A–155B. Age of Chaucer. (5–5)**
Four to 4½ hours per week.
155A. Pearl Poet and early Chaucer. Mr. Collier (W)
155B. Langland and late Chaucer. Mr. Kratins (Sp)

**156. Backgrounds of English Literature in the Continental Renaissance. (5)**
Four to 4½ hour per week. A survey of the principal continental documents which are important to an understanding of the English Renaissance.

Four to 4½ hours per week.
158A. Beginnings of the English Renaissance, and literature of the sixteenth century.
Mr. Greenblatt (F)

158B. Literature of the seventeenth century.
Miss Fox (Sp)

160. British Literature: 1900-1945, (5)
Four to 4½ hours per week. Mr. Paterson (Sp)

161. British and American Poetry: 1900-1945, (5)
Four to 4½ hours per week. Mr. Parkinson (F)

162. British and American Poetry: 1945 to the Present, (5)
Four to 4½ hours per week. Mr. Tracy (W)

163. Contemporary Literature, (5)
Four to 4½ hours per week. Mr. Loewinsohn (Sp)

Group II: Restricted Courses

100. Methods and Materials of Literary Criticism, (5)
Four to 4½ hours per week. (Sections limited to 20 students each.) Designed primarily for juniors whose major subject is English. The Staff (F, W, Sp)

108. Special Topics, (5)
Four to 4½ hours per week. (Sections limited to 20 students each.) Designed primarily for English majors. Topics vary from year to year. May be repeated for credit on a different topic. Students should consult the department's Announcement of Courses for offerings in the current academic year.
The Staff (F, W, Sp)

146A-146B-146C-146D. Major British Writers, (5-5-5-5)
Four to 4½ hours per week. Prerequisite: course 1A-1B. Majors and prospective majors should begin the 146A-D sequence as soon as possible after completing course 1A-1B. Close study of typical works of major authors from Chaucer through the twentieth century, with consideration of the more important aspects of English literary history. 146A, Chaucer through Spenser; 146B, Marlowe through Milton; 146C, Dryden through Austin; 146D, Blake through Yeats.
The Staff (F, W, Sp)

SPECIAL SEMINARS

96. Sophomore Seminar: Great Books of the Western Tradition, (5)
Four to 4½ hours per week. Intensive study of major works, for example: Orestes; The Republic; Augustine, Confessions; Divine Comedy; King Lear; Montaigne, Essays; The Prince; Don Quixote; Paradise Lost; Brothers Karamazov; The Interpretation of Dreams. Limited to 15 students. Normally open only to sophomores with a grade-point average of 3.5 or better. (Not limited to English majors.) Admission by faculty nomination and selection by the seminar staff.
The Staff (F, W, Sp)

196A. Junior Seminar: Great Books of English and American Literature, (5)
Four to 4½ hours per week. Intensive study of major works, for example: Canterbury Tales; King Lear, Hamlet; Paradise Lost; Gulliver's Travels; Prelude; Middlemarch; Bleak House; Ulysses; Leaves of Grass; Scarlet Letter; Moby Dick. Normally open only to junior students with a grade-point average of 3.5 or better. (Not limited to English majors.) Admission by faculty nomination and selection by the seminar staff.
The Staff (F, W, Sp)

196B. Senior Seminar: Special Topics, (5)
Four to 4½ hours per week. The topics will fall within one of the following general areas: (1) "Critical and Methodological Problems in the Study of Literature." Sample topics: Comedy; Stilistics; Genres; Modes of Literary Analysis; Psychoanalytic Criticism; Dramatic Literature and Problems in Staging; Literature and Sociology, Literature and Politics. (2) "Literary Modes and Eras." Sample topics: Politics and Literature in 18th-Century England; The Social Context of the British Novel of the 1840's; American Culture in the 1890's; Women in Literature and Society; Classic to Romantic. Normally open only to senior students with a grade-point average of 3.5 or better. (Not limited to English majors.) Admission by faculty nomination and selection by the seminar staff.
The Staff (F, W, Sp)

THE SENIOR COURSE

Sections limited to 20 students each. A period or type course appropriate as background for the major author studied is strongly recommended. Designed primarily for English majors. Intensive study of the more important works of a major author and the writing of a long essay.

151CH. Chaucer, (5)
Four to 4½ hours per week. Miss Middleton (Sp)

151G. Major Authors, (5)
Four to 4½ hours per week. The authors taught in 151G vary from year to year. Students should consult the department's Announcement of Courses for offerings in the current academic year.
The Staff (F, W, Sp)

151MI. Milton, (5)
Four to 4½ hours per week.
Mr. Anson (W); Mr. Richmond (Sp)

151S. Shakespeare, (5)
Four to 4½ hours per week.
Mr. Alpers (F); Miss Altman (W)

HONORS COURSES

H195. Honors Course, (5)
Credit assignment: 5 units for a successful thesis; the work may take one or two quarters, at the instructor's option. Prerequisite: open only to students in the honors program who have completed a section of 151. In this course the English major student will write a bachelor’s thesis, which may come out of work begun in a section of English 151.
The Staff (F, W, Sp)
SPECIAL STUDIES

199. Supervised Independent Study for Advanced Undergraduates. (1–5)

Meetings to be arranged. Enrollment is restricted by regulations listed on page 83. Open to students who have completed 15 or more units of upper division English with an average grade of not less than B. Requires the consent of the instructor and the approval of the chairman of major advisers. Reading and conference with the instructor in a field that shall not coincide with that of any regular course and shall be specific enough to enable the student to write an essay based upon his study. Must be taken on a passed/not passed basis.

The Staff (F, W, Sp)

ADVANCED COMPOSITION

141. Modes of Writing. (Exposition, Fiction, Verse, etc.) (5)

Four to 4 1/2 hours per week. Prerequisite: course 1A–1B or equivalent, and consent of instructor. Writing in connection with readings in recent English literature and its continental background. Course may be repeated once for credit with the consent of the instructor.

Mr. Barlow (F)

*142D. Advanced Prose. (5)

Four to 4 1/2 hours per week. Prerequisite: consent of instructor. Special section in advanced prose for teaching assistants, readers, and honors students in departments other than English.

142E. Advanced Composition. (5)

Four to 4 1/2 hours per week. Primarily for students seeking the secondary school teaching credential whose teaching major or minor is not English.

Mr. Miyoshi (F); Mr. Kratins (W); Mr. Stroud (Sp)

Admission to courses numbered 143 is by consent of the instructor. Any course numbered 143 may be repeated for credit.

143A. Short Fiction. (5)

Four to 4 1/2 hours per week. Mr. Michaels (Sp)

143B. Verse. (5)

Four to 4 1/2 hours per week. Mr. Tillinghast (F); Mr. Paley (F); Mr. Barlow (W); Miss Miles (Sp)

143C. Long Narrative. (5)

Four to 4 1/2 hours per week. The student will work throughout the quarter on a single project, either fiction (novel) or nonfiction (biography, history).

Mr. Michaels (F)

143D. Expository and Critical Writing. (5)

Four to 4 1/2 hours per week. Mr. Oliver (W)

143T. Poetry Translation Workshop. (5)

Four to 4 1/2 hours per week. Prerequisite: consent of instructor, willingness to translate, working knowledge of at least one foreign language. Open to those who wish to assimilate foreign influences for writing poetry or to seek a fuller understanding of any foreign poetry by rendering it into English.

Teacher's Courses

*300. Problems in Teaching English Literature and Composition in Secondary Schools. (3)

Three 1-hour meetings per week. For senior and graduate students undertaking an English teaching major or minor; ordinarily completed before practice teaching. Accepted in partial satisfaction of the 36-unit requirement in education for the general secondary credential.

*301. Problems in the Teaching of Literature. (3)

Students will serve as readers and discussion section leaders in an undergraduate lecture course, and must have completed satisfactorily a seminar, pro-seminar, or equivalent course in the area of the undergraduate course. Weekly meetings, preparation and evaluation of student exercises, and a term project report required.

342. Advanced Composition. (5)

Four to 4 1/2 hours per week. Advanced composition and methods of teaching composition. For students seeking the secondary teaching credential whose teaching major or minor is English. Prerequisite: graduate standing.

The Staff (F, W, Sp)

Graduate Courses

For admission to some seminars, special competence in a foreign language may be required, at the instructor's discretion.

*202. History of Literary Criticism. (5)

Four to 4 1/2 hours per week.

203. Graduate Readings. (5)

Four to 4 1/2 hours per week. Graduate lecture courses surveying broad areas and periods of literature history, and directing students in wide reading. (Open to advanced undergraduates, with the instructor's consent.) May be repeated for credit, in a different area. Offers vary from year to year. Students should consult the department's Announcement of Courses for offerings in the current academic year.

The Staff (F, W, Sp)

*204. Celtic Studies. (5)

Four to 4 1/2 hours per week. This course may be repeated for credit.

205. Structure of English. (5)

Four to 4 1/2 hours per week. The structure of present-day English—pronunciation, grammar, vocabulary, dialects.

Mr. Boyd (W)

208. Problems in the Study of Literature. (5)

Four to 4 1/2 hours per week. Approaches to literary study, including textual analysis, scholarly methodology and bibliography, critical theory and practice. Offers vary from year to year. Students should consult the department's Announcement of Courses for offerings in the current academic year.

The Staff (F, W, Sp)

210A–210B. Readings in Medieval Latin. (5–5)

Four to 4 1/2 hours per week. Prerequisite: Latin 2 or equivalent. An introduction to the central language and literature of the Middle Ages.

210A: Prose

210B: Verse
210C. Readings in Renaissance Latin. (5)
Four to 4 1/2 hours per week. Prerequisite: consent of the instructor. An introduction to the range of Renaissance Latin texts. Mr. Shumaker (W)

211A. Introduction to Old English. (5)
Four to 4 1/2 hours per week. Open to seniors with consent of the instructor. Rapid reading of Old English texts. Mr. Casteen (W)

211B. Beowulf. (5)
Four to 4 1/2 hours per week. Open to qualified undergraduates, with the instructor's consent. Mr. Casteen (Sp)

213. Readings in Middle English. (5)
Four to 4 1/2 hours per week. Rapid reading of selections in Middle English, from the twelfth century through the fifteenth. Mr. Renoir (Sp)

254. Readings in Milton. (5)
Four to 4 1/2 hours per week. Studies in Milton with emphasis on prose and on Milton's revolutionary puritanism.

SEMINARS

246. Graduate Pro-Seminars. (5-5)
Four to 4 1/2 hours per week. Two-quarter pro-seminars in the major chronological fields of English and American Literature providing graduate instruction in scholarly and critical approaches appropriate to each field. Enrollments limited to 20 students. A student will be normally expected to remain enrolled for both quarters.

246A-B Medieval
246C-D Renaissance (excluding, or at least not prominently featuring, Shakespeare)
246E-F Restoration and Eighteenth Century
246G-H Victorian (Modern British literature will be covered in 203)
246I-J American Literature. The Staff (F, W, SP)

250A-250B. English Seminars. (5-5)
One 2-3-hour meeting per week. Required of all graduate students. Extends two consecutive quarters; normally in progress grades will be assigned for the first quarter. A student may take a second 250 course for credit with the permission of his adviser and the instructor. Offers vary from year to year. Students should consult the department's Announcement of Courses for offerings in the current academic year.

270. Research Seminars. (5)
One 2-3-hour meeting per week. Intended for specially qualified Ph.D. candidates; will not satisfy the seminar requirement. May be repeated for credit. Offers vary from year to year. Students should consult the department's Announcement of Courses for offerings in the current academic year.

298. Special Studies. (5-10)
Normally reserved for students directly engaged upon the doctoral dissertation. The Staff (F, W, Sp)

299. Special Study. (1-5)
Primarily for students engaged in preliminary exploration of a restricted field, involving research and the writing of a report. May not be substituted for available seminars. The Staff (F, W, Sp)

601. Individual Study. (1-8)
Prerequisite: graduate standing. Individual study, in consultation with the graduate adviser, intended for qualified students to do necessary work to prepare themselves for language examinations and the comprehensive examination. The Staff (F, W, Sp)

602. Individual Study for Doctoral Studies. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

See Interdepartmental Studies for the complete description of this course.

IDS 137. The Age of Charlemagne: Tradition and Innovation. (5)
See Interdepartmental Studies for the complete description of this course.

English for Foreign Students (EFS)

(Department Office, T-2241)

Lecturer:
June R. McKay, Ph.D.

Performance on the Examination in English for Foreign Students, given at the beginning of each quarter, will determine the course in which an entering foreign student is to enroll. The courses are required of undergraduates, for whom they satisfy the Subject A requirement, and are optional for graduates. Auditors not permitted.

23. English Composition for Foreign Students. (4)
Four and one-half hours of lecture and one hour of laboratory per week. Required of undergraduate foreign students whose grades on the diagnostic examination indicate need for training in basic English for University work. To be taken concurrently with 27A, 27B or 27C. Must be passed with a grade of C- or better. The Staff (F, W, Sp)
25. English Composition for Foreign Students, (4)

Four and one-half hours of lecture per week. Required of undergraduate foreign students (1) whose grades on the diagnostic examination indicate need for instruction at this level (2) who have passed course 23. To be taken concurrently with 27A, 27B or 27C. Must be passed with a grade of C- or better.

The Staff (F, W, Sp)

27A-27B-27C. English Pronunciation and Conversation for Foreign Students. (2-2-2)

Three hours of lecture and two hours of laboratory per week. Required of undergraduate foreign students concurrently with course 23, 25, or 28 unless the student is excused. Students will be placed in A, B, or C according to their oral ability.

The Staff (F, W, Sp)

28. English Composition for Foreign Students. (5)

Four and one-half hours of lecture per week. Required of undergraduate foreign students (1) whose grades on the diagnostic examination indicate need for instruction at this level (2) who have passed course 23. To be taken concurrently with 27A, 27B or 27C unless all three have already been completed.

A grade of A- or better satisfies the Subject A requirement. Must be passed with a grade of C- or better.

The Staff (F, W, Sp)

40. English Composition for Foreign Students. (5)

Four and one-half hours of lecture per week. Required of undergraduate foreign students who have passed course 28. Must be passed with a grade of C- or better to satisfy the Subject A requirement.

The Staff (F, W, Sp)

ENTOMOLOGICAL SCIENCES

(Department Office, 137 Giannini Hall)

Professors:
John R. Anderson, Ph.D.
John E. Casida, Ph.D.
Howell V. Daly, Ph.D.
Richard L. Doultt, Ph.D., J.D.
Julius H. Freitag, Ph.D.
Deane P. Furman, Ph.D.
Kenneth S. Hagen, Ph.D.
Carl B. Huffaker, Ph.D.
Carlton S. Koehler, Ph.D.
E. Gorton Linsley, Ph.D.
Werner J. Loher, Ph.D.
Powers S. Messenger, Ph.D.
Woodrow W. Middlekauff, Ph.D.
Rudolph L. Pipa, Ph.D.
Evert I. Schlinger, Ph.D.
Ray F. Smith, Ph.D. (Chairman)
Edward S. Sylvester, Ph.D.
Yoshinori Tanada, Ph.D.
Robert van den Bosch, Ph.D.
David L. Wood, Ph.D.
Roderick Craig, Ph.D. (Emeritus)
William M. Hoskins, Ph.D. (Emeritus)
Abraham E. Michelbacher, Ph.D. (Emeritus)

Associate Professors:
Donald L. Dahlsten, Ph.D.
Jerry A. Powell, Ph.D.
Clarence J. Weinmann, Ph.D.

Assistant Professors:
John T. Doyen, Ph.D.
Bernd Heinrich, Ph.D.
George Oster, Ph.D.

Associate Professor:
John E. Simmons, Jr., Ph.D.

Lecturers:
William W. Allen, Ph.D.
William C. Batiste, Ph.D.
Leopoldo E. Caltagirone, Ph.D.
Reginald H. Dadd, Ph.D.
Louis A. Falcon, Ph.D.
Norman W. Frazier, Ph.D.
Richard Garcia, Ph.D.
Harold T. Gordon, Ph.D.
Thomas E. Mittler, Ph.D.
Dudley E. Pimnook, Ph.D.
George O. Poinar, Jr., Ph.D.
Douglas W. Price, Ph.D.
Edward S. Ross, Ph.D.
Charles H. Schaefer, Ph.D.
Charles G. Summers, Ph.D.

Undergraduate Major Adviser: Mr. Falcon
Graduate Advisers for Entomology: Mr. Freitag, Mr. Hagen, Mr. Koehler, Mr. Loher.
Graduate Adviser for Parasitology: Mr. Weinmann.
Graduate Adviser for Medical Entomology: Mr. Anderson.

The Department of Entomological Sciences in the College of Agricultural Sciences offers the entomology major in the Agricultural Sciences Curriculum (see page 67). It is designed to give broad training in biology, with a general orientation toward entomology as it relates to modern agriculture's broad spectrum of activity.

NOTE: For key to footnote symbols, see page 86.
In addition, the Department, jointly with the Department of Plant Pathology, offers a Pest Management Curriculum. For details, see page 415.

Undergraduate Major Requirements

*Humanities and Social Sciences*, 29 units as follows: English, rhetoric, or comparative literature (8); foreign language†† through course 3; additional courses, which may include not more than 10 units of foreign language (21).

*Physical Sciences and Mathematics*, 40 units as follows: chemistry—inorganic with laboratory (12); organic with laboratory (8); physics (12); mathematics and/or statistics (8).

*Biological and Agricultural Sciences*, 43 units, other than major field as follows: microbiology (4); genetics (5); physiology (4); pathology (4); additional biological sciences (26).

**Major Field**, 33 units as follows: general entomology (4); systematic entomology (4); insect ecology (4); insect classification (4); anatomy and physiology of insects (8); field practice course (5); additional entomology (4).

**Additional courses**, 35 units.

**Total units**, 180.

Certain courses may be required in satisfaction of the above. The undergraduate adviser will provide this information and any other details about the major.

Graduate Programs

A basic educational background in the physical and biological sciences is prerequisite to the study of entomology at the graduate level. The minimum requirements are usually fulfilled by a bachelor's degree from an institution of acceptable standing in an undergraduate program which includes at least the following subjects: general entomology, insect classification, insect anatomy and physiology, systematic entomology, insect ecology; a year of general biology, including zoology and botany and also cellular and organismal biology; a course in genetics; physiology and invertebrate zoology are strongly recommended, as is work in statistics. Chemistry, including organic chemistry, and physics are required. If the undergraduate program or previous studies have not included the above prerequisites, the deficiency must be removed at the outset of graduate study. Students with a bachelor's degree in a biological science and a satisfactory scholastic record may be admitted for graduate study in parasitology. They are expected to have had some training in microbiology, zoology, chemistry, genetics, animal physiology, and statistics. A background in entomology is desirable, but not essential.

The graduate curricula in entomology and parasitology leading to the M.S. and Ph.D. degrees are designed to prepare students for research and teaching responsibilities in these fields. Encouragement is given to studies of a fundamental nature. Before the Ph.D. degree is granted the candidate must satisfactorily demonstrate an understanding of the subject matter of a large field of study, an ability to perform original and significant research, and an ability to interpret and communicate findings in such fashion as to serve the progress of ideas in his field of emphasis. For further details, consult the graduate advisers.

†† No units are indicated for this requirement since it may be met wholly or in part by work taken in high school. If satisfied at the collegiate level, units may be used where applicable.
10. Natural History of the Insects. (4) Lectures, 3 hours per week; demonstration, 1 hour per week; and optional field trips. Prerequisite: not intended for students specializing in zoological sciences. An outline of the main facts and principles of biology as illustrated by insects with special emphasis on their significance in relation to plants and animals, including man. 

Mr. Ross (F)

§20. Introduction to the Philosophy, Ecology, and Economics of Pest Management. (4) Four hours of lecture per week. Introduction to the systems approach to pest control, including the philosophy, goals, ecological basis, strategy and tactics of integrated control. Consideration will be given to cropping systems, ecology, natural and artificial controls, and system interactions.

Mr. Smith, Mr. Wilhelm (W)

Upper Division Courses

100. General Entomology. (5) Lectures, 2 hours per week; laboratory, 6 hours per week, plus field trips to be arranged. Prerequisite: introductory course in a biological science. Biology of insects, including classification of orders, morphology, physiology, behavior, and ecology.

Mr. Daly, Mr. Price (Sp)

101. Insect Classification. (4) Lecture, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 100. Classification of insects to the family level with emphasis on identification.

Mr. Doyen (F)

102. Functional Insect Anatomy. (2) Two hours of lecture per week. Prerequisite: a college course in biology, zoology, or entomology. A survey of anatomical and physiological characteristics of insect organ systems.

Mr. Pipa (F)

102L. Laboratory in Functional Insect Anatomy. (2) Six hours of laboratory per week. Prerequisite: course 102 (may be taken concurrently). Comparative studies of the principal organ system of insects.

Mr. Pipa (F)

103. Environmental Physiology of Insects. (2) Two hours of lecture per week. Prerequisite: general biology, zoology, or entomology. Recommended: course 102 and Biochemistry 102. Physiological and comparative aspects of insect adaptations to the environment.

Mr. Heinrich (W)

103L. Laboratory in Insect Physiology. (2) Six hours of laboratory per week. Prerequisite: general biology, zoology, or entomology. Experiments on physiological function and response of selected insects.

Mr. Heinrich, Mr. Dadd, Mr. Gordon, Mr. Mittler, Mr. Pipa (W)

104. Systematic Entomology. (4) Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: courses 100, 101. Principles and practices, classification at the generic and specific levels, nomenclature, and bibliographic methods.

Mr. Powell (W)

105. Insect Ecology. (4) Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: upper division standing in one of the biological sciences. Ecology with examples from the insects; insect behavior; analysis of the insect environment; population dynamics.

Mr. Dahlsen, Mr. Messenger (Sp)

106. Field Entomology. (5) One hour of lecture and three hours of laboratory per week; field trips to be arranged. Prerequisite: courses 100 and 101. Emphasis on relations of insects to habitats and life zones through comparative studies of insect faunas. Collection of insect groups restricted to those with important biological or ecological data. Specimens will be coded and preserved for ecological purposes.

Mr. Schlinger, Mr. Powell (Sp)

110. Economic Entomology. (5) Lectures, 3 hours per week; laboratory, 6 hours per week. Life histories and habits of beneficial and injurious insects and arachnids on plants and animals, and the principles involved in manipulating populations.

Mr. Middlekauff, Mr. Koehler (Sp)

113. Insect Pest Management. (6) Lectures, 60 hours; field trips, 100 hours. Prerequisite: upper division standing and at least one course in agricultural entomology or insect ecology. Four-week summer field course in pest management principles and practices. Detection and sampling for pest and beneficial species and evaluation of damage. Experiments utilizing biological, chemical, and cultural control methods. Preenrollment required before end of preceding Spring Quarter. (Extrasession) Mr. Doutt, Mr. Leigh, Mr. Rice, Mr. Summers

114. Entomological Considerations in Forest Resources Management. (4) Three hours of lecture and three hours of laboratory per week, plus one 2-day field trip. Not open to entomology majors. Prerequisite: one course in general biology. Interrelations of insect populations, forest stands, and forest practices. Identification, life histories, ecology, and control of insects affecting western forests and forest products.

Mr. Dahlsten, Mr. Wood (F)

117. Insect Toxicology. (4) Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: Chemistry 5A-5B, or equivalent. Chemical composition of insecticides; mode of action; resistance mechanisms; and methods of toxicity testing.

Mr. Gordon, Mr. Casida (Sp)

§121A–121B–121C. Pathobiology. (6–3–3) Prerequisite: Biology 1A–1B, or consent of instructor. Courses must be taken in sequence, except with consent of instructor. Nature and causes of plant and animal diseases, with comparative data illustrating diseases of plants and invertebrate and vertebrate animals; interrelationships involved in disease spread; the rationale of disease management.

121A. Etiology, Pathology and Symptomatology. (6) Three 1-hour lectures and nine hours of laboratory per week. An introduction to pathology of plants and invertebrate animals, with emphasis on etiology, symptomatology, and control of diseases caused by microbial agents.

Mr. Raabe, Mr. Pinnock (F)

121B. Vector Relationships. (3) Three 1-hour lectures per week. Biological relationships of the pathogens of plants, invertebrates, and vertebrates to the arthropods and other agents which act as vectors in the spread of disease; arthropods as direct agents of disease.

Mr. Freitag, Mr. Furnam (W)

121C. Epiphytotics and Epidemicos. (3) Three 1-hour lectures per week. The population conse-
quences of disease processes in plants and animals; analysis and discussion of selected topics which illustrate the principles and practices of an epidemiological approach to arthropod-borne diseases of plants and animals.

Mr. Baker, Mr. Weinmann (Sp)

§122A—122B—122C. Control Methods in Pest Management. (3—3—3)
Three 1-hour lectures per week. Courses may be taken separately.
122A. Chemicals and their Environmental Impact. Prerequisite: course 20, Chemistry 8A—8B, or equivalent, or consent of instructor. Chemical materials and techniques used in pest management; advantages and limitations.

Mr. Allen, Mr. Casida, Mr. McCain (F)

122B. Biological and Microbial Agents. Prerequisite: courses 20, 100, 121A, Biology 1A—1B, or consent of instructor. Discussion of biological control in pest management; techniques for use of parasites, predators, and microorganisms against pests; advantages and limitations.

Mr. Caltagirone, Mr. Falcon, Mr. Schroth (W)

122C. Cultural and Behavioral Methods. Prerequisite: courses 20, 100, Biology 150, Chemistry 8A—8B, or equivalent, or consent of instructor. Description and utilization of materials and techniques for control of pests by agronomic modification and utilization of pest behavior; advantages and limitations.

Mr. Koehler, Mr. Yarwood (Sp)

130. Biological Control of Insects Pests and Weeds. (4)
Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: courses 100, 101. Theories and practices of biological control; population phenomena; and the biology of entomophagous insects. Mr. Van den Bosch, Mr. Caltagirone, Mr. Hagen (F)

140. Insect Pathology. (5)
Lectures, 4 hours per week; laboratory, 3 hours per week. Prerequisite: course 100, and at least one course in a microbiological science. Principles of insect pathology and insect microbiology; infectious and noninfectious diseases of insects; diagnosis, therapy, and microbial control.

Mr. Tanada, Mr. Poinar (W)

150. Medical and Veterinary Helminthology. (3)
Three hours of lecture per week. Helminthic infections of man and domestic animals. Biology, host-parasite interrelationships, pathogenesis, therapy, and control.

Mr. Weinmann (F)

150L. Helminthology Laboratory. (3)
Nine hours of laboratory per week. Prerequisite: course 150 (may be taken concurrently). Methods of handling and identifying helminths, host postmortem examinations, laboratory diagnostic techniques, experimental manipulation of helminths.

Mr. Weinmann (F)

*153. Medical and Veterinary Entomology. (3)
Three hours of lecture per week. Role of insects and other arthropods in transmission and causation of diseases of humans and domestic animals. To be given in odd-numbered years.

*153L. Medical and Veterinary Entomology—Laboratory. (2)
Six hours of laboratory per week. Prerequisite: course 153 (may be taken concurrently). Identification of arthropods of medical and veterinary importance. Techniques of collecting and studying living arthropods. To be given in odd-numbered years.

Mr. Furman, Mr. Anderson (W)

172. Principles and Methods of Entomological Research. (4)
(Formerly numbered 272)
Four hours of lecture per week. To be given in odd-numbered years. Techniques and purposes of the scientific method in entomology with emphasis on problem selection and the collection, evaluation, and presentation of data.

Mr. Sylvester (F)

197. Field Study in Entomology. (1—5)
Prerequisite: consent of the instructor. Supervised experience in off-campus organizations relevant to specific aspects of entomology. Regular individual meetings with faculty sponsor and written reports required. The Staff (Mr. Smith in charge) (F, W, Sp)

198. Directed Group Studies for Advanced Undergraduates. (1—5)
The Staff (Mr. Smith in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1—5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a pass/fail basis.

The Staff (Mr. Smith in charge) (F, W, Sp)

Graduate Courses

204. Principles of Systematic Entomology. (3—3—3)
Lectures, three hours per week. Theory, philosophy, and methodologies of systematic entomology. Each offering may be taken separately for credit and in any sequence.

*204A. Speciation in Insects. Prerequisite: course 104 and an upper division course in genetics.

Mr. Daly, Mr. Powell (F)

*204B. Contemporary Techniques in Systematic Entomology. Prerequisite: course 104 and a course in elementary statistics.

Mr. Daly, Mr. Doyen (F)

204C. Theory and Principles of Classification and Nomenclature. Prerequisite: course 104 or consent of instructor.

Mr. Schlinger, Mr. Linsley (F)

205. Population Ecology. (3)
Lectures, 3 hours per week. Prerequisite: course 105. To be offered in even-numbered years. Population dynamics, regulation, and measurement, theory of natural control.

Mr. Hufnaker, Mr. Messenger (F)

210. Principles and Problems in Agricultural Entomology. (3)
Lectures, 3 hours per week. Prerequisite: course 100 or 110. The principles of insect control, the side effects to plants and animals following insecticide usage; plot design and sampling techniques; legislative controls in agricultural entomology.

Mr. Middlekauff, Mr. Allen (W)

211. Insect-Crop Relationships. (4)
Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: course 100 or 110. Biometrics of important insects and mites on agricultural crops; their relationships to crop production; and special problems of control on the different crops.

Mr. Allen, Mr. Koehler (Sp)
214. Concepts and Research in Forest Entomology. (3)
Guided discussions, 3 hours per week; two 2-day field trips each month. Prerequisite: course 100 or 114, or consent of instructor. To be given in odd-numbered years. Discussion of concepts and practices in forest entomology and the past and current research from which they are derived.
Mr. Dahlsten, Mr. Wood (F)

217. Advanced Insect Physiology, Biochemistry, and Toxicology. (3)
Lectures, 3 hours per week. Prerequisite: courses 102, 103, 117, or consent of instructor. Recommended: Biochemistry 102. May be taken twice for credit. Selected topics. Mr. Casida, Mr. Gordon (W)

219. Physiological Mechanisms in Insect Behavior. (3)
Three hours of lecture per week. Prerequisite: upper division course in animal physiology. Locomotion, orientation, feeding-behavior, migration, rhythms, communication, hormones and behavior.
Mr. Loher (Sp)

219L. Laboratory in Physiological Mechanisms in Insect Behavior. (1)
Three hours of laboratory per week. Prerequisite: course 219 (may be taken concurrently). Laboratory in locomotion, orientation, feeding-behavior, rhythms, communication, hormones and behavior.
Mr. Loher (Sp)

230. Biology of Parasitoids. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 130 or consent of instructor. The ecology, behavior and developmental biology of parasitoids. Emphasis is on field and laboratory analysis of host/parasitoid relationships and the evolution of these specialized adaptations in a wide range of taxonomic groups.
Mr. Caltagirone (F)

*240. Advanced Insect Pathology. (3)
Lectures, 2 hours per week; laboratory, 3 hours per week. Prerequisite: courses 102, 103, 140. To be offered in odd-numbered years. Advanced consideration of infectious and noninfectious diseases of insects, diagnosis, symptomatology, morphopathology, physiopathology, epizootiology, and microbial control.
Mr. Tanada, Mr. Poinar (Sp)

*253. Advanced Medical and Veterinary Entomology. (2)
Lectures, 2 hours per week. Prerequisite: course 153; Public Health 180A and 180B. To be given in even-numbered years. The genesis of arthropod-borne diseases.
Mr. Furman, Mr. Anderson (F)

260. General Nematology. (3)
Lectures, 3 hours per week. Prerequisite: consent of instructor. Taxonomy, morphology, development, bionomics and host-parasite relationships of invertebrate, soil and plant nematodes. Special topics include nematodes as vectors of disease-producing agents, nutrition, host resistance and chemical and biological control of nematodes.
Mr. Poinar (W)

260L. General Nematology. (1)
Laboratory, 3 hours per week. Prerequisite: consent of instructor. May be taken concurrently with course 260. Involves a laboratory or field project dealing with some aspect of nematology. Designed to give the student an opportunity to individually investigate some aspect of nematology in detail.
Mr. Poinar (W)

263. Acarology. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: courses 100, 101. Ecology, biology, and classification of mites and ticks, with emphasis on the phytophagous and free-living forms.
Mr. Price (F)

*266. Insect Vectors of Plant Pathogens. (4)
Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: Plant Pathology 120. To be given in odd-numbered years. Role of insects and arachnids in the transmission and causation of plant diseases; the relationship of the pathogens to their vectors and the approaches to control.
Mr. Frettag, Mr. Sylvester (Sp)

269. History of Entomology. (4)
Lectures, 3 hours per week. Prerequisite: course 100. To be given in even-numbered years. Development of influential ideas and principles in biology with special reference to entomology. Consideration given to effects of philosophy, religion, political and economic factors on evolution of scientific method.
(W)

*275. Immature Insects. (4)
Lecture, 1 hour per week; laboratory, 9 hours per week. Prerequisites: courses 100, 101. To be given in even-numbered years. The biology and classification of immature insects with emphasis on aquatic and holometabolous forms.
Mr. Anderson, Mr. Daly, Mr. Powell (Sp)

287. Seminar in Insect Physiology. (2)
Two hours of lecture per week. May be repeated for credit. To be given on passed/not passed basis.
Mr. Heinrich, Mr. Loher, Mr. Mittler, Mr. Pipa (F, Sp)

288. Seminar in Parasitology. (2)
May be repeated for credit.
Mr. Anderson, Mr. Furman, Mr. Weinmann (W, Sp)

289. Special Seminar Topics. (2)
May be repeated for credit.
The Staff (Mr. Smith in charge) (F, W, Sp)

290. Seminar in Agricultural Entomology. (2)
May be repeated for credit.
Mr. Allen, Mr. Batiste, Mr. Koehler, Mr. Middlekauff (F, W)

292. Seminar in Insect Biochemistry and Toxicology. (2)
Lecture 2 hours per week. May be repeated for credit.
Mr. Casida, Mr. Gordon, Mr. Mittler, Mr. Pipa (W, Sp)

293. Seminar in Insect Pathology. (2)
May be repeated for credit.
Mr. Pinnock, Mr. Poinar, Mr. Tanada (F, Sp)

294. Seminar in Systematic Entomology. (2)
May be repeated for credit.
Mr. Daly, Mr. Linsley, Mr. Powell, Mr. Schlinger (W, Sp)
ENVIRONMENTAL DESIGN

(Office of the Dean, 230 Wurster Hall)

Professors:
William L. C. Wheaton, Ph.D.
William W. Wurster, A.B., I.I.D., F.A.I.A.
(Emeritus).

Staff Seminar in Entomology. (No credit)
Biweekly meeting for presentation of special topics.
The Staff (Mr. Smith in charge) (F, W, Sp)

IDS 10A-10B-10C. Man and His Environment—
Insect Control. (2)
May be repeated for credit.
Mr. Dahlsten, Mr. Hufacker, Mr. Messenger,
Mr. van den Bosch (F, W)

296. Seminar in Forest Entomology. (2)
May be repeated for credit.
Mr. Dahlsten, Mr. Wood (F)

298. Directed Group Studies. (1–6)
Advanced study or research on topics which may vary from quarter to quarter.
The Staff (Mr. Smith in charge) (F, W, Sp)

299. Research in Entomology and Parasitology. (1–12)
Original study on special topics in laboratory, field,
and museum. Credit awarded according to work accomplished.
The Staff (Mr. Smith in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1–8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree.

ENVIROMENTAL DESIGN COURSES

Lower Division Courses

3. Introduction to Environmental Design. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Problems in design and applied problems of graphic communication.
Mr. Davis (F, W, Sp)

4. Man and Environment. (4)
Two 1½-hour lectures and one 1-hour discussion

NOTE: For key to footnote symbols, see page 86.

6. Graphic Communication and Drawing. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Freehand drawing and sketching as a medium for the development and communication of physical concepts.
Mr. Treib (F, W)
169. History of the Environment. (4)
Three 1-hour lectures per week. Evolution of the American landscape, 1865 to present, with particular emphasis on highways, recreation, conservation, the agricultural landscape, and new forms of collective settlements.     Mr. Jackson (W)

170. Architectural and Urbanism of Antiquity and the Middle Ages. (4)
Three hours of lecture and one 1-hour discussion per week. Ancient and medieval architecture studied in its social and historical context. A selective survey of major building types and a few specific sites and monuments treated in detail. (F)

171. Architecture and Urbanism from the Renaissance to the Modern Period. (4)
Three hours of lecture and one 1-hour discussion per week. Architecture and urban design since 1400 considered in social and historical context. (W)

ARCHITECTURE
(Department Office, 232 Wurster Hall)

Professors:
Christopher Alexander, Ph.D.
Richard Bender, M.Arch.
E. Michael Czaja, M.Arch.
Vernon A. DeMars, A.B., F.A.I.A.
Jose N. Distefano, M.S.
Ezra D. Ehrenkrantz, M.Arch.
Joseph Esherick, B.Arch., F.A.I.A.
Norma D. Evenson, Ph.D.
Donald L. Foley, Ph.D.
Sam Y. Hassid, Ph.D.
Spiro Kostof, Ph.D.
Henry J. Lagorio, M.A.
Roslyn Lindheim, B.Arch.
S. Michael McCue, M.A., F.A.I.A.
Richard L. Meier, Ph.D.
Roger Montgomery, M.Arch.
Donald E. Olsen, M.Arch., F.A.I.A.
Richard C. Peters, M.F.A. (Chairman)
James A. Prentini, B.S.
Donald P. Reay, M.Sci.
Jesse Reichek
Horst W. Rittel
Karl V. Steinbrugge, B.S.
Claude Stoller, M.Arch., F.A.I.A.
Sim H. Van der Ryn, B.Arch.
Michael A. Goodman, M.A., F.A.I.A. (Emeritus)
Raymond W. Jeans, M.A. (Emeritus)
Warren C. Perry, B.S., F.A.I.A. (Emeritus)
George P. Simonds, M.A., F.A.I.A. (Emeritus)
Harold A. Stump, A.B. (Emeritus)

Associate Professors:
Gary Brown, M.Arch.
Kenneth H. Cardwell, A.B.
Alan J. Forrest, M.Arch.
Sanford Hirshen, B.Arch.
H. Donn Logan, M.Arch.
Kenneth H. Simmons, A.B., B.Arch.

Assistant Professors:
Carl C. Anthony, B.Arch.
Sam Davis, M.Arch.
William R. Ellis, Jr., Ph.D.
Lars G. Lerup, M.A.
Jean-Pierre Protzen, B.Arch.
Daniel Solomon, M.Arch.
Stephen O. Tobiener, Ph.D.
Edward M. Treib, M.Arch.
Anthony Ward, M.Arch.

Lecturers:
Stanley H. Anderson
Howard A. Friedman, B.Arch., F.A.I.A.
Daniel Yanow, B.S.

Undergraduate Programs
The four-year program leading to the degree of Bachelor of Arts with a major in architecture requires the completion of course work in study areas ranging over a diversity of subjects. These may include mathematics, physics, engineering, courses in
design, graphics and architectural history, in aspects of architecture as a profession and finally, in the social sciences and humanities.

The five-year program leading to the professional degree of Bachelor of Architecture is being discontinued, and is presently limited to students already enrolled in the program.

**Graduate Programs**

The Department offers the professional degree Master of Architecture and the academic degree Doctor of Philosophy.

**Master of Architecture**

Three programs leading to the M.Arch. degree are offered, depending upon a student’s undergraduate preparation:

I For persons holding the five-year professional degree, Bachelor of Architecture, from an accredited school of architecture: one year of residence and 36 quarter units.

II For persons holding non-professional bachelor’s degrees with an approved architecture major: two years of residence and 72 quarter units.

III For persons holding non-professional degrees without an approved architectural major: three years of residence and 108 quarter units, including the first-year core courses, Architecture 200A–200B–200C. Persons having some architectural work in their undergraduate preparation may petition to waive one or two quarters of residence and up to 24 units, depending on their specific preparation.

**Joint Program With the Department of City and Regional Planning**

The two departments offer a joint program for exceptionally qualified students who hold the five-year Bachelor of Architecture degree, or its equivalent. After a minimum of three quarters and 36 units in the Department of Architecture, and four quarters and 48 units in the Department of City and Regional Planning, the candidate may receive both the M.Arch. and M.C.P. degrees. Applicants should seek admission to the Department of Architecture and indicate on their application that they wish to be considered for the Joint Program. In addition to normal departmental admission requirements, applicants for this program should submit Graduate Record Examination scores.

**Doctor of Philosophy Degree in Architecture**

The Doctor of Philosophy in Architecture program is open to exceptionally qualified persons who present outstanding academic records along with clear evidence of commitment and ability in architectural research and scholarship. Graduate Division requirements with respect to admission, the language requirement, candidacy, and the dissertation under Plan A apply (see page 42). Applicants must hold a bachelor’s degree from an accredited institution. If they do not hold a professional degree in architecture, they will be required to complete a special program of professional studies in addition to normal Ph.D. requirements.

**Study Area A—Design Problems**

**101. Social and Behavioral Considerations as Architectural Design Determinants. (5)**

One 1-hour lecture, one 2-hour and two 3-hour laboratories per week. **Prerequisite:** Environmental Design courses 3, 4, and 6. Origin, nature and identification of architectural design problems. Investigation of behavioral, social and cultural considerations as form determinants. Study of functional and circulation patterns, hierarchy and choice in architectural spaces through design exercises. Case studies and seminars. (F, W, Sp)

**102A. Structure and Production as Architectural Design Determinants. (5)**

One 1-hour lecture, one 2-hour and two 3-hour laboratories per week. **Prerequisite:** course 101. Introduction to the design of architectural forms as influenced by load bearing systems, structural mechanics, standardization of parts, materials, handling, and assembly. (F, W, Sp)

**102B. The Physical Environment as an Architectural Design Determinant. (5)**

One 1-hour lecture, one 2-hour and two 3-hour laboratories per week. **Prerequisite:** course 102A.
Investigation of architectural problems emphasizing environmental factors, natural and man-made, as design determinants. Study of elementary building forms, building groups and neighborhoods.  

One 1-hour lecture, one 2-hour and two 3-hour laboratories per week. Prerequisite: course 102B. Introduction to architectural design synthesis. Architectural case studies will be assigned which require the coordinated resolution of the design determinants introduced in 101, 102A and 102B. An introduction of aesthetics and style as design determinants will also be included.  

103A. Introduction to Urban Design. (5)  
(Formerly numbered 103)  
Three 1½-hour lectures per week. Concepts, methods, context of urban design practice; professional roles, tasks, and values. Topics include neighborhood design, new towns, central business district redevelopment, campuses, and relevant unifying principles presented in the context of American cities and local cases.  
Mr. Montgomery (W)  

103B. Laboratory Problems in Urban Design. (5)  
Two 4-hour laboratories per week. Prerequisite: course 103A or consent of instructor. Application of urban design concepts and methods introduced in 103A, with a professional perspective including surveys, analysis, graphic communication, spatial composition, environmental quality. Topics selected from real situations dealt with through field-trips, program development, and design.  

104A–104B–104C. Community Design. (4–4–4)  
Two 4-hour laboratory-seminars per week. Prerequisite: consent of instructor. Projects dealing with community issues: the social, political, and technological determinants. Analysis, problem formulation, design, and implementation.  
Mr. Simmons and Staff (F, W, Sp)  

200A–200B–200C. Graduate Introduction to the Field of Architecture. (8–8–8)  
Five 5-hour laboratory-seminars per week. Prerequisite: graduate standing. An integrated course including introductory study of social, technological and environmental factors relevant to architectural design, study and practice in methodologies of communication and architectural design, and study of role of the architect and the profession.  

206A. Introduction to Urban Design. (4)  
(Formerly numbered 206)  
206B. Topics in Urban Design. (4)  
Two 2-hour lectures per week. Prerequisite: graduate standing, completion of two years of graduate design laboratory courses, or consent of instructor. Graduate introduction to the field, including individual reading program and short design project exercises.  

207. Special Problems. (4)  
Can be repeated for credit.  

208. Combined Course. (4)  
Course 208 must be taken concurrently with courses 213 and 222. Recommended as last course of Design Options Group I series. Prerequisite: completion of all required courses in Areas B and C.  
Mr. Lagorio (F, W, Sp)  

209. Environmental Design. (4)  

Course Series: Design Group II—  
Architectural Design and Research.  
Two 4-hour laboratory-seminars per week. Prerequisite: enrollment in Option I or completion of required courses in Design Group I and completion of all required courses and 6 units of professional electives in the particular study area of the course offering. Design and research in special study areas. Students are expected to enroll in the individual laboratory-seminar for a minimum of two consecutive quarters. At the end of the first quarter, an "in progress" grade will be given, and at the end of the second quarter, a letter grade will be assigned for the two-quarter work. Following completion of the second quarter and at the option of the instructor, students may repeat for one additional quarter.  

280. Study in Area A Urban Design Problems, (6)  
and Staff (F, W, Sp)  

281. Study in Area B, Environmental Control systems. (6)  

282. Study in Area C, Structure and Production as Related to Design Problems. (6)  
Mr. Bender, Mr. Ehrenkrantz (F, W, Sp)  

283. Study in Area D, Design Theories and Methods as Related to Design Problems. (6)  
Mr. Prozen (F, W, Sp)  

284. Study in Area E, Social and Economic Factors as Related to Design Problems, (6)  

266. Architectural Thesis and Comprehensive Seminar. (3)  
Two 3-hour seminars. Prerequisite: graduate standing. Recommended for two consecutive quarters for students in Plan A and for one quarter for students in Plan B. Review of the development of thesis course assignments preparatory to comprehensive examination. At the option of the instructor, students may repeat the seminar up to a maximum of three quarters.  

Study Area B: Environmental Control Systems  

110. Introduction to Environmental Control Systems. (5)  
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: completion of Physics sc-
119. Undergraduate Seminar in Structure and Production. (3)

One 2-hour seminar per week and individual meetings. Prerequisite: course 120, 121, upper division standing or consent of instructor. Undergraduate seminars exploring special topics in structure and production:

129A. Special Problems in Structure. (3)
129B. Industrialized Building Systems. (3)
Mr. Bender and Staff (F, W, Sp)

222. Design Problems in Structure and Production. (4)

Two 2-hour laboratories and one 1-hour seminar per week. Prerequisite: course 121 or consent of instructor. Combined course must be taken concurrently with 208, 213A, 213B. Synthesis of structural considerations, seismic factors, and relation to architectural design. Mr. Steinbrugge (F, W, Sp)

223. Architectural Design for Seismic Forces. (3)

Two 2-hour laboratory-seminars per week. Prerequisite: completion of engineering sequence or consent of instructor. The study of seismic forces; generation and effect on structures, earthquake resistant design and failures. Mr. Steinbrugge (W)

224. Industrialized Construction. (3)

Two 2-hour laboratory-seminars per week. Prerequisite: course 121 or consent of the instructor. Implications of industrialized building components and systems; design, fabrication and erection. Mr. Ehrenkranz (F)

229. Seminar, Structure and Production in Architecture. (3)

Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: courses 120 and 121, Civil Engineering 128A, 128B, 129, or consent of the instructor. Advanced study in structure and production in architecture.

229A. Light Weight Tension Structures.
229B. Industry and Technology.
229C. Modern Shell Design.
229D. Experimental Structures.
229E. Special Problems in Structure and Production.
Mr. Lagorio and Staff (F, W, Sp)

Study Area D—Design Theories and Methods

130. Design Theories and Methods. (5)

Two 1½-hour lectures and one 2-hour seminar per week. Comparison and discussion of the theories of environmental design, and development and testing of various methods, tools, and techniques available for environmental designers. Particular emphasis lies on the difficulties of architectural design and related fields. Mr. Rittel (F, Sp)

132. Computer Applications in Design. (4)

One 2-hour lecture and one 2-hour laboratory per week. The course develops a theoretical framework for application of digital computers in design. Survey of existing applications in architectural design, potentials and limitations. Models of numerical problems in design and their utility.
134. Freehand Drawing for Architecture. (4)
One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: Environmental Design 6. Freehand drawing (for Architecture majors) for the development and communication of design concepts. Theory in drawing as communication as well as building skills in describing form, judging proportion and graphic discipline.

135. Advanced Graphics for Architecture. (4)
One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: Environmental Design 6. Advanced practice and theory in the presentation of architectural ideas. Emphasis on systems of drawing rather than individual drawing types. Communication of ideas through drawings on opaque materials, as well as projected images. Photography as a communication medium and systems of graphic reproduction.

136. Theory and Methods of Graphic Communication in Architecture. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: upper division standing or consent of the instructor. Theories and methods of organizing two- and three-dimensional visual information dealing with architectural space, volume, and mass. Studio practice in methods of graphic presentation. Exploratory work may be initiated by the student with the consent of the instructor.

Mr. Czaja (F, Sp)

§191D. Architectural Research and Practice: Application of Design Methodology. (4)
One 1-hour lecture and two 2-hour laboratories per week. Prerequisite: upper division standing. The development of theoretical and methodological tools to support architectural research and practice. Emphasis upon problem definition, application, and evaluation.

230. Advanced Design Methods. (3)
Two 1½-hour seminars per week. Prerequisite: course 130 or consent of the instructor. Intensive study of a particular area of design methodology. Theoretical explorations and applications to problems of environmental design.

Mr. Rittel (W)

232. Seminar in Architectural Research. (3)
Two 1½-hour seminars per week. Prerequisite: graduate standing. Methods of scientific research and the use of research in environmental design. Every participant develops and carries out a small-scale research project.

Mr. Rittel (F)

233A. Urban Design Workshop I: Methods of Design Analysis. (4)
One 2-hour seminar and one 2-hour laboratory per week. Prerequisite: graduate standing; Computer Science 2 or equivalent. Workshop on analysis of architectural and urban design projects. Topics covered include engineering economy, cost feasibility analysis, simulation modeling.

Mr. Bazjanac (F)

233B. Urban Design Workshop II: Methods of Design Analysis. (4)
One 2-hour seminar and one 2-hour laboratory per week. Prerequisite: course 233A. Workshop on analysis of architectural and urban design projects. Topics covered include optimization, operational gaming, network analysis, project scheduling and control.

Mr. Bazjanac (W)

233C. Urban Design Workshop III: Methods of Project Planning. (4)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 233B or consent of instructor; Economics 100A or Microeconomics highly recommended. Workshop on operational methods for programming and planning urban design and large-scale architectural projects. Topics include predictive models; behavioral and institutional factors; planning, programming, budgeting strategies. Applications made to urban renewal, new settlement, and institutional project contexts.

Mr. Montgomery (Sp)

*237. Architectural Research Documentation. (3)
One 2-hour lecture per week. Prerequisite: doctoral standing or consent of instructor. Assesses literature related to research in architecture: serials, technical reports, books, abstracts, indexes. Optimal organization for architectural information. Quality control over new publications. Histories that remain in the record.

239. Seminar in Design Theories and Methods. (3)
Two 1½-hour seminars per week. Prerequisite: course 130 or consent of the instructor. Research seminars about selected topics.

239B. Rational Thought and the Design Process. (3) Mr. Rittel

239C. Analytical Aspects of Design Stochastic Features. (3) Mr. Distefano

239D. Advanced Topics in Analytical Design. (3)
Two 1½-hour lecture-seminars per week. Prerequisite: course 239C or consent of instructor. Intensive study of special topics in analytical design. Particular emphasis in the use of dynamic systems for prediction and control of environmental design processes.

Mr. Distefano

Study Area E—Social and Economic Factors in Architectural and Urban Design

140. Social and Cultural Factors in Architectural and Urban Design. (5)
Three 1-hour lectures and one 2-hour discussion per week. A survey of the relations of social functions to architectural forms, with respect to individual, group, family, neighborhood and complex organizational units. Identification and definition of recognized "institutionalized" forms and symbols.

Mr. Ellis (W, Sp)

*141. Form Determinants of the Dwelling. (3)
Three 1-hour lectures per week. Interaction of technological and aesthetic innovation in dwellings and the physical environment of the residential community.

145. Design Consequences of Public Technological and Social Change. (4)
Two 2-hour meetings per week. Prerequisite: consent of the instructor.

145A: Design Consequences of Public Policy Change.

145B: Design Consequences of Technological Change.

145C: Design Consequences of Social Change.

Mr. Reischek and Staff (F, W, Sp)
240. Advanced Study in Social and Cultural Factors in Architecture and Urban Design. (3)
One 1½-hour lecture and one 1½-hour seminar per week. Prerequisite: graduate standing or consent of the instructor. Intensive study of relationship of social and institutional functions to environmental forms.
Mr. Ellis (W)

241. Major Problems of Architecture. (4)
One 2-hour seminar, one 2-hour laboratory and one 4-hour laboratory per week. Prerequisite: enrollment in Option I. Identification of major problems of architecture; development of approaches to solutions. Problems proposed by the instructor, or the student.
Mr. Ellis (W)

242. Seminar in Architecture. (4)
(Formerly numbered 242A–242B)
Two 2-hour seminars per week. Prerequisite: course 232 or consent of instructor. Relation of architectural research to the discipline of architecture. Team investigation of topics related to theory and practice.
Mr. Ellis (Sp)

243. A Sociology of Space. (4)
Two 1½-hour seminars per week. Prerequisite: graduate standing or consent of instructor. Consideration of the role played by social values in the design, allocation, and utilization of space.
Mr. Ellis (Sp)

244. Architectural and Environmental Programming and Evaluation. (4)
(Formerly numbered 231A–231B)
One 1½-hour lecture and one 1½-hour seminar per week. Prerequisite: courses 130, 140 or 240 and/or consent of instructor. Formulation of pre-design decisions affecting architectural forms. Topics include the nature of institutions; issues of size, growth, and change; determination of diverse user needs; values and value systems. Specific projects will be evaluated relative to diverse criteria.

245. Group Relations and Environmental Design. (3)
Two 1½-hour seminars per week. Prerequisite: consent of instructor. Focused on the irrational group and organizational processes in the design of human and non-human environments. Participants will study and experience their own covert group processes and apply what is learned to a variety of environmental design situations and products.

249. Seminar, Social and Behavioral Factors in Architectural and Urban Design. (3)
Two 1½-hour seminars per week. Prerequisite: course 140 or consent of the instructor. Advanced study in social and economic factors in architectural and urban design.
249A. Social and Cultural Factors. (W, Sp)
249B. Behavioral Factors. (W)
249C. Technological Factors. (W)

Study Area F—Architectural Administration and Related Professional Studies

160. Introduction to Architectural Administration. (4)
Two 2-hour lecture-discussions per week. Prerequisite: completion of two courses from course 201 series. Architect, owner, contractor relations, contract documents, and the ethics of the profession.
Mr. Friedman (F, Sp)

161. Construction Administration. (4)
Two 2-hour lecture-discussions per week. Prerequisite: course 160. Administration and supervision of construction, industry practices and the application to the construction process.

166. Technical Graphic Communications. (3)
Two 2-hour lectures and two 2-hour laboratories per week. Prerequisite: upper division standing or consent of instructor. Development and theory of technical graphic communication as an architectural language related to drawings and contract documents. Laboratory projects in graphic form as an expression of architectural concepts, architectural detailing, and materials.
Mr. Lagorio and Staff

269. Seminar in Architectural Administration. (3)
Two 1½-hour seminars per week. Prerequisite: course 160 or consent of the instructor.
269A. Construction Law.
269B. Architectural Practice.
269C. Architectural Administration.

Study Area G—History of the Environment
See Environmental Design 169 through Environmental Design 177.

173. American Architecture. (4)
Two 1½-hour lectures per week and other meetings as scheduled. Prerequisite: Environmental Design 170 and 171 or consent of instructor. The architecture of America from Colonial times to the present.

174. Modern Architecture. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: Environmental Design 170 and 171 or consent of the instructor. The background and evolution of architecture in the nineteenth and twentieth centuries.

176. The Architecture of Islam. (4)
Two 1½-hour lecture/discussions per week. Prerequisite: Environmental Design 170 and 171 or consent of the instructor. Selected monuments in Muslim lands from the seventh century to the present with emphasis on the early period and on buildings in Spain and the Near East. Independent student research under faculty guidance.

177. Survey of Urban Design. (4)
Two 1½-hour lectures per week and one 1-hour discussion period. Prerequisite: courses 170 and 171 or consent of the instructor. The evolution of urban form, civic design and planning theory, with emphasis on the development of the modern city.
Miss Evenson (Sp)

178. Baroque Architecture and Urbanism. (4)
Two 1½-hour lecture-discussions per week. Prerequisite: Environmental Design 170 and 171 or consent of instructor. A study of architecture and urban design in Europe and the Americas, 1600–1750.
Mr. Tobriner
271. History of Architecture Theory. (4)
Two 1½-hour seminars per week. Prerequisite:
Environmental Design 170 and 171, plus one course
from Environmental Design 173 to 178 or consent of
instructor. Examination of theories of architecture
from Vitruvius to present.

272. Seminar in the Architecture of Antiquity. (4)
Two 1½-hour seminars per week. Prerequisite:
Environmental Design 170 and 171, plus one course
from Environmental Design 173 to 178 or consent of
instructor. Special problems selected for concen-
trated study from the building types of the ancient
world. May be repeated once for credit.
Mr. Kostol (W)

273. Seminar in American Architecture. (4)
Two 1½-hour seminars per week. Prerequisite:
Environmental Design 170 and 171, plus one course
from Environmental Design 173 to 178 or consent of
instructor. Original research on selected problems
in the history of past and recent architecture in the
United States, and especially in the physical environ-
ment of the West Coast.

274. Seminar in Modern Architecture. (4)
Two 1½-hour seminars per week. Prerequisite:
Environmental Design 170 and 171 plus Enviro-
nmental Design 173 or 174 or consent of instructor.
Consideration in depth of selected aspects of modern
architecture.

277. Seminar in History of Urban Design. (4)
Two 1½-hour seminars per week. Prerequisite:
Environmental Design 170, 171 and 177 or consent
of instructor. Consideration of selected aspects of
urban design through discussion and directed re-
search.

278A–278B. Methods of Historical Research and
Criticism in Architecture. (4–4)
One 3-hour seminar per week and other meet-
ings to be arranged. Prerequisite: graduate standing and
consent of instructor. Consideration of basic tools
and methods of research in the history of the en-
vironment, the historiography of the field since 1900,
and the relevance of allied disciplines like archae-
ology, preservation and restoration, anthropology,
etc.
Miss Evenson (W, Sp)

279. Seminar in Technology and Architecture. (4)
One 3-hour seminar per week. Prerequisite: En-
vironmental Design 170 and 171 or consent of in-
structor. A study of selected aspects of the influence
of technology on architecture and urbanism during
given historical periods.

Special Studies

197. Field Study in Architecture. (1–5)
Prerequisite: Consent of instructor. Supervised
experience relevant to specific aspects of architecture
in off-campus organizations. Regular individual meet-
ings with faculty sponsor and written reports re-
quired.
Mr. Peters and Staff (F, W, Sp)

198. Special Group Study. (1–5)
To be arranged. Studies developed to meet needs.
No more than 5 units are allowed in any one quarter.
The Staff (Mr. Peters in charge) (F, W, Sp)

199. Supervised Independent Study and Research.
(1–5)
Enrollment is restricted by regulations listed on
page 87. Must be taken on a passed/not passed
basis. Studies developed to meet individual needs.
The Staff (Mr. Peters in charge) (F, W, Sp)

298. Special Group Study. (1–4)
Studies developed to meet needs. No more than
4 units are allowed in any one quarter.
The Staff (Mr. Peters in charge) (F, W, Sp)

299. Individual Study and Research for Master's
and Doctoral Students. (1–9)
Individual studies including reading and indi-
vidual research under the supervision of a faculty
adviser and designed to reinforce the student's back-
ground in areas related to his proposed dissertation
topic. To be offered each quarter. Candidates for
the master's program are limited to 4 units each
quarter. The Staff (Mr. Peters in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major
field adviser, intended to provide an opportunity
for qualified students to prepare themselves for the
various examinations required of candidates for the
Ph.D. This course may not be used for units or
residence requirements for the doctoral degree. Must
be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Peters in charge) (F, W, Sp)

CITY AND REGIONAL PLANNING

(Department Office, 228 Wurster Hall)

Professors:
William Alonso,† Ph.D.
Donald Appleyard,‡ M.C.P., A.A.Dip.
Leonard J. Duhl, A.B., M.D.
John W. Dyckman,† Ph.D.
Donald L. Foley, Ph.D.
I. Michael Heyman, B.A., LL.B.
T. J. Kent, Jr., M.C.P.
Richard L. Meier,‡ Ph.D.
Corwin R. Mocine, B.S. (Vice-Chairman)
Roger Montgomery, M.Arch.
Michael B. Teitz, Ph.D. (Chairman)

Francis Violich, B.S.
Melvin M. Webber, M.A., M.C.P.
William L. C. Wheaton, Ph.D.

Associate Professor:
Stephen S. Cohen, Ph.D.

Assistant Professors:
Douglas B. Lee, Ph.D.
Thomas G. Dickert, M.L.A., M.C.P.

Professor:
Horst Rittel
The planning of cities is as old as urban civilization, but the present-day planning profession has emerged in response to the rapid growth, changing character, and critical problems of twentieth-century urban development. Planning has become an accepted function of government, both in overall terms and in connection with particular programs, while planning techniques are likewise employed by large-scale private developers. Theorists and researchers in other disciplines have become increasingly interested in urban problems, and their work, often in partnership with planners, is contributing to greater knowledge and more sophisticated methods in planning practice. City and regional planning is a rapidly expanding field, with some 3,500 professionals in the United States, most of them members of the American Institute of Planners.

Characteristically, city, county, and metropolitan regional planning agencies are responsible for recommending guide lines for channeling the urban physical development of their respective jurisdictions. City planners are also relied upon in other types of public agency—including local, state and federal agencies dealing with highways, transportation, housing, urban renewal, public works, economic development, human and natural resources development, education, and health. A significant fraction of the profession engages in consulting, to city planning and other governmental agencies, and to private firms of various sorts.

The Department of City and Regional Planning offers a two-year graduate program of professional education in the field of city and regional planning leading to the degree, Master of City Planning. The department also offers a Ph.D. degree in city and regional planning. The departments of Architecture, Landscape Architecture, and City Planning have established concurrent programs in Urban Design enabling students to take two master's degrees in less time than is required in separate pursuit of those degrees. In addition the department has established a concurrent program with the School of Law and the School of Public Health.

These programs reflect the explaining concern of city planners with a wide variety of urban and regional problems, and the search for the empirical and theoretical understanding necessary to attack those problems. Courses in planning theory and practice are supplemented both within and outside the department by courses in the basic structure and functioning of the urban system from many viewpoints. Some of these courses are open to qualified undergraduate and graduate students in related fields. For more detailed information about these curricula, consult the Announcement of the College of Environmental Design or the Department of City and Regional Planning, Room 228 Wurster Hall.

Undergraduate Course Work There is no undergraduate major offered in the Department of City and Regional Planning. All undergraduate courses in city and regional planning are included in the Letters and Science List of Courses. For regulations governing this list, see the Announcement of the College of Letters and Science.

110. Introduction to City Planning. (4)

Three 1½-hour lectures per week. Prerequisite: open to majors in all fields. Survey of city planning as it has evolved in the United States since 1800 in response to physical, social, and economic problems; major concepts and procedures used by city planners and local governments to improve the urban environment.

(F); Mr. Mocine (W);
Mr. Wornum (Sp)

111. Introduction to Housing. (5)

Two 1½-hour lectures per week and tutorial sessions; two half-day field trips. Prerequisite: open to majors in all fields. Development of the housing problem and government housing policy especially in the United States, selected aspects of design and planning, critical current issues and the future of housing.

Mr. Montgomery (Sp)
122. The Black Ghetto in Urban Structure. (3)
Two hours of lecture per week. Prerequisite: consent of instructor. A survey of the place of the ghetto in the metropolitan structure, focusing on housing, jobs, and transportation. It will also consider the problems of education, health, business and economic development within their sociocultural patterns, and social, economic, and ideological elements of current thinking on these issues.

199. Special Study for Advanced Undergraduates. (1-5)
Prerequisite: consent of instructor. Must be taken on a passed or not passed basis.

200A-200B. The Evolution of Cities. (4)
Two 1½-hour lectures per week and one 2-hour seminar per week. The role of cities in civilization. The historical origins of their institutions and physical forms. The structure and functions of cities in developed and developing countries. (F, W, Sp)

201. Introduction to City Planning. (4)
Two 1½-hour lectures and one 2-hour seminar per week. Origins and evolution of city planning, influences of urban growth, legal and institutional framework, and scientific and philosophical premises. Major principles of current practice; roles of analysis, projection, design, and public and private policy. Alternative approaches.
Mr. Mcbine, Mr. Wheaton and Staff (F)

202. Studio: Community General Plan and Developmental Studies. (5)
Two 4-hour studios and one 2-hour studio per week. Introductory laboratory experience in analysis, policy-advising and general-plan preparation for a small urban community; emphasis is on planning for physical development of new communities.
Mr. Violich (W)

203. Planning and Governmental Decision-making. (4)
Two 1½-hour lectures per week. Prerequisite: graduate standing in city and regional planning, or consent of instructor. Origins and evolution of the idea of planning. Values hierarchies, ends-means continua, and the nature of social action. Rationales for governmental intervention in self-regulating social systems. Problems of prediction and choice under conditions of uncertainty. Alternative planning strategies.
Mr. Webber, Mr. Rittel (W)

204. Introduction to Planning Analysis. (4)
204B. Urban Data Processing. (1)
One 1½-hour laboratory per week. Prerequisite: consent of the instructor. Survey of data sources and types, card handling equipment, computer package programs, mapping and information display, and other methods used in the formulation, analysis, and interpretation of urban questions. Problems.
Mr. Lee (F)

204C. Planning Theory and Quantitative Method. (1)
One 1-hour lecture per week. Prerequisite: consent of the instructor. The relationship between the planning process and the use of quantitative analysis. Readings and discussion.
Mr. lee (F)

204D. Introduction to Computer Programming. (1)
One 1½-hour laboratory per week. Beginning computer programming in the Fortran computer language, with applications in matrix techniques and urban data processing. Problems.
Mr. Lee (F)

205. Methods of Planning Analysis. (4)
Four lecture hours per week. Prerequisite: courses 204A, 204B, and 204C, or equivalent. The course emphasizes simple methods suitable to a range of policy problems, rather than advanced technique. Topics may include index numbers, measurement, time series, migration estimation, population projection, multiplier models, multivariate analysis, financial analysis, and others. Weekly problems, examinations.
Mr. Lee, Mr. McGuire (W)

206. City Planning Legislation and Governmental Organization. (4)
Two 1½-hour seminars per week. Prerequisite: course 201 or consent of instructor. Duties and role of the physical planning agency in municipal and metropolitan governments; major alternative definitions of city planning; relationship of long-range physical plan to urban development agencies; significance of city planning legislation in reorganization of local government.
Mr. Worum (F)

207A-207B. Economic Analysis for Social Planning. (4-4)
Two 1½-hour seminars per week; tutorial sessions. Open to city planning students; other graduate students with consent of instructor. Concepts, methods, and modes of analysis for examining the processes through which changes in economic activities generate changes in social structures and in political systems.
Mr. Cohen (F); ——— (W)

208. Studio: Urban District and Physical System Plans. (6)
Three 4-hour studios per week. Preparation of detailed physical development plans for major city districts, e.g., a central district, or physical systems. Determination of the design of vital components; development policies, timing; implementation devices. Introduction to survey and analysis techniques for physical design.
Mr. McGuire, Mr. Dickert (F)

209. Introduction to Housing, Renewal, and Development. (4)
Two 1½-hour lectures per week. Prerequisite: consent of instructor. Structure of the housing industry, finance, public policies, technology. Planning for neighborhoods, new development, urban renewal. Roles of the market, public action, design and building processes. Social consequences of alternative policies.
Mr. Mcbine (F); Mr. Wheaton, Mr. McGuire (W)

210A. The Analysis of Urban Livability. (4)
Two 1½-hour sessions per week. Prerequisite: consent of instructor. Emphasis is primarily on the use of social surveys in urban planning. It is secondarily on certain related analytic approaches, especially the social demographic composition of urban households, the analysis of urban activity patterns, and the use of observational methods. Substantive theme will be on livability in urban areas, with an eye to measuring satisfaction-dissatisfaction with urban conditions and services.
Mr. Foley (W)

210B. The Analysis of Urban Livability. (4)
One 1½-hour seminar and four hours of laboratory or field work per week. Prerequisite: course 210A or
211. Location Theory and Spatial Interaction Models. (4)

One 2-hour seminar and one 1-hour seminar per week. Prerequisite: Economics 100B or equivalent; one semester of college calculus, or consent of instructor. Methods of evaluating general-plan policy. Ecological descriptive theories and economic behavioral theories of location and of spatial structure. Introduction to static and growth models of residential and industrial location. Governmental influences on spatial distribution of urban activities.

Mr. Foley (Sp)

212. Introduction to Economics of Public Enterprise. (4)

Two 11/2-hour lectures per week. Prerequisite: course 203; and Economics 100B or equivalent; or consent of instructor. Roles of governmental agencies as producers of urban services in nonmarket setting. Measurement of benefits and costs, and their implications. Criteria and procedures for investment decisions concerning types and qualities of services and facilities.

Mr. Collignon (Sp)

214. Zoning, Subdivision Control, Capital Improvement Programming. (4)

One 2-hour seminar and one 3-hour studio per week. Prerequisite: course 205A; and Economics 100B or equivalent; or consent of instructor. Legal, administrative, and financial aspects. Review of current practice and possible improvements in effectuation procedures.

Mr. Mocine (Sp)

215. Transportation and Land Use. (4)

Four lecture hours per week. Prerequisite: Economics 206A and 206B, courses 205A, 211, and 212, or the equivalent, or consent of instructor. Advanced seminar dealing with the issues and research questions surrounding the impacts of transportation policies on land use and development. Pricing, investment, land use control, administrative behavior, and policy decision making are representative aspects of the problem. Paper.

Mr. Lee (W)

216. Studio-Laboratory: Plan Preparation I. (5)

One 3-hour session and one 2-hour session per week. One 3-hour studio per week. Field problem in major phases of city and metropolitan planning work. A collaborative student-group effort in formulating policy recommendations within specific governmental framework. Mr. Kent, Mr. Wornum (W)

Mr. Foley (Sp)

217. Urban Renewal. (4)

Two 11/2-hour lectures per week. Prerequisite: course 209 or consent of instructor. Offered on a passed/not passed basis. Class members will be expected to be engaged in a group project or in their own individual projects, carrying out a field survey or engaged in analyzing the data from a field survey. The methodological and substantive emphases of course 210A pertain.

Mr. Foley (Sp)

218. Seminar on Urban Planning in Latin America. (4)

Two 2-hour lectures per week. Prerequisite: knowledge of city planning field or of Latin American development; a reading knowledge of Spanish is desirable. Problems of urban development in Latin America; policies and programs to alleviate them; regional urbanization forces and their impact on cities; governmental framework for urban planning; underlying concepts, current methods and further evolution of the field.

Mr. Violich (Sp)

233. Introduction to Regional Analysis and Planning. (4)

One 2-hour seminar and one 1-hour seminar per week. The concept of region and methods of regionalization; survey of regional problems and objectives; emerging views of regional planning. Regional models as planning tools. Intra- and interregional investment allocation during the development process. Review of current regional planning activity.

Mr. Jacobs (W)

234. The Economics of Urban Growth. (4)

Three hours of lecture per week. Prerequisite: Business Administration 101G and 102G or Economics 100A–100B–100C or equivalent; Mathematics 190A–190B–190C or equivalent. A rigorous examination of recent theories of economic growth, and of the concepts of increasing returns and exter nalities, with respect to their implications for urbanization. The spatial allocation of urban growth among cities as well as within cities. Policy issues.
235. Political Economy and Planning. (4)
One 3-hour seminar per week. A seminar for students in planning, investigating the interaction of political-economic forces and of social outputs in the planning process. The French planning experience will be used as a base for examining the literatures from the various social sciences for their relevance to development planning.
Mr. Cohen (F)

236. Urban Problems and the Legal Process. (4)
Two 2-hour meetings per week. Introduction to the legal framework relevant to urban planning problems, stressing the law surrounding intergovernmental relations in metropolitan areas; legal restraints on the use of various techniques of intervention; and processes and procedures of distinctive "legal" character.
Mr. Heyman (W)

237. Citizen Involvement in the City Planning Process. (4)
Two 1½-hour sessions per week. An examination of the roles of the citizen and citizen organizations in the city planning process. Models for citizen involvement ranging from advising to community control. Examination of the effectiveness of different organizational models in different situations.
Mr. Moine (Sp)

244. Housing and Urban Development. (4)
Two 1½-hour lectures per week. Prerequisite: courses 209 and 217. Housing and related development in urban fringe areas; social, economic and political implications. Effects upon journey to work, social overhead investment requirements, regulatory policies. New towns, land assembly, open space, and other problems.
Mr. McGuire (Sp)

246. Planning Land-Use and Communications Systems. (4)
Two 2-hour lectures per week. Prerequisite: courses 205A and 211, or consent of instructor. Structure of urban systems and interdependencies among subsystems. Predictive growth models; valvative frameworks for policy-making; operational planning strategies. Emphasis upon regional land-use, transportation, and communications systems and behavior. Laboratory exercises in application of operational models.

247. Methods of Program Planning. (4)
Two 2-hour lectures per week. Prerequisite: courses 203 and 212, or consent of instructor. Techniques for simulating and evaluating alternative sequences of governmental actions. Designing community-development programs within a setting of mixed public-private enterprise. Benefit-costs analysis; cost-effectiveness basis for budgeting and programming; the politics of program planning.
Mr. Teitz (Sp)

250. Theories of the Planning Process. (3)
Two 1½-hour lectures per week. Prerequisite: courses 203 and 212, or consent of instructor. Planning as a special type of decision-making process; applications in guiding urban spatial development.

251. The Logics of Planning. (4)
Two 1½-hour meetings per week. Prerequisite: course 203 or consent of the instructor. An advanced course, primarily for doctoral students, focusing upon the conceptual and methodological bases of contemporary planning approaches, especially those deriving from value theory, decision theory, and the new policy sciences.
Mr. Rittel (F)

253. Research Seminar in Regional Development. (4)
One 3-hour seminar per week. Prerequisite: course 233 or consent of the instructor. A close examination of selected issues in policy, methods and patterns of regional development, through regional planning and faculty research papers and class discussion.

255. Seminar on the Urban General Plan. (4)
One 2-hour seminar per week. The legislative and technical functions of the urban general plan; general-plan characteristics; organization of general-plan documents.
Mr. Kent (Sp)

One 2-hour lecture per week. Prerequisite: for doctoral students in fields of urban social policy or consent of instructor. A series of case studies analyzing a variety of federal programs, examining their development, implementation, and impacts upon local urban communities. Visiting lecturers from federal, state, and city programs will examine their own plans and strategies in various social policy areas.
Mr. Duhl (Sp)

261. Urban Social Policies Planning Seminar. (3)
One 2-hour seminar per week. Prerequisite: course 260. Limited to doctoral students in fields of urban social policy or consent of the instructor. Intensive examination of the theoretic issues posed in lecture course 260. Topics concern the political character of governmental planning, the rational and non-rational attributes of planning processes, and the bureaucratic interagency and intergovernmental constraints on rational policy formulation.
Mr. Duhl (Sp)

262. Systems Analysis for the Public Sector. (4)
Two 1½-hour seminars per week. Prerequisite: for doctoral students in fields of urban social policy or consent of instructor. Systems analysis as an approach to problem solving. Conceptual issues in problem formulation and model construction. Analysis and evaluation of system studies in specific social policy areas.

263. Deliberate Social Change in the City. (3)
One 2-hour seminar per week. Prerequisite: course 260 or 261 and consent of instructor. Theories of the behavioral and sociopolitical dynamics of social and institutional change will serve as the basis for discussion of a series of case studies of efforts to effect social change in the city. The case studies will be prepared and presented by students.
Mr. Duhl (F)

264. Social Indicators. (3)
One 2-hour seminar per week; tutorial sessions. Prerequisite: advanced graduate students with consent of instructor. The seminar will examine the objectives of an array of governmental programs, seeking to design sensitive indicators of program effectiveness. An appraisal of social accounting systems that measure payoffs from investments in public services. Students are expected to contribute to the search for new indicators.
Mr. Webber (Sp)

265. Patterns of Response to Social Change. (4)
Two 1½-hour seminars per week; tutorial sessions. Prerequisite: consent of instructor. Offered
on a passed or not passed basis. The course will examine various situations in which people or institutions face radical changes in their lives, and try to develop from these examples some general arguments about patterns of response to change, and their implications for policy and the handling of conflict.

290. Seminar. (3)

Prerequisite: consent of the instructor. Advanced study in city and regional planning. Specific topics will be announced at the beginning of each quarter.

The Staff (F, W, Sp)

Experimental Courses

S'291K. Rehabilitation Services and Programs: The Structure and Delivery of Social Services. (2)

One 1½-hour seminar per week. Prerequisite: consent of instructor. An overview of the needs of disabled people, the rehabilitation process, and vocational rehabilitation and other social service programs. Analysis of current policy and planning problems which affect the disabled.

Mr. Collignon (F)

Special Studies

298. Group Studies. (1–12)

Prerequisite: consent of instructor. Topics to be announced at beginning of each quarter. No more than 5 units may be taken in one section.

The Staff (F, W, Sp)

299. Individual Study or Research. (1–12)

Prerequisite: consent of instructor.

The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1–8)

Individual study for the comprehensive or language examination requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

IDS 175. A Nontechnical Introduction to Operations Research. (4)

See Interdepartmental Studies for the complete description of this course.

IDS 230. Amenity Resources Planning. (4)

See Interdepartmental Studies for the complete description of this course.

IDS 241. The Urban Environment. (4)

See Interdepartmental Studies for the complete description of this course.

DESIGN

(Department Office, 234 Wurster Hall)

Professors:

William A. Garnett
Willard V. Rosenquist, M.A.
Charles E. Rossbach, M.F.A.
Hervin Schaefer, Ph.D.
Peter H. Voulkos, M.F.A.
Anna Hadwick Gayton (Anna Gayton Spier), Ph.D. (Emerita)
Hope M. Gladding (Emerita)
Lea Van Puyambroeck Miller, M.F.A. (Emerita)

Lucretia Nelson, M.A. (Emerita)
Winfield Scott Wellington, M.A., Gr.Arch. (Emeritus)

Associate Professor:

Margaret P. Dhaemers (D'Hamer), M.A., M.F.A. (Chairman)

Assistant Professor:

Craig McArt, M.F.A.

Undergraduate Program

For more complete information, see the Announcement of the College of Environmental Design.

Graduate Program

The graduate program is organized to provide advanced training in product and communication design, as well as specialization in any of the study areas defined in the curriculum. The degree awarded is the Master of Arts in Design.

For more detailed information about the graduate program consult the Announcement of the College of Environmental Design and the graduate adviser in the Department of Design.
Environmental Design: Design / 275

Lower Division Courses

*16. Freehand Drawing. (4)

One 1-hour lecture and two 3-hour laboratories per week. Freehand drawing as a basic skill for development and communication of design concepts. Must be taken in addition to Environmental Design 6 as a prerequisite for Design 101.

Upper Division Courses

*101. Introduction to Design. (4)

Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: Environmental Design 3, 4, 6 and course 16. The nature and scope of design problems in the microenvironment emphasizing man's response to form. Familiarization with the fields of product and communication design and the involvement of the studies in the Design Problems and Media and Technology study areas.

Study Area A: Design Problems

102A–102B–102C. Product Design. (4–4–4)

One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 101. Design problems involving the relationship of man to product and product to environment.

102A. Consumer products. Mr. McArt (F)
102B. Professional and Industrial Equipment. Mr. McArt (W)
102C. Environmental Furnishings. Mr. McArt (Sp)

103A–103B–103C. Communication Design. (4–4–4)

One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 101. Design problems in the various communications media stressing principles of graphic order and expression.

103A. Graphic Composition. (F)
103B. Reproduction and Multiples. (W)
103C. Graphics Used in Static and Animated Contexts. Mr. Rosenquist (Sp)

Study Area B: Media and Technology

120A–120B. Ceramics. (4–4)

Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor. 120A is prerequisite to 120B. Basic throwing, handbuilding, and glazing techniques. Individual creative development using the ceramic or pottery idiom, 120B may be repeated once for credit. Mr. Voulkos (F, W, Sp)

*121A–121B. Printed Textile Design. (4–4)

Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor. 121A is prerequisite to 121B. Design 162A, B, is required and should be taken concurrently. Principles of structure and pattern in random form relationships and development of techniques. 121B may be repeated once for credit.

122A–122B–122C. Constructed Textiles. (4–4–4)

Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor. 122A is prerequisite to 122B. Design 162A, B is recommended. Laboratory study of woven and non-woven textile structures, emphasizing the interrelation of techniques and materials in textile design. 122B may be repeated once for credit.

*125A–125B. Metal Design. (4–4)

Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor; 125A is prerequisite to 125B.

125A. An introduction to the formal planning, modeling, and fabrication of metals with design emphasis on the particular physical properties of the common ductile metals for functional usage. 125B. Individual planning and testing of metal design problems. Emphasis placed on advanced metal working processes and design. Specific instruction in cutting, shaping, and joining of metals. 125B may be repeated once for credit.

*126A–126B. Glass Design. (4–4)

Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor. 126A is prerequisite to 126B.

126A. Basic techniques and design principles for the forming and fabrication of glass. 126B. Advanced problems in the design and fabrication of glass forms. The design, construction, and maintenance of studio equipment. 126B may be repeated once for credit.

127. Basic Techniques of Photography. (4)

Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor. Assignments testing standard materials, equipment, and processes for optimum performance. Instruction, assignments, and critiques introducing conditions of photo illustration in the field.

Mrs. Dhaemers, Mr. Garnett (F, W)

128. Documentary Photography. (4)

Two 3-hour laboratories per week. Prerequisite: course 127 or consent of instructor. Photography as a working tool for various career disciplines. Advanced techniques, materials, and processes for (a) gathering reference material, (b) the development of presentation material, (c) research and planning photographic essays. Design 128 may be repeated once for credit. Mr. Garnett (F)

129. Photography as an Art Form. (4)

Two 3-hour laboratories per week. Prerequisite: course 127 or consent of instructor. Experimental approach to materials and processes. The visual realization of ideas. Design 129 may be repeated once for credit. Mrs. Dhaemers (W)

130. Introduction to Artificial Lighting Photography. (4)

Two 3-hour laboratories per week. Prerequisite: course 127 or consent of instructor. Introductory instruction and assignments in the use of artificial light. Design 130 may be repeated once for credit. Mr. Garnett (W)

133. Experimental Approaches to Visual Communications. (4)

One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 101. The use of light as a medium for human expression in audiographic form, photographic images and graphics for programmatic contexts. Mr. Rosenquist (F, W)
*134A–134B. Advanced Experimentation in Design. (4–4)
  Two 3-hour laboratories per week. Prerequisite: course 101 or consent of instructor.
  134A. Investigation and experimentation in materials and methods with emphasis on aesthetic considerations, by means of individual projects.
  134B. Evaluation of findings through the development and actual construction of the individual projects originated in 134A.

Study Area C: Design Theory and Methods

*141. Modes of Communication. (4)
  Two 1½-hour lectures per week. Communication through visual means as utilized by individuals, small groups, and the mass media. Comparisons in terms of physical aspects, symbols, and psychological implication.

*145. The Formal Basis of Visual Expression. (4)
  Two 1½-hour illustrated lectures per week. Readings, exercises in visual analysis, examinations. Representational, abstract, and symbolic modes of expressing ideas in visual terms as exemplified in the arts of preliterate cultures.

Study Area D: History of Design

*160A–160B. Design Survey. (4–4)
  Three 1-hour lectures per week. 160A not prerequisite to 160B. Historical survey of design in the minor arts from the ancient Near East to the present, with emphasis on the development of style and analysis and evaluation of form.
  160A. The Ancient World and the Middle Ages.
  160B. The Renaissance to the Present.

*161A–161B–161C. Preliterary Art. (4–4–4)
  Two 1½-hour illustrated lectures per week. Characteristics of the art industries of selected peoples seen in relation to environment, technology, tradition, and cultural outlook.
  161A. Paleolithic Western Europe, Africa.
  161B. Oceania.
  161C. North, Middle, and South America.

*162A–162B. Antecedents of Industrial Textiles. (4–4)
  Three 1-hour lectures per week. 162A is not prerequisite to 162B. Survey of selected textile constructions and technologies that have led to today’s mass produced fabrics. Examples from worldwide geographic areas presented within their historical and cultural contexts.
  *162A. The Americas, Oceania, and Africa.
  162B. The Orient, Near East, and Europe.
  Mr. Rossbach (Sp)

*163. History of Furniture and Interior Design. (4)
  Three 1-hour lectures per week. The interior and its furnishings as an aesthetic composition and as an expression of domestic culture from the Middle Ages to the present.

180. Proseminar: Twentieth-Century Design. (3)
  One 3-hour meeting per week. Intensive study of significant phases of design developments and their relation to broader artistic movements.

Special Studies

197. Field Studies in Design. (1–5)
  Prerequisite: consent of instructor. Supervised experience relevant to specific areas of design in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required.
  The Staff (F, W, Sp)

198. Special Group Study. (1–5)
  To be arranged. Studies developed to meet needs. No more than 5 units are allowed in any one quarter.
  The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
  Enrollment is restricted to regulations listed on page 87. Must be taken on a passed/not passed basis. Studies developed to meet individual needs.
  The Staff (F, W, Sp)

Graduate Courses

Study Area A: Design Problems†

*201. Elements of the Microenvironment. (4)
  Two 3-hour laboratories per week. Prerequisite: courses 102A, 102B, 102C or equivalent. Design of products as components for specific situations. Model and prototype development employed in the design process.
  Mr. McArt

*202. Product Systems Development. (4)
  One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: courses 102A, 102B, 102C or equivalent. Conceiving interrelated products as systems, and developing the systems with consideration for the greater environment.
  Mr. McArt

203. Interior Space Planning. (4)
  (Formerly numbered 230)
  One 1-hour lecture and two 3-hour laboratories per week. Interior design problems analyzing occupant requirements, communication networks, organizational structures, and building plans in developing space layouts for businesses, schools, hospitals, etc. Control of the interior environment through systems and materials for optimum human performance and comfort.
  Mr. McArt (W)

*205. Graphics. (4)
  One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: courses 103A, 103B, 103C or equivalent. Graphic design in the environmental context. Communication techniques and reproduction processes.

*206. Package Design. (4)
  One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: courses 103A, 103B, 103C

† Either of the following courses may currently be credited toward the M.A. degree in design: Industrial Engineering 174, or Landscape Architecture 151.
or equivalent. Experimental approaches to the development and construction of space-enclosing surfaces, with emphasis on the materials as a form determinant. Consideration of structure, joining systems, access and graphic treatment of surfaces.

Mr. McArt

207. Design Studio. (4)

Two four-hour laboratories per week. Design problems involving projects which combine communication and product design concerns.

Mr. McArt (Sp)

Study Area B: Media and Technology

222. Seminar in Experimental Approaches to Media and Methods. (4)

Three hours of seminar per week. Emphasizes on aesthetic problems through development, presentation, and discussion of individual projects. May be repeated once for credit.

Mr. Rossbach (Sp)

229. Photography as an Art Form. (4)

Three hours of seminar per week. Emphasizes on aesthetic problems through development, presentation, and discussion of individual projects. May be repeated once for credit.

Mr. Rossbach (Sp)

*232. Environmental Photography. (3)

Three hours of seminar per week. Emphasizes on aesthetic problems through development, presentation, and discussion of individual projects. May be repeated once for credit.

Mr. Garnett (Sp)

233. Special Problems in Light, Motion, and Form. (4)

One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: Course 133. The application of light, motion, and form to T.V. or multimedia and their effects on spatial orientation and arrangement.

Mr. Rosenquist (W, Sp)

*234. Special Problems in Photography. (4)

Three hours of seminar per week. Prerequisite: Course 233 or consent of instructor. Photography as a means to pursue light and motion relationships in a separate context from content.

Mrs. Dhaemers

235. Seminar in Photography. (3) Mrs. Dhaemers (Sp)

Study Area C: Design Theory and Methods

*240. Seminar in Design Research. (3)

Two 1½-hour seminars per week. Advanced study especially related to graduate work and research. Review of the development of thesis contents.

*241. Seminar in Design Practice. (3)

Two 1½-hour seminars per week. Investigation of career options for the professional designer. Discussion of designer-client relations, professional ethics, administration and legal aspects.

242. Seminar in Textile Research. (3)

One 2-hour seminar per week. Problems in textile research, utilizing literary sources, analytical techniques, and specimens in University collections.

Mr. Rossbach (W)

243. Seminar in Ceramic Design. (3) Mr. Voulkos (Sp)

Study Area D: History of Design

*250. Seminar in Design History and Criticism. (3)

One 3-hour seminar per week. Prerequisite: Graduate standing and consent of instructor. Consideration in depth of selected aspects of design history and criticism through directed research and discussion.

Special Studies

298. Special Group Study. (1-5)

Studies developed to meet needs. No more than 5 units are allowed in any one quarter.

The Staff (F, W, Sp)

299. Individual Study and Research for Master's Students. (1-5)

Individual studies including reading and individual research under the supervision of a faculty advisor, designed to reinforce the student's background in areas related to his proposed thesis topic.

The Staff (F, W, Sp)

Environmental Design Course

*172. History of the Environment. (4)

See Environmental Design courses for the complete description of this course.

LANDSCAPE ARCHITECTURE

(Deptartment Office, 202 Wurster Hall)

Professors:
Donald Appleyard, M.C.P., A.A. Dip.
Garrett Eckbo, M.L.A.
Luna B. Leopold, Ph.D.
R. Burton Litton, Jr., M.L.I.A. (Chairman)

Richard L. Meier,‡ Ph.D.
Edward C. Stone,‡ Ph.D.
Francis Violich,‡ B.S.
H. Leland Vaughan, B.L.A. (Emeritus)

Associate Professors:
Michael M. Laurie,§ M.L.A.
Robert J. Tetlow,§ M.L.A.
Robert H. Twiss, Ph.D.

‡ One each from the following two groups of Business Administration courses may be currently credited toward the M.A. degree in design: (a) 150, 150G, 151, 163; and (b) 169, 263.
The Profession

The profession of Landscape Architecture plays an important role in identifying and solving environmental problems at the levels of planning and design. Professional practice includes planning for conservation of open space and natural amenities, land management and development, design of parks and recreation areas, schools, housing, and urban redevelopment projects. Landscape Architects are involved in the assessment of the impact projects and proposals may make on the environment and in designing such projects to be compatible with the landscape in which they are to be located. Because of the increasing complexity of the problems, Landscape Architects collaborate with Architects, City Planners, Ecologists, and Sociologists.

Undergraduate Program

The four-year curriculum leading to the A.B. degree with a major in Landscape Architecture is structured to give the student an opportunity for a broad general education as well as an introduction to the fundamentals of professional practice. Required core courses represent a minimum basic coverage in theory, design, and technology, but the program provides an opportunity to study, more intensively, all aspects of Landscape Architecture, including landscape analysis and planning, urban design, recreation, site design and development, graphics, construction, and planting design. Departmental electives and lists of recommended courses encourage the student to give his program a natural science, social factors, or professional emphasis.

The undergraduate and professional graduate curricula offered by the Department of Landscape Architecture are accredited by the American Society of Landscape Architects.

For more complete information, see the ANNOUNCEMENT OF THE COLLEGE OF ENVIRONMENTAL DESIGN. For courses offered in Summer Session, see the SUMMER SESSION BULLETIN.

Graduate Program

The Master of Landscape Architecture Degree The program is designed to offer advanced work in the broadening fields of landscape design and environmental planning. Students from both design and non-design fields may apply. The normal program is two years, but additional course work is normally required for students from non-design fields.

Within the graduate program it is possible to pursue a general course of study or to specialize in landscape design or environmental planning. Landscape design concentrates on project planning and programming and on the detailed design of public
and private exterior spaces. It covers natural and behavioral factors of open space design, plant materials, site construction, and community recreation projects, and explores new fields such as community participation in local open space design. Environmental planning is concerned with the larger context of natural and urban environments. The program brings together study of ecology, conservation planning, environmental law, resource development, recreation planning, urban open space, and highway systems. Current research programs, such as those utilizing an environmental design simulator and computer graphics facilities, enrich the study of these topics.

Joint Program in Urban Design  The departments of Landscape Architecture and City and Regional Planning jointly offer a program of studies in urban design leading to both the Master of Landscape Architecture and Master of City Planning degrees. Applicants must be admitted separately by both the Department of Landscape Architecture and the Department of City and Regional Planning.

The Ph.D. Degree in Environmental Planning  The Doctor of Philosophy program in Environmental Planning will have a core field of “environmental planning and design” with “natural” and “social” minor fields. It is aimed towards the education of teachers, researchers, and advanced professionals in the fields of landscape architecture and environmental planning. Applicants may be from landscape architecture or other fields. They must present outstanding academic records. It is anticipated that most applicants will have completed a professional degree or other master’s degrees before entering. Students with only a bachelor’s degree should apply to the M.L.A. program first.

For information about this program please consult directly with the Graduate Secretary, Department of Landscape Architecture, Room 202 Wurster Hall.

For more detailed information about the graduate program, consult the ANNOUNCEMENT OF THE COLLEGE OF ENVIRONMENTAL DESIGN and the graduate advisers in the Department of Landscape Architecture.

Lower Division Courses

10. Ecological Analysis. (3)  
(Formerly 3)  
Three 1-hour lectures per week. Prerequisite: consent of instructor. Open to non-majors. Analysis of environmental factors, ecosystem functions, and ecosystem dynamics, as they relate to decision-making for landscape planning and design.  
Mr. McBride (Sp)

10L. Ecological Analysis Laboratory. (2)  
(Formerly 3L)  
One 4-hour laboratory per week. Prerequisite: consent of instructor and enrollment in Landscape Architecture 10. Open to non-majors. Field and laboratory study of ecological parameters used in decision-making for landscape planning and design.  
Mr. McBride (Sp)

11. Introduction to Plant Materials. (4)  
(Formerly 23)  
Two 4-hour laboratories and field study per week. Plant identification and classification. Common plants suitable for California.  
Mr. Beatty (F)

30. Introductory Graphics for Landscape Architecture. (3)  
(Formerly 11)  
Two 2-hour laboratories per week. Introductory professional graphics. Instrument drawing and sketching. Tools, methods, standards. Line drawings for reproduction in pencil and ink.  
Mr. Reeves (F)

31. Graphic Presentation Techniques. (3)  
Two 2-hour laboratories per week. Prerequisite: course 30, or Environmental Design 6. Professional graphics, sketching and rendering. Perspective drawing.  
Mr. Tetlow (Sp, SS)

Upper Division Courses

100 Introduction to the Principles of Landscape Architecture. (4)  
(Formerly 122)  
Two 4-hour laboratories per week. Investigation of form in nature and the sources of form in landscape architecture at all scales.  
Mr. Laurie, Mr. Winters (F)

101. Landscape Planning for the Community. (4)  
(Formerly 132)  
Two 4-hour laboratories per week. Prerequisite: course 100. The effect of physiography, cultural factors, and landscape criteria on open space design and community form.  
Mr. Laurie (W)

102. Urban Landscape Design. (4)  
(Formerly 142)  
Two 4-hour laboratories per week. Prerequisite: course 100 and a minimum of two other Landscape Architecture studio courses. Design projects within the urban context, including renewal development.  
Mr. Moore, Mr. Downey (W)
103. Landscape Design. (4)  
(Formerly 152)  
Two 4-hour laboratories per week. Prerequisite: course 102. Project planning and design with reference to overall community form. Mr. Violich (Sp)  

104. Site Planning. (4)  
(Formerly 172)  
Two 4-hour laboratories per week. Prerequisite: course 100 and a minimum of one other Landscape Architecture studio course, or advanced standing in Architecture. Planning and design of site developments with special reference to the landscape architect's role. Mr. Litton (Sp)  

105. Intensive Design. (4)  
(Formerly 182)  
Two 4-hour laboratories per week. Prerequisite: course 100, and a minimum of one other Landscape Architecture studio course, or advanced standing in Architecture. The design of gardens, parks, plazas, and other landscape site developments of limited scale. Emphasis on the development of a working relationship with a professional office for program input. Mr. Litton (Sp)  

106. Community Participation in Design and Neighborhood Recreation Projects. (4)  
(Formerly 126)  
Two 4-hour laboratories per week. Prerequisite: consent of instructor. Development of plans and construction techniques for specific projects in collaboration with neighborhood organizations, city agencies, and industry. Course is offered in relation to suitable projects being available. May be repeated twice for credit. Mr. Laurie, Mr. Moore (F, W, Sp)  

110. Regional Plant Materials. (4)  
(Formerly 121)  
Two 4-hour laboratories per week. Prerequisite: course 11 or consent of instructor. Identification and utilization of native and introduced plants, and their impact in the landscape. Mr. Beatty (Sp)  

111. Planting Design. (4)  
(Formerly 133)  
Two 4-hour laboratories per week. Prerequisite: course 11 or equivalent. Application of fundamental, technical, and aesthetic principles of planting design to landscape problems. Mr. Beatty (W)  

112. Landscape Horticulture. (3)  
(Formerly 143)  
Two 1½-hour lectures per week. Prerequisite: course 11, or consent of instructor. Horticultural factors in landscape design installation, and management. Microclimatic factors, soil management, plant growth, turf grass, pruning, and other planting and maintenance problems. Mr. Beatty (W)  

112L. Landscape Horticulture Laboratory. (1)  
One 3-hour laboratory per week. Prerequisite: course 112 may be taken concurrently. Laboratory problems in landscape horticulture. Greenhouse and field horticultural operations. Use of Blake Garden facilities. Mr. Beatty (W)  

120. Topographic Form and Design. (4)  
(Formerly 124)  
Two 4-hour laboratories per week. Prerequisite: Civil Engineering 21 recommended. Topographic and grading problems in landscape construction, Design and structural relationships; graphic and computational exercises; technical graphics. Mr. Tetlow (W)  

121. Landscape Structures and Materials. (4)  
(Formerly 154)  
Two 4-hour laboratories per week. Prerequisite: course 120. Materials and structures in landscape construction. Design and structural relationships; graphic and computational exercises; technical graphics. Mr. Tetlow (F)  

122. Landscape Site Engineering. (4)  
(Formerly 164)  
Two 4-hour laboratories per week. Prerequisite: course 120 or equivalent. Design and construction of site utilities. Engineering of irrigation, drainage, and soil structures used in site development. Graphic exercises, technical drawing. Mr. Arbogast, Mr. Razzano (Sp)  

130. Survey of Landscape Architecture. (3)  
(Formerly 100)  
Two 1½-hour lectures per week. An introduction to the history, theory, and materials of landscape architecture; contemporary application and practice. Mr. Laurie (F)  

131. Landscape Analysis and Problem Organization. (3)  
(Formerly 121)  
Two 1½-hour meetings per week. Theories and methods in landscape analysis, emphasizing natural factors and design problem organization. Mr. Violich, Mr. Dickert (W)  

132. Recreation and Open Space Systems. (4)  
(Formerly 160)  
Two 2-hour lecture and visitor-presentation sessions; plus one discussion meeting per week. Prerequisite: consent of instructor. The function and meaning of leisure. Recreation as a socio-ecological system in time and space. Environmental systems, Planning issues and design criteria. Student-selected field studies. Mr. Moore (Sp)  

133. Design Implications in Forestry and Resource Management. (3)  
(Formerly 141)  
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: upper division standing and consent of instructor. An exploration of wildlands as a landscape resource, stressing visual composition as a base to which forestry and resource management decisions may be given form and relationships through design. To be offered in alternate years, beginning spring, 1973. Mr. Litton (Sp)  

140. Social and Psychological Factors in Open Space Design. (3)  
(Formerly 151)  
Two 1½-hour lectures per week. Theories of home, neighborhood, territory, communication, public behavior and play. Feedback research on user-behavior in existing housing developments, parks, urban squares, playgrounds, campgrounds. Ob­ grams for redesign. Mrs. Cooper-Marcus (F)  

160. Professional Practice Seminar. (2)  
(Formerly 131)  
One 2-hour seminar per week. Seminars with active practitioners from public agencies and private offices. Consideration of the present state and future potential of the profession. (W)
170. History and Literature of Landscape Architecture. (3)
(Formerly 125)
Two 1½-hour lectures per week. Developmental history of landscape design practice; relationships to society, climate, and topography.
Mr. Brown (Sp)

197. Field Study in Landscape Architecture. (1–4)
To be arranged. Prerequisite: upper division standing and consent of instructor and sponsor. See departmental information sheet for limitations. Supervised experience relative to specific aspects of landscape architecture. Regular individual meetings with faculty and outside sponsor. Reports required. Must be taken on a passed/not passed basis only.
The Staff (F, W, Sp)

198. Directed Group Study. (1–5)
To be arranged. Prerequisite: consent of the instructor.
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment restricted by regulations listed on page 87. Must be taken on a passed or not passed basis only.
The Staff (F, W, Sp)

See Environmental Design course listings for description of required environmental design courses for landscape architecture major.

200A–200B. Introduction to Landscape Design. (Design. (4–4)
(Formerly numbered 200A–200B–200C)
Two 4-hour laboratories per week. Prerequisite: consent of instructor; for graduate students entering landscape architecture from nondesign fields. Development of design perception and graphic expression, introductory project organization and design problems.
Mr. Litton, ———— (F, W)

201. Problems in Environmental Planning. (4)
(Formerly 203)
Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 103 or consent of instructor. Problems in planning and design of natural and physical landscape of urbanizing regions.
Mr. Dickert, Mr. Twiss (W)

202. Problems in Landscape Design. (4)
(Formerly 205)
Eight hours of laboratory per week. Prerequisite: Landscape Architecture 103 or consent of instructor. Landscape Architecture 234 to be taken concurrently. Project design in the context of the urban or regional landscape.
Mr. Laurie, ———— (Sp)

203A–203B. Advanced Problems in Landscape Design and Environmental Planning. (4–4)
(Formerly 223A,B)
Two 3-hour workshops per week. Prerequisite: completion of the first graduate year and consent of instructor. Planning and design problems to be developed and organized by faculty and students.
The Staff (F, W)

204. Environmental Simulation. (Variable 2–4)
(Formerly 291A)
Two to four hours of laboratory per week. Prerequisite: consent of instructor. An experimental workshop using the Environmental Simulator. Model-making for movie and video presentation; assessment of alternative simulation techniques; comparative behavioral studies of simulations and the real world; new methods of urban and highway system design.
Mr. Appleyard (F, W, Sp)

205. Planting Design. (4)
Two 4-hour laboratories per week. Prerequisite: course 11, course 200A–200B, or consent of instructor. Studies in the use of plants in landscape design considering aesthetic, horticultural, and ecological factors. Emphasis on the role of plants in open space systems and in urban design projects.
Mr. Beatty (Sp)

220. Landscape Construction and Implementation. (4)
(Formerly 206)
Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 122 or equivalent. Field observation in relation to laboratory problems. Analysis of installations and practices. Specifications and technical implementation.
Mr. Tetlow (Sp)

221. Quantitative Methods in Environmental Planning and Design. (4)
Two 2-hour seminars per week. Prerequisite: consent of instructor. Discussion and critique of the application of quantitative methods to environmental assessment, analysis and evaluation in planning and design. Topics to include multivariate analysis, optimization, simulation modeling, and operational gaming. Emphasis will be given to the use of quantitative methods in landscape planning and design research.
Mr. Dickert (F)

231. Introduction to Computer Graphics and Mapping. (4)
(Formerly 208)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: basic computer programming course. May be taken concurrently. Introduction and exercises using programs for symbolic two-dimensional mapping, three-dimensional plotting, and graphic subroutines, with data from student's area of interest. Individual problem sessions to be included, as necessary.
Mrs. Leiman (W)

232. Legislation and Administrative Regulation in Environmental Management. (3)
(Formerly 220)
Two 1½-hour meetings per week. Prerequisite: consent of instructor. A study of selected problems in law and administrative regulation pertaining to environmental quality. Comparison of diverse approaches found in federal land management, state open space preservation, and pollution control measures; stressing the matter of environmental indices and standards.
Mr. Twiss, Mr. Heyman (W)

233. Environmental Planning. (4)
(Formerly 209)
Two 1½-hour lectures or discussions per week. Prerequisite: consent of instructor. Description and critique of the environmental aspects of planning and development processes, using case material in housing, outdoor recreation, highways, flood control, etc. Role of environmental impact studies and resource inventories will be analyzed in their administrative contexts.
Mr. Twiss (Sp)

234. Intensive Design. (Variable 2–3)
(Formerly 204)
Two hours of lecture and discussion per week. Analysis of site potentials, program requirements, economic and technical resources, and the resultant form determinants. Development of concepts based on perceptual evaluation of site and surroundings. Relevance of neighborhood, community, and regional contexts, and of general cultural climate.
Mr. Eckbo (Sp)
235A–235B. Advanced Social Justice Implications. Technologies for Present and Future. Prerequisite: consent of instructor. This course is directed toward problems of the present and future within the field of social justice and emphasizes the impact that technological change has on human society. The course focuses on the relationship between technology and society, and how this relationship is influenced by social, economic, and political factors. The course also explores how technological developments affect our understanding and application of social justice principles.

235A–235B. Thesis Research Seminar. (2) One 2-hour seminar per week. Prerequisite: completion of the graduate year. Consideration of the alternative methods and strategies for thesis research. The Staff (F, W)

236A–236B. Thesis Research Seminar. (2) One 2-hour seminar per week. Prerequisite: completion of the graduate year. Consideration of the alternative methods and strategies for thesis research. The Staff (F, W)

237. Seminar in Environmental Design. (4) (Formerly 241) Four hours of lecture and discussion per week. Prerequisite: consent of instructor. Exploration of environmental design processes used in both time and space for each individual. Discussion of the concept of a unified field. Mr. Eckbo (F)


239. Introduction to Landscape Design and Environmental Planning. (1) One 1½-hour seminar per week. Prerequisite: consent of instructor. Faculty viewpoints on problems in landscape design and environmental planning; definitions of the professional field; faculty reports on their current educational, professional, and research projects. The Staff (F)

270. Studies of European Landscapes. (3) Three hours of lecture and discussion per week. Prerequisite: consent of instructor. The evolution of the human landscape between 800 A.D. and 1800 A.D., including forests, settlement patterns, roads, agricultural reclamation, city forms, as well as gardens and parks in Europe. Mr. Jackson (W)

298. Group Study. (1–5) To be arranged. The Staff (F, W, Sp)

299. Individual Research. (1–5) To be arranged. The Staff (F, W, Sp)

IDS 120. Environmental Education and Design. (5) See Interdepartmental Studies for the complete description of this course.

IDS 210. Assessment of the Environment. (4) (Formerly numbered IDS 222) See Interdepartmental Studies for the complete description of this course.

IDS 211. Geological and Engineering Factors in Environmental Planning. (4) (Formerly numbered IDS 220) See Interdepartmental Studies for the complete description of this course.

IDS 230. Amenity Resources Planning. (4) See Interdepartmental Studies for the complete description of this course.

IDS 241. The Urban Environment. (4) (Formerly numbered CP 210 and LA 202) See Interdepartmental Studies for the complete description of this course.

**ENVIRONMENTAL STUDIES**

**Group Major in Environmental Studies**

*Head adviser:* Mr. Daniel B. Luten.

The group major in Environmental Studies is offered in the College of Letters and Science. It is designed to provide undergraduate programs focusing upon environmental problems and the study of complex ecological relationships. A student may elect to follow one of three channels in the group major, focusing on physical science, biological science, or social science. Details of course listings appear below. In each of these channels, there is a substantial amount of common ground, so that students in the program will be able to communicate and to work together. Each program emphasizes a broad and comprehensive training in elementary fundamentals of mathematics, physics, chemistry, and biology, and in those areas of social science directly related to environmental questions. Such training is regarded as indispensable for those who wish to acquire more than a superficial understanding of the impact of science and technology on society, and who wish to contribute to the solution of environmental problems.

The senior seminar (Environmental Studies 196) is an important feature of the group major in environmental studies. Typically a group of fifteen seniors, including students

**NOTE:** For key to footnote symbols, see page 86.
from each of three programs, will work under faculty guidance for the entire academic year on a single environmental problem. The technical, economic, and political background will be studied thoroughly, and then detailed model solutions will be worked out.

The requirements of the major listed below are presently in the process of revision. Interested students should consult the current Announcement of the College of Letters and Science for a more accurate description.

Area I, Physical Science

Lower Division Courses  Mathematics 1A–1B–1C, 51A–51B–51C; Computer Science 2; Physics 4A–4B–4C–4D; Chemistry 1A–1B; Biology 11A–11B. Strongly recommended: Chemistry 8A, 8B.

Upper Division Courses  For All Students: Biology 150; Demography 100; Environmental Studies 196, Senior Seminar in Environmental Studies. For Physics Students: Physics 112, 116A–116B–116C, 124; or, For Chemistry Students: Chemistry 104A–104B, 109A–109B, 114H.

Recommended electives: Anthropology 148; Civil Engineering 144; Geography 130A, 144, 146; Physics 137A, 137B, 137C; Public Health 150.

Area II, Biological Science

Lower Division Courses  Mathematics 16A–16B–16C; Computer Science 2; Physics 6A–6B–6C; Biology 1A–1B; Chemistry 1A–1B. Strongly recommended: Chemistry 8A, 8B.

Upper Division Courses  Anthropology 148 or Geography 103 or Sociology 160; Biology 150; Demography 100; Environmental Studies 196, Senior Seminar in Environmental Studies.

Seven biology courses, to be selected from the following list: Botany 125, 154; Entomological Sciences 105; Forestry 111, 122, 124, 126, 175, 177; Nutritional Science 160; Zoology 107A, 107B, 140.

Recommended electives: Geography 130A, 130B; Geology 10, 110; Interdepartmental Studies 180; Public Health 150 or Civil Engineering 144.

Area III, Social Science

Lower Division Courses  Mathematics 16A–16B–16C; Computer Science 2; Physics 6A–6B–6C; Chemistry 1A–1B; Biology 11A–11B; Sociology 1 and 20, or Economics 1A–1B.

Upper Division Courses  Biology 150; Demography 100; Sociology 140, 160; Anthropology 148; Geography 100A or 100B or 103; Geography 130A, 130B; Environmental Studies 196, Senior Seminar in Environmental Studies.

Recommended electives: Geology 10, 110; Interdepartmental Studies 180; Public Health 150 or Civil Engineering 144; Sociology 178.

196. Senior Seminar in Environmental Studies. (6)

Three hours of lecture and three hours of laboratory per week. Prerequisite: senior standing in the Group Major in Environmental Studies. Joint seminar for majors representing the physical, biological, and social science programs. A systemic consideration of a specific environmental problem. Ecological, technical, economic, political, and cultural backgrounds are investigated and detailed integrated solutions are proposed. Fieldwork is required. (Sp)
ETHNIC STUDIES

Afro-American Studies Program
(Program Office, 3335 Dwinelle Hall)

Professor:
Henry Ramsey, Jr., LL.B. (Acting)

Assistant Professors:
William M. Banks, III, Ph.D. (Coordinator)
Barbara Christian, Ph.D.
William Hayes, Ph.D.

THE MAJOR

The major program in Black Studies leads to the B.A. degree.

1. Admission to a major requires that the student be in good academic standing in the University. The student shall either have satisfied or be in the process of satisfying the Reading and Composition requirement either through Afro-American Studies 1 and 2 or a sequence that has been approved by the College of Letters and Science. Prior to admission the student must have an interview with the departmental adviser at which time an appropriate program of study will be worked out.

2. It is important that the major in Black Studies provide the student with requisite knowledge and skills for subsequent graduate or professional training. Thus, within the Program the student must elect to concentrate in the social sciences or humanities. Such a concentration allows flexibility without requiring the student to enroll in a wide range of general courses relative to Blacks.

3. In addition to the major requirements as outlined below, eight courses must be completed outside of the concentration in Black Studies. Students who plan to go on to graduate study are strongly advised to take a research methodology course that is specific to the anticipated graduate major.

4. Certain students may wish to pursue a double major, combining Black Studies and a discipline. In this case the departmental adviser through consultation will plan a program of study that effectively complements the student's academic and career objectives.

5. None of the major requirements may be taken passed/not passed. Only one Independent Study (199) or Directed Group Study (198) may be used to satisfy the requirements for the major.

Social Science Students electing to pursue a social science concentration within Black Studies must complete the following program: Afro-American Studies 186 or 187; Afro-American Studies 180, 181 or 182; Afro-American Studies 178 or 109; Afro-American Studies 117 or 118; History 169A or 169B or Sociology 110A or 110B; Afro-American Studies 189 or Sociology 111; one seminar course in the 113 series (the course number is designed for seminars on selected topics and may be repeated for up to 15 credits); one course in the humanities concentration; and at least two courses that are continuations of the above listed courses.

Humanities The humanities concentration requires the following: Afro-American Studies 186 or 187; course 150A, 150B, or 150C; course 153 or 154; Afro-American Studies 113, Afro-American Studies 164A; Afro-American Studies 163 or Music 128K; Afro-American Studies 159; Afro-American Studies 138 or Afro-American Studies 152A, 152B, or 152C; and at least one course in the social science concentration.

Recommended: Some awareness of the situation of other ethnic minorities is important in the comprehension of the black experience, so it is strongly recommended that Afro-American Studies majors take a course dealing with the history and experiences of other minority groups in the New World.

NOTE: For key to footnote symbols, see page 86.
Minor  The minor in Black Studies is designed for students who elect to major in a specific academic discipline. A total of 25 units or the equivalent (usually 5 courses) must be completed in the Afro-American Program. These courses are to be selected in consultation with the departmental studies adviser. The courses are expected to provide a substantive field of preparation with the student's major discipline. Only one Independent Study (199) or Directed Group Study (198) can be used to satisfy the minor requirements.

Honors Program  Qualified students (with a minimum overall grade point average of 3.0) may arrange an individual program of special study in consultation with the major adviser, to begin not later than the first quarter of their senior year. The program will culminate in the writing of a senior honors thesis.

Lower Division Courses

1. Composition (5)
Four hours of lecture and one hour of discussion per week. Through a continued exploration of themes related to the Black Experience, students will develop composition and general communication skills. Discussion will focus on the rich and varied modes of expression peculiar to Afro-Americans, i.e., Black dialect, folklore. (F, W, Sp)

2. Composition (5)
Four hours of lecture and one hour of discussion per week. Prerequisite: course 1. Continued training in expository and argumentative writing with more intensive emphasis on modes of argument, tools and techniques of research, and introduction to literary forms. (F, W, Sp)

3. Black Life and Culture in the United States, (5)
Four hours of lecture and one hour of discussion per week. A multidisciplinary exploration of the cultural and social milieu of Black people in the United States. Extensive use will be made of media. Particularly designed for freshmen and sophomores. (F, W)

31A–31B. Elementary Swahili. (5–5)
Four hours of lecture and at least one hour of laboratory per week. Elementary Swahili is designed to give communication skills in reading, writing, and speaking the language. Appreciation of the peoples who speak the language as their mother tongue, and their culture as well as the geographical boundaries in which they reside. (W, Sp)

Upper Division Courses

109. Black Economic History. (5)
Four hours of lecture and one hour of discussion per week. Analysis of the Black community's economic status in America, exploration of the role of racism in the thwarting of minority group economic interests. (F, Sp)

110. Black Community Development. A Historical Perspective. (5)
Four hours of lecture and one hour of discussion per week. This course is an examination of the historical evolution of Black communities in the U. S. from slavery to the contemporary era. It will focus on the spatial, social, and economic conditions of the Black masses during major periods of existence in the U. S. (F, Sp)

111. Minority Groups in the American Economy. (5)
Four hours of lecture and one hour of discussion per week. The status of selected racial minority groups with respect to their economic position in society. Special attention on various economic development strategies. (W, Sp)

112. Contemporary Black Economic Alternatives. (5)
Four hours of lecture and one hour of discussion per week. Consideration of economic strategies that directly relate to the development of Blacks in America. Black capitalism, cooperatives, and socialist approach will be studied. (F)

113. Selected Topics and Issues in Black Life and Culture. (5)
Four hours of lecture and one hour of discussion per week. Designed to permit an instructor to deal with a specialized topic. The topic will vary. Mr. Banks, Mr. Ramsey (W)

117. Black People and Psychology. (5)
Four hours of lecture and one hour of discussion per week. A course that treats psychological theory and research pertaining to Black people. Emphasis on new models. Mr. Hayes (F, Sp)

118. Dominated Man. (5)
Four hours of lecture and one hour of discussion per week. An analysis of the phenomenon of domination as it affects the "dominated" and the "dominant." Through a comparative approach, social and psychological dynamics of dominance, resistance and submission in groups such as Blacks, women, Jews, homosexuals, etc., will be studied. (W)

120. Mental Health in the Black Community. (5)
Four hours of lecture and one hour of discussion per week. A comprehensive analysis of the concept of "mental health" as it relates to Black Americans. Special attention is given to mental health programs and practices that particularly affect Black and other minority communities. Considerations of research, available services, resources, and social policy are examined. Mr. Hayes (W)

138. Communications Media and the Minority Experience. (5)
Four hours of lecture and one hour of discussion per week. The historical and contemporary role of television, radio, and other media as it relates to the minority communities. The role of media in influencing social policy will be considered. (F, Sp)
150A-150B-150C. Survey of Afro-American Literature:
(A) 1746-1920; (B) "Renaissance" Period; (C) 1950-Present. (5-5-5)

Four hours of lecture and one hour of discussion per week. The course represents a 3-quarter sequence designed to acquaint students with the literature generated by Black people in the U. S. The course will serve as a prerequisite for students wishing to enroll in more specialized courses in the department. The sequential breakdown is in chronological order: A. 1746-1920; B. "Renaissance" Period; C. 1950-present.

151. Advanced Writing. (5)

Four hours of lecture and one hour of discussion per week. Prerequisite: courses 1 and 2 and consent of instructor. Designed to give intensive work in expository and argumentative writing on topics of current concern as well as on aspects of cinema, television, theater, and dance. Close attention to style, syntax, structure, voice and the manipulative elements of persuasion.

152A. The Novel. (5)

Four hours of lecture and one hour of discussion per week. Explores the development of narrative writing by slave narrators, autobiographies, short stories, with major emphasis on the novel as a tool for the formation of the Black consciousness.

152B. The Black Essay. (5)

Four hours of lecture and one hour of discussion per week. Major Black essays will be discussed. Particular emphasis on the way in which Afro-Americans have transformed the essay to express the dimensions of their own experience.

152C. Afro-American Poetry. (5)

Four hours of lecture and one hour of discussion per week. The main thrust of this course will be to investigate the works of major contemporary Afro-American poets with special emphasis placed on their concern with new forms and visions growing out of Black life. Some poets will be Gwendolyn Brooks, Imamu Baraka (LeRoi Jones), David Henderson, Don Lee, Nikki Giovanni, Miss Christian (Sp)

153. Literature of the Caribbean. (4)

Two hours of lecture twice weekly. A survey of the literary works that have been produced by West Indian authors and poets.

154. The New Black Aesthetic. (5)

Four hours of lecture and one hour of discussion per week. Examines the principle by which Black Art can be understood and appreciated within the framework of African-Americans and neo-African culture. The course will proceed with a background concern for the question of revolution.

155. Images of the Black Women in Literature. (5)

Four hours of lecture and one hour of discussion per week. The Black woman as portrayed in Western literature and in Afro-American writing. Analysis of the cultural and social assumptions that contribute to the various images projected. Miss Christian (F)

156. Langston Hughes. (5)

Four hours of lecture and one hour of discussion per week. A study of Hughes' canon and attention to his role and influence on the national and international stage as a man of letters.

157. Seminar on LeRoi Jones. (5)

Four hours of lecture and one hour of discussion per week. Jones' preoccupation with the development of his own psyche will be the basis of study of his work. His poetry, short stories, dramas, and essays will be looked at as indications of his development as a writer. Some time will be devoted to his development as a political thinker, since this is an essential part of his work.

159. Black Folk Culture in the New World. (5)

Four hours of lecture and one hour of discussion per week. Consideration of the folk culture of Blacks in the New World, emphasizing continuities and similarities.

163. Black Art in the New World. (5)

Four hours of lecture and one hour of discussion per week. Consideration of the art of Black people in the New World, tracing the forms to an African influence.

164A-164B. The Black Experience in Theatre: The Black Playwright. (5-5)

Four hours of lecture and one hour of discussion per week. An investigation of the plays which deal with the experience of Black people in America. Basically an introduction to the Black play as well as the Black playwright, the course will examine the problems of reading and analyzing the play, and the structural and thematic peculiarities of each playwright.

166. Slavery: A Comparative Analysis. (4)

Four hours of lecture per week. A comparative analysis of the institution of slavery as it existed in many parts of the world during different periods; examination of the philosophical, economic, and social factors that relate to the institution.

167A. Third World Cinema. (4)

Three hours of lecture per week. A course designed to explore the use and misuse of Third World people and images in the film industry. Through articles, lectures, and selective film showings, aspects of this subject will be analyzed and discussed. A survey of film history will be studied dating from the early years through the 1950's. A film will be shown once a week.

167B. Black Cinema. (4)

Four hours of lecture and one hour of discussion per week. A course designed to explore the use and misuse of Black people in the film industry. Through articles, lectures, and selective films, all aspects of this subject will be analyzed and discussed.

169A-169B-169C. The Black Ensemble Theatre Company. (3-3-3)

Five hours of lecture per week. Admission by audition only. A three quarter course designed to engender the creation of a permanent ensemble theatre group—the producing arm of Afro-American Studies at Berkeley will consist of five intensive theatre workshops.

171. The Sociology of Black Leadership in American Society. (5)

Four hours of lecture and one hour of discussion per week. Consideration of the leadership phenomenon in the history of Afro-Americans. Emphasis on the socio-political factors that influence the nature of Black leadership in the U. S.

Mr. Banks (Sp)
172. Black Revolt: Past and Present. (5)
Four hours of lecture and one hour of discussion per week. Consideration of Black revolts, particularly in the New World; the revolts of L'Ouverture, Cristobal, Bolivar, as well as the more contemporary forms are discussed in terms of their philosophies, strategies, and tactics. (Sp)

173. The Black American: A Legal History. (5)
Four hours of lecture and one hour of discussion per week. Consideration of the legal decisions that have affected the status of Black people in America. The social, economic, and political implications of the constitutional issues will be explored. (Sp)

177. Education and Equality. (5)
Four hours of lecture and one hour of discussion per week. An analysis of recent research and theory on the issue of education and equal opportunity. The work of Jencks, Coleman, Jenson, Cross, et al., will be examined. Particularly recommended for prospective teachers. (Sp)

178A–178B. Educational Institutions and Black Americans. (4–4)
Four hours of lecture per week. Examination of educational institutions and processes and their specific effect on Black people. A comparative analysis of traditional educational models and the current trends in Black studies. A major theme will be the role of education in the overall liberation and development of the Black community. (F, W)

180. Black Politics in the United States. (5)
Four hours of lecture and one hour of discussion per week. A historical consideration of Afro-Americans’ involvement in political processes and activities. Emphasis on those political activities that evolve from the group position of Blacks in the United States. (W)

181. Health Status and Health Delivery Systems and Minority Community. (5)
Four hours of lecture and one hour of discussion per week. To examine the relationship between the health status of Black people in America and the health delivery system. Federal, state, and local health care policy will be explored. Topics to be covered include: manpower and training, medical care organization, and research and evaluation. An introduction to students concerned with the health care status of poor and minority people.

Mr. Hayes (Sp)

182. Black Life and Culture in the Caribbean. (5)
Four hours of lecture and one hour of discussion per week. A study of the cultural and social milieu of Black peoples in the context of the Caribbean Islands. (W, Sp)

183. African Liberation Movements. (5)
Four hours of lecture and one hour of discussion per week. A major part of class will be devoted to giving a broad overview of the political systems in Southern Africa and Guinea-Bissau. The philosophies, strategies, and tactics of the African Liberation Movements in Southern Africa will be surveyed. (F)

184. Contemporary Black Political Life. (5)
Four hours of lecture and one hour of discussion per week. Analysis of the contemporary political involvements of Black people, starting with the Civil Rights Movement and progressing through the various forms and expressions of Black political activity that exist today. (Sp)

185. Social Research and Problem Solving in the Urban Community. (4)
Two hours of laboratory and six hours of supervised field work. The course will explore recent urban and social developments that are reflected in the local East Bay Community. Students will thus get an opportunity to combine the theoretical and empirical dimensions of the urban minority experience. (F, W, Sp)

186. Political Development in the Caribbean. (5)
Four hours of lecture and one hour of discussion per week. A consideration of the historical and political developments that produced the nations of the Caribbean. Emphasis on independence movements and current struggles with nationhood. (W)

187. Black Life and Culture in South America. (5)
Four hours of lecture and one hour of discussion per week. Study of the development of Black community and culture in South America. Examination of race as a factor in the societies of South America. (Sp)

189. Pan Africanism: Past and Present. (5)
Four hours of lecture and one hour of discussion per week. An examination of the concept of Pan-Africanism, its historical and intellectual development. A study of contemporary movements that incorporate the Pan-African theoretic. (F)

197. Field Study. (1–5)
Field study to investigate special educational concerns in the Black community. Mr. Banks (F, W, Sp)

198. Directed Group Studies for Undergraduates. (1–5)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87 of this catalogue. Must be taken on a passed/not passed basis. Mr. Banks (F, W, Sp)

100H. Honors Theses. (5)
To be supervised in cooperation by faculty advisor. (Sp)

Chicano Studies Program
(Program Office, 3408 Dwinelle Hall)

Myrtha Chabran, M.A. (Coordinator)
Jorge Acevedo, M.A.
Velia Garcia-Hancock, M.S.W.
Lila Gonzalez de Garfinkel, Ph.D.

David Hayes-Bautista, M.A.
Juan Martinez, Ph.D.
Malaquías Montoya, B.A.
Rogelio Reyes, M.A.
The Chicano Studies Program seeks to serve students in the following ways:
1. by inspiring in students a sense of commitment and responsibility to the Chicano community and by providing students with the knowledge and skills to work effectively for Chicanos; 2. by providing courses leading to an A.B. degree in Chicano Studies, and by providing a contribution to Ethnic Studies core courses.

The Chicano Studies Program seeks to provide a base for the university education of Chicanos and other students interested in a bilingual, bicultural education. In addition to the undergraduate degree program, Chicano Studies offers the academic community a rich resource in its Chicano Studies Library. The Library houses a large collection of books, journals, and periodicals, plus 1,000 color transparencies of important Chicano art works.

Chicano Studies Major

The Bachelor of Arts degree in Chicano Studies will be awarded upon fulfillment of the following requirements:

1. Completion of 180 units, at least 60 units of which must be in upper division courses.
2. Maintenance of at least a C average in all courses undertaken at the University and in all courses in the major program.
3. Completion of the general University requirements regarding senior residence, Subject A, American History and American Institutions.
4. Demonstrated proficiency in the use of the English language: two courses in a reading and composition sequence approved by the Chicano Studies faculty.
5. Demonstrated proficiency in Chicano Spanish: the third course in the advanced sequence of Chicano Spanish (28C). This requirement may be met in part, or in total, by an examination approved by the Chicano Studies faculty.
6. Completion of the major in Chicano Studies as follows: An introduction to Chicano Studies one upper division course; a seminar in Chicano Studies: one upper division course; (Ch.S. 100, Ch.S. 182), an additional 40 upper division units in Ethnic Studies, of which at least 20 units must be in Chicano Studies (the remaining units may be elected from anywhere in the other Ethnic Studies programs subject to the approval of the faculty). For further information, please consult with the Chicano Studies Major Adviser, Nina Genera, 3412 Dwinelle, 642-2190.

Note: for additional course offerings, consult the Chicano Studies Divisional Office, 3408 Dwinelle Hall.

Lower Division Courses

1A–1B. English Reading and Composition for Native Speakers of Spanish. (5–5)

Five 1-hour lectures per week. Prerequisite: consent of instructor. Completion of Subject A required. Designed specifically to meet the needs of the Spanish/English bilingual students. Students draw on their own immediate experiences for the themes and issues to develop language skills in oral and written expression, precision of thought, and response to literature.

Mr. Reyes (F, W)


Five 1-hour lectures per week. Prerequisite: Spanish spoken at home; consent of instructor. Development of confidence and facility in speaking and writing Spanish from the students' latent knowledge of the language. Day to day speech emphasized in the early portion of the sequence in the spoken as well as in the written forms, with a gradually increasing emphasis on more formal and standard usages. For students who comprehend well, but who speak with considerable difficulty. (F, W, Sp)


Five 1-hour lectures per week. Prerequisite: Spanish spoken at home; consent of instructor. (Note: fulfills foreign language breadth requirement for Letters and Science.) Development of confidence and facility in speaking and writing Spanish from the students' latent knowledge of the language. Day-to-day speech emphasized in the early portion of the sequence in the spoken as well as in the written forms, with a gradually increasing emphasis on more formal and standard usages. For students who comprehend well and who speak with ease and considerable fluency. Mrs. Gonzalez de Garfinkel (F, W, Sp)

Upper Division Courses

100. Introduction to the Scope, Philosophy, and Methods of Chicano Studies. (5)

Prerequisite: sophomore standing. An analysis and definition of the philosophy, scope, and methods of Chicano Studies. Students will trace the development of a definition and rationale for Chicanismo through a critical and comparative examination of methodologies.

Mr. Acevedo (F)
105. Survey of Chicano Literature. (5)
Five 1-hour lectures per week. A survey of all literary genres with the exclusion of the novel. A historical approach in the analyses of themes. Special emphasis given to work published in magazines and newspapers. Mrs. Chabran (F)

106. Third World Literature. (5)
Five 1-hour lectures per week. During the winter quarter we will concentrate on Third World Literature written within the borders of the United States. Emphasis will be on La Raza, Black, Native American, Asian Literature. We will try to define the nature of the experience of Third World people in this country. Comparative approach. Also some preliminary research on the term "Third World" itself. Very little lecturing, lots of discussion.
Mrs. Chabran (W)

107. Chicano and Latin American Literature. (5)
Five 1-hour lectures per week. Emphasis given to the relationship between Latin American Literature and Chicano Literature. Latin American Literature will include Brazil, British West Indies, and French West Indies in translation, as well as the traditional Spanish-speaking. Chicano will include a novel, plays, and poetry.
Mrs. Chabran (S)

108. The Research Paper. (5)
Five 1-hour lectures per week. A step-by-step presentation of a structured sequence of research procedures that the student should be familiar with in order to write effective research papers of moderate length (12-15 pages).
Mr. Reyes (F)

118. Chicano Art History. (5)
Five 1-hour lectures per week. A lecture and discussion course surveying the background and main currents of Chicano art. The roots of Chicano art are traced in Aztec, Spanish, and Mexican history.
Mr. Montoya (Sp)

119. Art Workshop. (3)
Nine hours of laboratory per week. Prerequisite: consent of instructor. A multi-media art workshop for both novice and experienced artist. Printmaking, painting, sculpture, papier-mache, etc. Particular emphasis on the examination of pre- and post-Columbian artistic heritage of Chicanos and contemporary Chicano artistic expression, these examinations to form a correlative framework for the students' own production. This course may be repeated once for credit.
Mr. Montoya (F, W)

125. Creative Writing Workshop. (5)
Five 1-hour lectures per week. Prerequisite: course 1A-1B. Development of skills in writing in English. Chicano Spanish will be included within the realm of Spanish. Exploration of the short story, drama, poetry, expository, and critical writing as well as translation as a creative medium. Students may select projects within the above categories.
Mr. Gonzalez de Garfinkel (Sp)

131. Social Institutions. (5)
Four 1-hour lectures and one hour discussion per week. (Note: fulfills general University requirement for American Institutions.) A study of U.S. institutions through examination of contemporary issues challenging these foundations of the American experience. The extent to which institutions have been sensitive to the pluralistic nature and changing character of American society is the central theme of the course. In this context the interrelationship of institutions and their collective influence on the values and national character of the American people is subjected to analysis.
Mrs. Garcia-Hancock (F, W)

134. American Justice and Chicano People. (5)
Four 1-hour lectures and one hour discussion per week. A general survey of the institutions of justice in the U.S. and their contact with the Chicano people. The social foundations of criminal justice and the role of racial minorities in that system will provide focus for the course. Major theories of crime will be considered from minority perspective. Institutions of law enforcement will be subjected to specific analysis in terms of the Chicano experience. Proposals for system reform and radical change will be explored in light of contemporary social and political realities.
Mrs. Garcia-Hancock (Sp)

137. Chicano Perspectives on Crime and Corrections. (5)
Four 1-hour lectures and one hour discussion per week. The development and function of contemporary corrections. The physical, social, and psychological therapy programs. Concepts of rehabilitation explored. Major theories of crime and corrections viewed from Chicano perspectives. Social work and other behavior modification techniques and treatment disciplines evaluated.
Mrs. Garcia-Hancock (F)

139. La Chicana. (5)
Five 1-hour lectures per week. Explores the psychological, social, and political experience of Chicano women in the Southwest with historical and contemporary reference. The role of the Chicana is examined as the central function of the broader Chicano experience and within the specific context of the family.
Mrs. Gonzalez de Garfinkel (W)

140. Advanced Art Workshop. (3)
Nine hours of Laboratory per week. Prerequisite: course 119 or consent of instructor. An art workshop for the advanced student. Develops two art forms exclusively: mural painting and advanced poster art. The advanced poster art will concentrate on process: silk-screening, photo-silk-screening, layout and composition for camera-ready art. The mural painting will include instruction in techniques illustrated with slides.
Mr. Montoya (F, Sp)

145A-145B. Chicano Health Problems and the Structure of Health Care. (5-5)
Five 1-hour lectures per week. Prerequisite: consent of instructor. An undergraduate introduction to the health care problems of Chicanos and the historical relation of United States health care structures, public and private, to those problems. For contrast, alternative health care structures, foreign and domestic, will be considered in light of these problems.
Mr. Hayes-Bautista (F, W)

151. Chicano History. (5)
Four 1-hour lectures and one hour discussion per week. Survey of the history, culture, and mestizization of the Mexican Americans. A look at U.S. History from the perspective of the Chicano. Analysis of problems of assimilation. Discussion section to be arranged. (Note fulfills general University requirement for History.) (F)

ETHNIC STUDIES / 289
153. Contemporary Chicano Issues. (5)
Four 1-hour lectures and one hour discussion per week. Analysis of conditions resulting from a shift in the Spanish-speaking population from agricultural and rural to urban and industrial areas since World War II. Mr. Martínez (W)

155. Chicanos in California. (5)
Four 1-hour lectures and one hour discussion per week. Prerequisite: consent of instructor. Includes Spanish and Mexican background and the relations of the Spanish-speaking Californians with Anglos from 1848 to the present. Mr. Martínez (Sp)

160. The Development and Transformations of Ethnic Identity. (4)
Four 1-hour lectures and one hour discussion per week. Theories of ethnic identity development will be studied for their applicability to the Chicano experience, including psychological, psychoanalytical, culture and personality, and social interactional theories. Substantive theories relating to the transformation of ethnic identity will be studied and added upon when found deficient. Primary material such as films, art work, periodicals, books, and interviews will be used to ground such theory in reality. Mr. Haye-Bautista (F)

165. Pre-Chicano Thought and Culture. (5)
Five 1-hour lectures per week. Social, psychological, philosophical, and historical heritages of La Raza. An exploration of the ideologies that have created La Raza. Emphasis will be on Mexican material since most of La Raza in California is of Mexican ancestry. Mr. Acvedo (W)

170. Language and Culture in the Chicano Community. (5)
Five 1-hour lectures per week. Prerequisite: consent of instructor. A course designed to give Spanish/English bilinguals a linguistic foundation in the Spanish dialect of Aztlán. An analysis of the interrelation between language and culture in the Chicano community will also be included. Original materials such as tape recordings and unpublished documents in or about Chicano Spanish will be collected and researched. Mr. Reyes (W)

175. Bilingualism and Biculturalism in the Chicano Community. (5)
Five 1-hour lectures per week. Prerequisite: consent of instructor. This course is designed to develop new methods and techniques for bilingual and bicultural education for Chicanos at all levels. The results of the experimental work which includes workshops in poetry, music, and theater will form the basis for the development of a comprehensive theory of bilingual and bicultural education as it relates to Chicanos. Mr. Reyes (Sp)

181. Seminar in the Development of Substantive Theory for Community Research. (3)
Three 1-hour lectures per week. Prerequisite: junior standing. Substantive theories now used to study and categorize Chicanos will be studied and evaluated for effectiveness. Their contributions to the development of Chicano sociological stereotypes will be examined. Methods for developing substantive theories for use in Chicano community research will be discussed. Mr. Haye-Bautista (W)

182. The Chicano Community: A Seminar. (5)
Five 1-hour lectures per week. Prerequisite: junior or senior standing. An examination of the general characteristics of the Chicano barrio and its relationship to typical urban and rural governmental models. A theoretical grounding in the disciplines of community organizing and community development and consideration of innovative and more controversial models. Mr. Acvedo (Sp)

185. Chicano Separatist Education. (5)
Five 1-hour lectures per week. The course provides a new opportunity for the re-assessment of the educational process. The Chicano analysis of deschooling and alternative schools combined with a hard look at compensatory devices, prepare the way for a definition of Chicano Separatist Education, and the further planning and projection of the people's right to education. Mr. Acvedo (W)

192. Practicum in the Development of Substantive Theory for Community Research. (3)
Three 1-hour lectures per week. Prerequisite: the seminar. Supervised independent field experience in the community relevant to specific aspects of Chicano Studies. Regular meetings with faculty sponsor and written reports required. Mr. Acvedo in charge (F, W, Sp)

198. Directed Group Study. (1-5)
Prerequisite: consent of instructor. Directed group study in Chicano Studies for advanced students. Regular meetings with faculty sponsors and written reports required.

Mrs. Garcia-Hancock in charge (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Prerequisite: consent of instructor. Independent work for advanced students in Chicano Studies. Enrollment is restricted by regulations listed on page 87. Regular individual meetings with faculty sponsor and written reports required. Offered on a passed/not passed basis only. Mr. Martínez in charge (F, W, Sp)

Contemporary Asian Studies Program

Coordinators:
Patrick S. Hayashi
Colin Watanabe

UNDERGRADUATE PROGRAM

The Contemporary Asian Studies Program offers a unified and comprehensive undergraduate curriculum which seeks to make at least three major contributions. First, it
prepares students for positions of service and leadership in Asian American communities. To do this, the program draws heavily on the curricula of such schools as Education, Public Health, Law, Sociology, and Criminology. The program itself offers instruction in those areas relating to the special needs of Asian American communities. Second, the program explores the hitherto neglected aspects of the cultural, political, and historical experience of Asians in America. In doing so, it provides the undergraduate with thorough instruction on the experience of Asians in the United States, and prepares students for graduate work in their own and allied fields. Third, the program broadens the curriculum at Berkeley to include instruction which reflects the conditions of Asians and other Third World people living in America.

THE MAJOR

At this time, the program does not offer a program of study leading to a departmental major. However, students wishing to major in Asian American Studies may do so, with proper approvals, on an individual basis.

Lower Division Courses

3A. Asian American Identity. (5)
Four and one-half hours lecture and one hour discussion per week. A reading and composition course examining selected literary, socio-political, and historical works related to the Asian American experience. Students will read, discuss, and write about such topics as Asian and American culture and values, racism, the form and function of communication. Fulfills the Subject A Requirement. (F

3B. Asian American and Third World Literature. (5)
Four and one-half hours lecture and one hour discussion per week. A reading and composition course examining literature of the Third World experience in America. Representative works from Asian, Black, Chicano, Native American, and White Literature, including novels, biographies, essays, short stories, prose, and poetry, will be examined not only for their literary significance but also for their social, cultural, political, and psychological impact. (W)

3C. Third World Literature. (5)
Four and one-half hours lecture and one hour discussion per week. A reading and composition course on the Third World. Representative works, including novels, biographies, essays, short stories, prose, and poetry, will be examined not only for their literary significance but also for their social, cultural, political, and psychological impact on domestic and international Third World and non-Third World peoples. (Sp)

10. Asian American History. (5)
Three hours of lecture and two hours of discussion period per week. An overview of the Asian American experience, 1848 to present. Topics include influence of traditional values, Eastern and Western; comparative immigration and settlement patterns; labor history; legal-political influences, local, national, and international; interracial relationships. Mr. Takagi (F)

30. Introduction to Asian American Communities. (5)
Three hours of lecture and two hours of discussion per week. The evolution of social, religious, economic, and political institutions in Asian American communities with cross-cultural comparisons with institutions of other communities. Includes field trips and some supervised field work. (F, W)

50A-508-50C. Cantonese. (5-5-5)
Five hours lecture and three hours laboratory per week. Development of oral and written skills in the dialect most commonly found in Bay Area Chinese communities. Includes an examination of cultural, social, and historical aspects of Chinese communities to enable students to use language skills in community field work situations. (F, W, Sp)

51A-51B-51C. Community Japanese. (5-5-5)
Five hours lecture and two hours laboratory per week. Development of oral and written skills in the dialects most commonly found in Bay Area Japanese communities. Includes an examination of cultural, social, and historical aspects of Japanese communities to enable students to use language skills in community field work situations. (F, W, Sp)

52A-52B-52C. Tagalog. (5-5-5)
Five hours lecture and two hours laboratory per week. Development of oral and written communication skills in the dialect most commonly found in Bay Area Filipino communities. Includes an examination of cultural, social, and historical aspects of Filipino communities to enable students to use language skills in community field work situations. (F, W, Sp)

Upper Division Courses

121A-121B. Chinese American History. (5-5)
Three hours lecture and two hours discussion per week. An overview of the Chinese American experience, 1848 to present. Topics include influence of traditional values, Eastern and Western; patterns of immigration and settlement; labor history; the influence of public policy, foreign and domestic, on the Chinese individual and community. (F, W)

123A-123B-123C. Filipino American History. (5-5-5)
Three hours lecture and two hours discussion per week. A two-quarter sequence covering Filipino American history, 1521 to present. Topics include influence of traditional values, both Filipino and Western; patterns of immigration and settlement; labor history; international events and their effects on the Filipino individual and community. (F, W, Sp)
131. Approaches to Community Organization. (5)
Three hours lecture and two hours discussion per week. An overview of theoretical and practical aspects of community organization and the development of strategies specific to Asian communities and their problems. Supervised field work complements reading and discussion and provides material for subsequent classroom analysis. (W, Sp)

132. Asian American Communities and the Law. (5)
Three hours lecture and two hours discussion per week. Examination of the structure and function of the legal institution with emphasis on California law, especially those areas which most affect Asian Americans. Topics include immigration law, selected topics in criminal law, tenant-landlord law, family law, selective service law, and prison rights. (F)

133. Education in Asian American Communities. (5)
Two hours lecture and three hours laboratory per week. Emphasis on school-community relations at the elementary, secondary, and higher levels. Includes an exploration of Asian Studies and English-as-a-Second-Language programs at all levels. Three hours of field work, including tutoring, teaching, counseling, and observing in East Bay schools required. (W)

134. Asian American Communities and Public Health. (5)
Three 1½-hour meetings per week. Survey of existing health care delivery systems in Asian American communities, the practice of “ethnic” medicine, community attitudes toward public health, the state of professional training, and a consideration of possible changes and alternatives. (W)

135. Social Services in Asian American Communities. (5)
Three hours lecture and two hours discussion per week. Selected problems in housing, employment, and mental health in Asian American communities. Group study designed to analyze the social service delivery system in relationship to these problems and to formulate alternative solutions. (Sp)

170. Proseminar on Asian Women. (5)
Three hours of lecture and 1½ hours discussion per week. Prerequisites: course 3 or course 10 and consent of instructor. An analysis of events, forces, and movements affecting Asian women in America drawing from material in literature, history, philosophy, political science, and other fields. Reading, reports, papers, and discussions. Limited enrollment. (F)

183. A Comparative Analysis of Racism in America. (5)
Three hours lecture and one hour discussion per week. A comparative and historical analysis of the different forms of oppression in America. Study of white racial attitudes toward Afro Americans, Mexican Americans, Asian Americans, and American Indians to give students an understanding of the racial minority experience as well as the meaning and nature of American culture. Mr. Takaki (F, Sp)

184. Seminar on Selected Topics in Asian American History. (5)
Three 1½-hour meetings per week. In this seminar, students will examine primary documents in order to analyze narrowly defined topics related to the history of racial attitudes in America. Use of social science methods and literary criticism as tools for historiographical analysis will be given special attention. Every student will write a major paper. Course 183 as well as pre-enrollment consultation with the instructor are recommended. Mr. Takaki (W)

197. Directed Field Studies in Asian American Communities. (1–5)
Prerequisite: course 30 or any of the 130 series (may be taken concurrently). Students, under the guidance of staff members, work with community service agencies to research community problems, evaluate existing programs, and develop new programs where necessary. (F, W, Sp)

198. Directed Group Studies. (1–5)
Directed group studies under the supervision of the staff. (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Prerequisite: course 10 or consent of faculty member and program coordinator. Student creates a program of study and research under the guidance of a faculty member. Mr. Takaki (F, W, Sp)

Native American Studies Program
(Program Office, 3415 Dwinelle Hall)
Coordinator:
Richard W. Band (Squamish), M.A.

Lecturers:
Steve A. McLemore (Cherokee-Pima), M.S.
Christine Morris (Blackfoot), M.A.

Native American Studies provides a comprehensive program concerned with all aspects of the Native American past and present from the perspective of the Native American. The program encourages students to develop within that framework the analytical skills necessary to pursue further studies in professional areas of education (Public Health, Law, Education, Social Work, etc.).

The major program provides students with: a general knowledge of Native American cultures—past and present; a general knowledge of the position of other ethnic groups in American society; a general knowledge of how Native American cultures are viewed by other academic departments; a general knowledge of the history and in-
stitutions of American society; and a general knowledge of research and analytical skills in order to conduct specialized research.

A significant aspect of Native American Studies is the opportunity to conduct meaningful fieldwork. Tutoring Indian children in East Oakland and working with Indian inmates in San Quentin and the California Medical Facility at Vacaville, are two examples of fieldwork emphasized within the program.

**THE MAJOR**

The major program in Native American Studies leads to a B.A. degree. Admission to the program requires prior successful completion of Native American Studies 50 and an interview with the Academic Adviser who will help work out an appropriate program of study (all study lists are subject to the approval of the Academic Adviser). The interview should be held no later than the first quarter of the junior year. The student will be required to outline his or her academic and professional goals.

The degree of Bachelor of Arts in Native American Studies will be granted on the following conditions:

1. Completion of 180 units, at least 40 of which must be in upper division courses.
2. Maintenance of at least a C average in all courses undertaken at the University and in all courses in the major program.
3. Completion of general University requirements as to senior residence, Subject A, and American History and Institutions.
4. Completion of 25 core units—at least 20 upper division, which involve the following:
   - A. N.A.S. 50—The Native American in Contemporary Society (5).
   - B. N.A.S. 110—Introduction to Research Problems of Native American Communities (5).
   - C. N.A.S. 130—American Indian Sovereignty (5).
   - D. Research Methods (10). *
5. Completion of an additional 25 units in Native American Studies, at least 20 of which must be in upper division courses.
6. Completion of at least 12 units in courses that have significant Native American content but are offered by divisions or departments other than Native American Studies.

**Honors Program**

Native American Studies provides a program leading to the B.A. degree with honors. A student will be recommended for honors if he or she has completed at least one term of 12 units in which the student has an average of at least B for all work undertaken in Native American Studies and has been approved specially for inclusion in honors by the Committee on Honors either upon recommendation by the Native American Studies faculty or upon such other basis or criterion as the Committee may determine. The student will be required to complete an additional 15 units in Native American Studies—senior honors seminar, research, and thesis. In order to graduate with a B.A. degree with honors, a student must obtain at least a B average.

**Courses and Seminars**

Courses and seminars are listed below. Instructor listings, quarterly offerings, and schedule changes are available in 3415 Dwinelle Hall.

*Letters and Science List:* for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

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* The ten units of research methods may be taken within Native American Studies (N.A.S. 198) or within a division or department that offers units that would be better suited to the goal of the student's program of study.
week. An analysis of political issues and problems of Native Americans on reservations and in urban areas. Major topics to be discussed: the Bureau of Indian Affairs, the United States Public Health Service, the relocation system, the reservation system, discrimination, urban life, Indian organizations, stereotypes, the “New Indian.” Mr. McLemore (F, W, Sp)

60A. Introduction to Sioux Language and Culture. (3)

Three hours lecture per week. Prerequisite: course 50 or consent of instructor. The course will give the student an introductory understanding of the history, traditions, and modern life of the second largest Indian group in the United States. Reservation life as well as Sioux adjustment to the urban (San Francisco Bay) area will be described and related to special problems of Indians.

60B. Intermediate Conversational Sioux. (3)

Three hours lecture per week. Prerequisite: course 60A or consent of instructor. The study of everyday usage of the Sioux language with emphasis on pronunciation.

60C. Advanced Conversational Sioux. (3)

Three hours of lecture per week. Prerequisites: courses 60A and 60B or consent of instructor. An intensive study of formal and informal patterns of Sioux oratory.

75. Native American Medicines. (5)

Three hours lecture and two laboratory hours per week. Prerequisite: course 50 or consent of instructor. An investigation of Native American medicines and an analysis of their utility in the contemporary Native American community. Mr. McLemore (Sp)

85. Native American Education, (5)

Three hours lecture and two discussion hours per week. Prerequisite: course 50 or consent of instructor. A study of the historical development of American Indian education and proposed solutions to selected problems of education in the various types of schools. During the latter part of the quarter, emphasis will be given to the contemporary period.

Upper Division Courses

102. Hidden Cultural Heritage of the Native American. (5)

Three hours of lecture and two discussion hours per week. Prerequisite: course 50 or consent of instructor. An analysis of little known aspects of the Native American heritage from earliest times to the contemporary period, focusing on topical areas such as history, ecology, medicine, statesmanship and government, resistance to conquest, ethnic humor, the arts, and philosophy. A distinctive Native American viewpoint is presented.

110. Introduction to Research Problems of Native American Communities. (5)

Three hours of lecture and two discussion hours per week. Prerequisite: course 50 or consent of instructor. The course is designed to point out the inadequacy of present research methodology in analyzing the contemporary situation of the Native American and his community. Upon focusing on those current problems of research, several alternate methods will be considered specifically designed for the Indian situation.

122. Contemporary American Indian Education. (5)

Three seminar hours and two discussion hours per week. Prerequisites: courses 50, 85 or consent of instructor. Advanced study of contemporary Indian education, focusing on selected topics covered in course 85, but leaving room for attention to other topics of special interest to students in the class. The specific topics will be announced at the beginning of the quarter.
present. The historical review will include a study of the principles of traditional Indian economies, the impact of European conquest, and 20th Century adjustments. Contemporary issues in Indian economies will be stressed. (Sp)

171. North American Indian History. (5)
Three lecture hours and two discussion hours per week. Prerequisite: course 50 or consent of instructor. This course is designed as a survey-lecture course. It will primarily deal with the political, legal, and military relationships between the various American Indian tribes and the United States Government from 1776 to the present. Special emphasis will be placed upon Native American contributions and Native American resistance. (F)

175. California Indian History. (5)
Three lecture hours and two discussion hours per week. Prerequisite: course 50 or consent of instructor. History of the Indians of California with emphasis on the lifeways, mores, warfare, and relations with the United States Government. Attention will be given to the background and evolution of acculturation up to the present day. (Sp)

176. Indian Nations of the Southwest and Contemporary Issues. (5)
Three lecture hours and two discussion hours per week. Prerequisite: course 50 or consent of instructor. An historical analysis of the Indian Nations of the southwestern United States, with special emphasis on the contemporary period, including an analysis of problems arising from government, state institutions, and non-Indian special interest groups. (Sp)

177. Plains Indian History. (5)
Three lecture hours and two discussion hours per week. Prerequisite: course 50 or consent of instruc-
tor. History of the Plains Indians with emphasis on the lifeways, mores, warfare, and relations with the United States Government. Attention will be given to the background and evolution of acculturation up to the present day. Mrs. Morris (F)

179. Southeast Indian History. (5)
Three lecture hours and two discussion hours per week. Prerequisite: course 50 or consent of instructor. History of the Southeast Indians with emphasis on the lifeways, mores, warfare, and relations with the United States Government. Attention will be given to the background and evolution of acculturation up to the present day. Mr. McLenore (W)

197. Fieldwork in the Native American Community. (1-5)
Individual conferences to be arranged. Prerequisites: upper division standing and consent of instructor. Supervised experiences relevant to specific aspects of the Native American community in off-campus settings. Regular individual meetings with Faculty sponsor and written reports required. Mr. Band in charge (F, W, Sp)

198. Supervised Group Study. (1-5)
Individual conferences to be arranged. Prerequisites: upper division standing and consent of instructor. Group discussion, research, and reporting on topics by students. Mr. Band in charge (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Individual conferences to be arranged. Prerequisite: upper division standing and consent of instructor. The individual student, with consent and guidance of an instructor, researches an interest not covered in courses offered by the Division. Must be taken on a passed/not passed basis only. Mr. Band in charge (F, W, Sp)

FOLKLORE
Professors:
William R. Bascom, Ph.D. (Chairman)
Alan Dundes, Ph.D.
Wolf I am Eberhard, Ph.D.

Assistant Professors:
Ruth Boyer, Ph.D.
Michael N. Nagler, Ph.D.

The Folklore Program
This program is designed to provide graduate students with a competent knowledge of both the materials of folklore and of the various methods of studying these materials. The program is an interdisciplinary one in which faculty members from both the humanities and the social sciences participate. The scope of the courses is international and worldwide. However, students may specialize in a particular genre, e.g., folktale; or in a particular area, such as Russian folklore.

The Major There is no undergraduate major in folklore.

Preparation for Graduate Study The best preparation for a graduate program in folklore is a strong undergraduate record in one of the broad fields with which folklore is closely affiliated. Since it is a study of the humanist expression which is handed down by tradition rather than by writing, it is related to all those departments that deal with literature, art, music. Since folklore also deals with the entire traditional culture of man as manifested in his customs and beliefs, it has close affiliations with anthropology, design, history, linguistics, philosophy, psychology and sociology. Consequently, a

NOTE: For key to footnote symbols, see page 86.
good undergraduate record in any of these disciplines is highly desirable though not necessarily required.

The Graduate Major The requirements for the M.A. in folklore include 30 units of which at least 12 must be graduate level (200 number) in folklore, and an M.A. thesis based upon fieldwork or some other research project. (No course credits are allowed for the thesis.) Students must take at least one course in two of the following three areas: folk narrative, folk or ethnic music, folk or primitive art. As an introduction to the discipline, students must take Anthropology 159, The Forms of Folklore, and Anthropology 160, Narrative Folklore, or present evidence of having taken equivalent courses at other institutions. In addition, all students are required to take the interdisciplinary Folklore 250A–250B, Folklore Theory and Techniques. The student must also demonstrate proficiency in reading at least one foreign language. German is perhaps the most useful language for folklore studies, but French, Spanish or some language intimately connected with the M.A. thesis may be approved to satisfy the language requirement. Questions on the requirements for the M.A. in folklore should be addressed to the graduate adviser, Folklore Program, in 201 Kroeger.

250A–250B. Folklore Theory and Techniques. (3–3)
One 2-hour meeting per week. An interdisciplinary consideration of diverse topics related to fieldwork and research in folklore. Mr. Dundes (F, W)

266A–266B. The Folktale and Allied Forms. (3–3)
One 2-hour meeting per week. The study of folk narrative including motif and type classifications, theories of myth and folktale, and methods of analyzing prose narrative. Mr. Dundes (W, Sp)

298. Readings in Folklore. (3–6)
Individual conferences to be arranged. The Staff (Mr. Bascom, Mr. Dundes in charge) (Su, F, W, Sp)

299. Directed Research. (3–6)
Individual conferences to be arranged. The Staff (Mr. Bascom, Mr. Dundes in charge) (Su, F, W, Sp)

Related Courses In Other Departments
The Forms of Folklore (Anthropology 159)
Narrative Folklore (Anthropology 160)
Folklore Seminars (Anthropology 260)
a. problems of folklore
b. psychology and folklore
c. North American Indian folklore
d. additional seminars on special topics to be announced

Mythology (Classics 178)
Children's Literature: Oral Interpretation (Librarianship 228C)
Theory of Dance: Ethnic and Social Dance (Physical Education 160A)
Scandinavian Mythology (Scandinavian 160)
Afro-American Music (Music 128K)
Readings in Old Icelandic Sagas (Scandinavian 206)
The Poems of the Poetic Edda (Scandinavian 208)
Introduction to the Ballad (Spanish 108)
The Ballad (Spanish 208A, 208B, 208C)

FOOD SCIENCE
For courses in Food Science, see Department of Nutritional Sciences.

FOREIGN LITERATURE IN TRANSLATION

Classics
34. Epic Poetry: Homer and Vergil.
35. Greek Tragedy.
100A–100B–100C. Greek and Latin Literature in Translation.
136A–136B. Socrates and the Socratic Tradition.

NOTE: For key to footnote symbols, see page 86.

Comparative Literature
41A–41B–41C–41D–41E. Introduction to Literary Forms.
120. The Biblical Tradition in Western Literature.
*160. Western Literary Crosscurrents in Twentieth-Century China.
Dutch
*160. Literature of the Low Lands in English Translation.

French
150A—150B—150C. French Literature in English Translation.

German
39D. Twentieth-Century German Literature in Translation.

Italian
39A—39B. Classics of Italian Literature.
39C. Contemporary Italian Authors.
130. Dante’s Divine Comedy.
140. Petrarch.
150. Machiavelli.
160. Italian Culture during the Fascist Period.
170. Modern Italian Literature.
180. Pirandello.

Near Eastern Studies
154C. The Bible in Translation.
163A—163B. History of Persian Literature.
168A—168B. Turkish Literature in Translation.
172A—172B. Ancient Mesopotamian Documents and Literature.
182A—182B—182C. Arabic Literature in Translation.

Oriental Languages
*38A—38B—38C. Great Books of Eastern Asia.
140. Civilizations of Eastern Asia: China.
141. Civilizations of Eastern Asia: Japan.
142. Civilizations of Eastern Asia: Korea.
143. Civilizations of Eastern Asia: Mongolia.
155. Traditional Japanese Historical Writing.
*171A—171B. The Development of Buddhism in the Far East.

Scandinavian
107. The Plays of Ibsen.
108. Strindberg.
109. Scandinavian Drama of the Twentieth Century.
120A—120B. The Novel in Scandinavia.
123. The Viking Age.
125. Old Icelandic Literature.
160. Scandinavian Mythology.
165. Scandinavian Folklore.
171. Contemporary Swedish Literature.
175A—175B. Kierkegaard.

Slavic Languages and Literatures
39. Great Writers of Russian Literature.
130. Topics in Twentieth-Century Russian Literature.
133A—133B—133C. The Russian Novel and its Relations to West European Literatures.
134A. Dostoevsky.
134B. Tolstoy.
134C. Chekhov.
134D. Turgenev.
134G. Gogol.
134N. Monographic Studies in Russian Literature.
135. Russian Drama from the Seventeenth Century to the Twentieth.
139. Twentieth-Century Russian Literary Criticism.
150A—150B. Survey of Polish Literature and Intellectual Trends.
155. Polish Romanticism.
156. The Polish Theater.
159. Contemporary Polish Poetry and Fiction.
160A—160B. Survey of Czech and Slovak Literature.
170A—170B. Survey of Serbian and Croatian Literature.

Hungarian
185A—185B—185C. Survey of Hungarian Literature.

South and Southeast Asian Languages and Literatures.
121. Early Indian Literature.
122. Medieval Indian Devotional Literature.
123. The Indian Story.
124. Modern Indian Literature.
125. Tamil Literature in Translation.
140. Hindu Mythology.
FORESTRY AND CONSERVATION

(Department Office, 145 Mulford Hall)

Professors:
David L. Brink, Ph.D.
Robert A. Cockrell, Ph.D.
Robert N. Colwell, Ph.D.
Fred E. Dickinson, Ph.D.
Rudolf F. Grah, Ph.D.
Harold F. Heady, Ph.D.
A. Starker Leopold, Ph.D.
William J. Libby, Ph.D.
Arno P. Schniewind, Ph.D.
Arnold M. Schultz, Ph.D.
Edward G. Stone, Ph.D.
Henry J. Vaux, Ph.D.
John A. Zivnuska, Ph.D. (Chairman)
Harold H. Biiswell, Ph.D., (Emeritus)
Emanuel Fritz, M.F. (Emeritus)
Myron Krueger, M.S., D.Sc. (hon.) (Emeritus)

Associate Professors:
John A. Helms, Ph.D.
William L. M. McKillop, Ph.D.

Dennis E. Teegarden, Ph.D.
Pual J. Zinke, Ph.D.

Assistant Professors:
Donald G. Arganbright, Ph.D.
Don C. Erman, Ph.D.
Joe R. McBride, Ph.D.
Lee C. Wensel, Ph.D.

Assistant Professor:
Robert G. Lee, M.F.S. (Acting)

Lecturers:
Arthur B. Anderson, Ph.D.
Paul Casamajor, M.F.
Bernard M. Collett, M.S.
William G. O’Regan, Ph.D.
Herbert G. Sampert, M.F.
Marshall White, Ph.D.
W. Wayne Wilcox, Ph.D.
Eugene Zavarin, Ph.D.

The requirements for the curricula in the School of Forestry and Conservation are listed on page 74.

Letters and Science Lists: courses 10, 115, 116, 117, 122, 123A–123B–123C, 142, 143, 144, 170, 173, 175, 177, 178, IDS 10A–10B–10C, IDS 186, are included in the Letters and Science List of Courses. For regulations concerning this list see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

10. Conservation of Forest and Wildland Resources. (4)
Three 1-hour lectures per week. Principles of use and management of forests and other wildlands in relation to the needs of society for wood, water, forage, and recreation; forestry and conservation policies and programs. Mr. Zivnuska (F)

IDS 10A–10B–10C. Man and His Environment—Crises and Conflicts. (5–5–5)
See Interdepartmental Studies for the complete description of this course.

NOTE: For key to footnote symbols, see page 86.
102. Forest Photogrammetry and Photo Interpretation. (4)  
Three 1-hour lectures and one 3-hour laboratory per week. Specifications for aerial photography for forestry use; procurement of aerial photography; geometry of aerial photographs; mapping from aerial photographs; fundamentals of photographic interpretation; photo interpretation applied to forestry problems.  
Mr. Colwell (Sp)

103. Forest Harvesting Systems. (3)  
Two 1-hour lectures and one 3-hour laboratory per week. Design and operation of harvesting systems; engineering, cost, aesthetic, and protection aspects of forest roads, structures, and logging facilities.  
Mr. Sampert (W)

105. Control and Management of Fire. (3)  
Two 1½-hour lectures per week. Prerequisite: 8 units of physics. Effects of fire on wildland vegetation, and environment; fundamentals of fire behavior; organization and practices for preventing and suppressing wildfires; objectives of wildland fire control policies; use of fire.  
(F)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: 8 units of principles of economics, 110A. The individual planning unit. Resource valuation: consumer preferences; appraisal; market and non-market values of wildland resources. Resource allocation in the individual planning unit: constraints and parameters; introduction to quantitative planning techniques. 110B. Theory and problems in regional and national contexts. Wildland resources of California and U.S. Goals and goal determination. Models for regional and national analysis. Case studies of regional planning. Planning for environmental quality. 110A—Mr. McKillop (W) 110B—Mr. Vaux (Sp)

113. Forest Regulation and Management. (4)  
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: courses 110A–110B. Objectives of forest ownership; control of investment and growing stock; forest property organization; management planning and control for the production of wood crops and related goods and services.  
Mr. Graham (W)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: courses 110A–110B; Mathematics 16A or equivalent. Quantitative approaches to decision-making in forest resource management, including principles of marginal analysis, benefit-cost analysis, and mathematical programming. Analysis of selected case studies in forest, range, wildlife, and recreation resource management.  
Mr. Teeguarden (Sp)

115. Introduction to Natural Resource Policy. (4)  
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: senior standing. Evolution of forest and related natural resource policies in the U.S.; processes and groups involved in formulating natural resource policies and programs; administration of policies; introduction to current issues in wildland resource conservation.  
Mr. Vaux (Sp)

116. Recreational Use of Forests and Wildlands. (3)  
Two 1-hour lectures and one 1-hour discussion per week. Prerequisite: consent of instructor; background in principles of resource ecology and social science is required. Examination of likely causes of recreational behavior and trends in the use of wildlands for recreational purposes; social processes for allocating scarce recreational resources; policy and management problems arising from recreational use; basic concepts for managing resource oriented recreation.  
Mr. Lee (F)

117. Sociology of Natural Resources. (4)  
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: consent of instructor. Development and conservation of natural resources in relation to social change; biosocial and sociocultural sources of stability and change in the utilization and management of wildland natural resources; social origins and consequences of past and present wildland management issues.  
Mr. Lee (W)

121. Dendrology. (3)  
Two 1-hour lectures and one 3-hour laboratory per week. The study of trees and associated woody species, including their identification, taxonomy, botany, and silvicultural characteristics and a review of the literature of the field.  
Mr. Zinke (F)

122. Forest Influences. (4)  
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: 5 units of biology or soil science. Unit processes of the energy balance hydrologic cycle, and the cycling of chemical elements as influenced by forests and associated vegetation. Principles applicable to watershed management, climatic control, soil fertility maintenance, and environmental impact analyses.  
Mr. Zinke (Sp)

123A–123B–123C. Ecology of Renewable Natural Resources. (5–5–5)  
Four 1-hour lectures per week and 40 hours of laboratory or field trips per quarter. Prerequisite: 6 units of biology. Evaluation of ecological principles common to all aspects of renewable natural resources. The course emphasizes ecosystem productivity and is oriented to man's role as a manipulator of ecosystems. 123A. Vegetation Dynamics. 123B. Biota. 123C. Subsystems and Biomes.  
The Staff (Mr. Stone in charge, 123A) (F) (Mr. Erman in charge, 123B) (W) (Mr. Schultz in charge, 123C) (Sp)

125. Principles of Silviculture. (5)  
Four 1-hour lectures and one 4-hour laboratory per week, with up to three Saturday field trips replacing laboratory sessions. Prerequisite: course 123A or equivalent preparation in community ecology. Principles and concepts of the biological aspects of establishment, growth, composition, and quality of forest stands and trees, the manipulation of forests and the development of stand structure to maximize the usefulness of forests to man.  
Mr. Helms (F)

Graduate Courses

201. Advanced Forest Mensuration. (3)  
Two 1½-hour lecture/discussion meetings per week. Prerequisite: course 101 or equivalent. Advanced topics in forest mensuration and forest inventory.  
Mr. Wensel (W)
202. Advanced Photographic Interpretation. (3)
Two 1-hour lectures and one 2-hour discussion period per week. Prerequisite: a basic course in photo interpretation or photogrammetry. A survey of current research in forest photo interpretation and related fields. An analysis of the practical forestry applications of multiband spectral reconnaissance. Practice in the interpretation of aerial photography and other imagery of forested areas.
Mr. Colwell (Sp)

205. Seminar on Fire as an Ecological Factor. (3)
One 3-hour group conference per week.

209. Seminar in Research Methods. (3)
Two 1½-hour seminars per week. Identification and statement of research problems; formation of hypotheses; analytical methods applicable to forestry problems.
Mr. Wensel (W)

211. Seminar in Analysis of the Forest Economy. (3)
One 3-hour seminar per week. Prerequisite: 12 units of economic theory, resource economics, or forest economics.
Mr. McKillop (F)

212. Seminar in Economics of Forestry Enterprises. (3)
One 3-hour seminar per week. Prerequisite: 12 units of economics, agricultural economics or forest economics.
Mr. Teeguarden (W)

Two 1½-hour meetings per week. Prerequisite: courses 110A–110B, 114 or equivalent. Case studies involving inventory, evaluation, decision making, and planning for wildlife resource management.
Mr. Grah (Sp)

215. Seminar in Natural Resource Policy. (3)
One 2-hour seminar per week. Prerequisite: course 115 or equivalent.
Mr. Zivnuska (Sp)

221. Seminar in Forest Genetics. (3)
Two 1½-hour meetings per week.
Mr. Libby (F)

222. Seminar in Forest Influences and Watershed Management. (3)
One 3-hour seminar per week. Open to qualified graduate students from other departments.
Mr. Zinke (F)

224. Natural Resource Ecosystems. (3)
Three hours of lecture per week. Derivation of ecosystem concept from ecological and philosophical backgrounds; relation of ecosystem study to the natural and social sciences; general systems analysis and synthesis; man's role as dependent factor and independent planning agent; the ecosystem as a conceptual tool in resource management.
Mr. Schultz (Sp)

225. Advanced Silviculture. (3)
Two 1½-hour lectures per week. Prerequisite: course 125.
Mr. Helms (F)

IDS 186. Remote Sensing of Earth Resources. (5)
See Interdepartmental Studies for the complete description of this course.

IDS 210. Assessment of the Environment. (4)
See Interdepartmental Studies for the complete description of this course.

Wood Science

Upper Division Courses

131. Anatomy and Physical Characteristics of Wood. (4)
Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: upper division students in other departments may be admitted with consent of instructor. Gross and minute characteristics of wood in relation to identification and properties; identification of certain important commercial woods; relation of principal physical and mechanical properties to conditions of timber growth.
Mr. Cockrell (F)

132. Mechanical Processing of Wood. (4)
Three 1-hour lectures and one 1-hour discussion per week. Upper division and graduate students from other departments may be admitted with the consent of instructor. Production methods, raw material requirements, material flow, and product specifications of solid and laminated products produced from wood; integration of wood processing plants.
Mr. Dickinson (W)

133. Physical Properties of Wood. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 131 and 18 units of general physics. Density, physical stability, and durability of wood as influenced by such factors as wood characteristics and moisture content; thermal, electrical and acoustical properties of wood.
Mr. Arganbright (F)

134. Mechanics of Wood. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 131, Civil Engineering 130 or equivalent; upper division or graduate students from other departments may be admitted with consent of instructor. Elasticity, strength, and rheology of wood; factors affecting mechanical behavior; derivation of working stresses.
Mr. Schniewind (W)

135. Chemistry and Chemical Processing of Wood. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 131 and 7 units of organic chemistry; upper division students from other departments accepted with consent of instructor. Chemical constituents of wood; chemistry and technology of pulp, paper, fiberboard, and silvichemicals; chemical treatments of wood.
Mr. Brink (Sp)

Graduate Courses

231. Advanced Wood Anatomy. (3)
Two 1½-hour lectures per week. Prerequisite: course 131 or equivalent and consent of instructor. Open to qualified graduate students from other departments. Gross and minute anatomy of wood; ultrastructure of wood cell walls; reaction wood; anatomy of phloem; review of current literature.
Mr. Cockrell (F)

232. Advanced Wood Physics. (4)
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: course 133 or equivalent. Adsorption of water, nonaqueous vapors, and gases by wood. Shrinking and swelling in water, aqueous solutions, and nonaqueous liquids. Fluid flow including permeability and diffusion. Thermal properties with modes of heat transfer important in wood processing and usage.
Mr. Arganbright (W)
233. Advanced Wood Mechanics. (3)
Two 1½-hour lectures per week. Prerequisite: course 134 or equivalent. Deformation and fracture of wood, mechanics of the cell wall, current topics from the literature. Mr. Schniewind (Sp)

235. Chemistry of Polysaccharides, Lignin, and Extractives. (4)
Four 1-hour lectures per week. Prerequisite: course 135 (may be taken concurrently) or equivalent; qualified undergraduate students may elect this course. Aspects of nomenclature, structures, biosynthesis, reactions, and distribution of terpenoids, fats, flavonoids, tannins, lignans, lignins, monosaccharides and polysaccharides and related materials occurring in plant material with emphasis on woody plant structures. Mr. Brink, Mr. Zavarin (Sp)

238. Special Topics in Wood Science and Technology. (1-4)
Hours to be arranged. Prerequisite: open to properly qualified graduate students. Advanced study in wood science and technology, primarily for advanced graduate students. Course, including each of its subdivisions, may be repeated.
The Staff (Mr. Cockrell in charge, 238A) (F, W, Sp)
(Mr. Zavarin in charge, 238B) (F, W, Sp)
(Mr. Brink in charge, 238C) (F, W, Sp)
(Mr. Schniewind in charge, 238D) (F, W, Sp)
(Mr. Arganbright in charge, 238E) (F, W, Sp)
(Mr. Dickinson in charge, 238F) (F, W, Sp)
(Mr. Wilcox in charge, 238G) (F, W, Sp)
(Mr. Collet in charge, 238H) (F, W, Sp)

239. Seminar in Wood Science and Technology. (1)
One 1-hour lecture per week. Prerequisite: open to qualified graduate students from other departments. Current student research and reports in Wood Science and Technology. Course may be repeated. Pass/ not pass basis.
Mr. Dickinson (W, Sp)

IDS 136. Biological Deterioration of Wood. (3)
See Interdepartmental Studies for the complete description of this course.

Range Science

Upper Division Courses

141. Principles of Range Management. (4)
Three 1-hour lectures and one discussion hour per week. Management and improvement of range lands; interrelationships of livestock grazing, wildlife, timber, water, and soil. (W)

142. Range Plants. (4)
Two 1-hour lectures per week and one 3-hour laboratory per week. Systematic relationships and identification of range grasses, forbs, and shrubs; their distribution, growth, forage, values, and response to use. (Sp)

143. Range Animal Nutrition and Management. (3)
Two 1½-hour lectures per week. Principles and practices with particular reference to ruminants on wildland ranges. Mr. Heady (W)

144. Range Ecology. (4)
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: a course in plant community ecology. Composition, structure, vegetational changes, and grazing problems in representative range plant communities. Mr. Heady (Sp)

145. Range Analysis and Planning. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: consent of instructor. Range land planning based on vegetational sampling, forage production, grazing use, grazing capacity, and range condition. Mr. Heady (W)

Graduate Course

244. Seminar in Range Ecology. (3)
One 3-hour meeting per week. Mr. Heady (Sp)

Wildlife Science

Upper Division Courses

170. Wildlife Biology and Management. (3)
(Formerly numbered IDS 170)
Three hours of lecture per week. Prerequisite: upper division standing. Ecologic mechanisms that regulate populations of wild animals. Survey of most important orders and families of wildlife in North America—status and problems of conservation. Review of wildlife conservation on other continents. Mr. Leopold (W)

173. Field Course in Wildlife and Fisheries. (8)
Full-time field study for first five weeks of summer quarter, including lectures, laboratory and field exercises. Prerequisite: consent of instructor. Emphasis on research methods and field surveys. Offered at Sagehen Creek Field Station near Truckee, California. Limited to ten students. Mr. White, Mr. Erman

175. Wildlife Populations. (4)
Two 2-hour lecture and discussion periods per week. Prerequisite: course 170 or equivalent. Dynamics of wildlife populations. Mechanisms regulating natality, mortality, population density, and productivity. Mr. White

177. Case Histories in Wildlife Management. (4)
Two 2-hour lecture and discussion periods per week. Prerequisite: course 175 or equivalent. Analysis of political, social, and economic factors that influence the decision-making process in governmental programs of wildlife conservation and management. Mr. Leopold (Sp)

178. Freshwater Ecology. (4)
Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: 8 units of biology. Analysis of the role of physical-chemical factors important to life in lakes and streams, interactions between aquatic organisms and their environment, and some aspects of production and harvest from aquatic ecosystems. Mr. Erman (Sp)

Graduate Courses

270. Seminar in Wildlife Biology and Management. (3)
One 3-hour meeting per week. Prerequisite: courses 170 and 175 or equivalent. Reading, conference, and discussion. Reports and discussion of recent studies in wildlife biology and management. Open to qualified graduate students from other departments. Mr. White, Mr. Leopold (W)
278. Seminar in Freshwater Ecology. (3)
One 3-hour meeting per week. Prerequisite: knowledge of biology, taxonomy, and ecology. Discussions and student presentations on topics or problems related to fisheries, aquatic ecology, and water pollution.
Mr. Erman (F)

Special Studies

Upper Division Courses

198. Directed Group Study. (1-8)
Prerequisite: consent of instructor. Group study or investigation of special problems.
The Staff (Mr. Zivnuska in charge) (F, W, Sp)

199. Supervised Independent Study and Research for Undergraduates. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.
The Staff (Mr. Zivnuska in charge) (F, W, Sp)

296. Individual Study. (1-7)
Prerequisite: consent of instructor and graduate adviser. Individual study in consultation with a member of the faculty directed to analysis and synthesis of the literature of a specialized subject area in forestry and conservation.
The Staff (Mr. Zivnuska in charge) (F, W, Sp)

298. Directed Group Study. (1-5)
Section 1—pass/not pass basis; Section 2—letter grades.
Reading and conferences, under direction of a member of the staff, for properly qualified graduate students.
The Staff (Mr. Zivnuska in charge) (F, W, Sp)

299. Individual Research. (1-12)
The Staff (Mr. Zivnuska in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Zivnuska in charge) (F, W, Sp)

FRENCH

(Department Office, 4125 Dwinelle Hall)

Professors:
Alexandre E. Calame,† Docteur ès Lettres
Phillip Damon, Ph.D. (Interim Chairman)
Alvin A. Eustis, Jr., Ph.D.
Basil Guy, Ph.D.
Irving Putter, Ph.D.
Walter E. Rex, Ph.D.
Clifford H. Bissell, Ph.D. (Emeritus)
Clarence D. Brenner, Ph.D. (Emeritus)
Francis J. Carmody, Ph.D. (Emeritus)
Jacqueline de La Harpe, Docteur ès Lettres (Emerita)
Marie-Louise Dufrenoy, Ph.D. (Emerita)
Edward F. Meylan, Ph.D. (Emeritus)
Manfred M. G. Sandmann, Litt.D. (Emeritus)
Ronald N. Walpole, Ph.D. (Emeritus)

Associate Professors:
Paul M. Bertrand Augst, Ph.D.
Joseph J. Duggan, Ph.D.

Leonard W. Johnson, Ph.D.

Assistant Professors:
R. Howard Bloch, Ph.D.
Marie-Hélène Huet, Ph.D.
Anne A. Smock, Ph.D.

Assistant Professor:
Phyllis Zuckerman, M.A. (Acting)

Lecturers:
Esther Alder, Ph.D.
John D. Bednar, Doctorat d'Université
Françoise M. Hourcade, Diplôme d'études Supérieures
Gérard Jian, M.A.
Anne-Marie Lasocki, Ph.D., Licenciée en droit
George Longree, Ph.D.
Françoise Sorgen, Diplôme d'études Supérieures

The Major Courses 1, 2, 3, 4, 5, 6, and 35 or their equivalents; 44 upper division units in French (of which 18 units have to be taken in residence) including:

(a) courses 103, and either 103B or 103C;
(b) four literature courses in the series 112 through 120 distributed over three periods or centuries and at least one additional literature course.

NOTE: For key to footnote symbols, see page 86.
Honors Program  Honor students may enroll in the honors program. Students in the honors program must complete two quarters of H198 with a grade of B or better and pass the comprehensive examination in order to receive honors in French.

Minor for the Teaching Credential  Thirty units of lower division courses in French (or the equivalent) and French 35, 103A, 103B, or 103C, and 130 or 134A or 134B.

Certificate of Completion in French  Requires the equivalent of the major and courses 130, 134A–134B.

GRADUATE STUDY

The M.A. Program  A minimum of 36 units in French is required, including at least 18 units of graduate courses. With permission of the graduate adviser a maximum of 6 units of upper division or graduate work in other departments may be substituted for work in French, but the minimum of 18 units of graduate French courses remains the same. The aim of the program is to provide a comprehensive historical knowledge of French literature; to that end, candidates will be asked to familiarize themselves with the works on a departmental reading list (copies available from the graduate secretary). Command of the list will be tested partly by examination, partly by course work, and partly by the writing of a long paper. For further information, consult the graduate secretary and graduate advisers.

The Ph.D. Program  Language requirements: a reading knowledge of Latin and two other languages is required. The program asks each student to choose three defined areas of study within French literature in the period of his doctoral dissertation, with the additional choice of an adjunct field germane to these studies: (1) the work of a single major author; (2) a historical period in French literature; (3) the development of a form or genre. The candidate will take such courses as he and his adviser consider necessary. For further information, consult the graduate adviser and the department guide to higher degrees.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

1. Elementary French. Beginner’s Course. (5)
   Five 1-hour classes and at least one laboratory session per week.
   Mr. Jian (F, W, Sp)

2. Elementary French (Continuation of 1). (5)
   Five 1-hour classes and at least one laboratory session per week. Prerequisite: course 1 or equivalent.
   (F, W, Sp)

3. Elementary French. (5)
   Five 1-hour classes per week and one laboratory session per week. Prerequisite: course 2 or equivalent.
   (F, W, Sp)

4. Intermediate French (Continuation of 3). (5)
   Five 1-hour classes per week. Prerequisite: course 3 or equivalent.
   (F, W, Sp)

5. Intermediate French. (5)
   Five 1-hour classes per week. Prerequisite: course 4 or equivalent. Composition, reading, and grammar review.
   (F, W, Sp)

6. Intermediate French. (5)
   Five 1-hour classes per week. Prerequisite: course 5 or equivalent. Composition, reading, and grammar review.
   (F, W, Sp)

12A. Accelerated Beginning French. (10)
   Five 2-hour classes and four laboratory sessions per week. An intensive course in beginning French, equivalent to French 1 and French 2.
   (F, W, Sp)

12B. Accelerated Intermediate French. (10)
   Five 2-hour classes and four laboratory sessions per week. An intensive course in intermediate French, equivalent to French 3 and French 4.
   (F, W, Sp)

12C. Accelerated Advanced French. (8)
   Five 2-hour classes per week. Prerequisite: course 4 with a grade of A or B. Composition and conversation; an intensive course for prospective majors. Equivalent to French 5 and French 6.
   (Sp)

13. Intermediate Conversation. (2)
   Two 1-hour classes and one 1-hour laboratory period per week. Prerequisite: course 3 or equivalent. Recommended for prospective majors.
   (F, W, Sp)

14. Advanced Conversation. (2)
   Two 1-hour classes and one 1-hour laboratory period per week. Prerequisite: completion of course 4 or course 13. Recommended for prospective majors.
   (F, W, Sp)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C.
Mr. Eustis (F, W)

118A–118B–118C. The Enlightenment. (4–4–4)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C.
Mr. Guy (F, W, Sp)

119A–119B–119C. The Nineteenth Century. (4–4–4)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C.
Mr. Putter (F, W, Sp)

120A–120B–120C. The Twentieth Century. (4–4–4)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C. (F, W, Sp)

121A–121B–121C. Literary Themes and Genres. (4–4–4)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C. Specific topics will vary from year to year.

122. Contemporary Critical Approaches to Literature. (4)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C. Specific topics will vary from year to year.

123. Introduction to French Linguistics. (4)
Three 1-hour classes per week. Sounds, spelling, works, and constructions. Mr. Bednar (F)

130. Advanced Composition. (4)
Three 1-hour classes per week. Prerequisites: courses 103A and either 103B or 103C. Required for certificate of Completion and Minor in French. Prose style. Emphasis on developing good prose style and an extended vocabulary. (F, W, Sp)

131A–131B. Comparative Stylistics and the Techniques of Translation from English to French. (4–4)
Three 1-hour classes per week. Prerequisite: courses 103A and either 103B or 103C.
Miss Hoet (F, W)

134A–134B. French Civilization. (4–4)
Three 1-hour classes per week. Prerequisite: course 103A. Required for Certificate of Completion and Minor in French.

140. Senior Seminar. (4)
Two 1-hour classes per week. Prerequisites: senior standing and courses 103A and either 103B or 103C, and 104A–104B. Devoted to the intensive study of major authors, movements and genres.
The Staff (F, W, Sp)

141A–141B–141C. Readings in French Literature. (4–4–4)
Three 1-hour classes per week. Readings in French, class discussion and exercises in English. Topics offered will vary from year to year.
Mr. Johnson (W)

198. Directed Group Study for Advanced Undergraduates. (1–4)
One to three hours per week. Group studies of a selected topic or topics. The Staff (F, W, Sp)
H198A–H198B. Honors Course. (2–2)
Prerequisites: a minimum overall GPA of 3.0 and a minimum GPA in French of 3.0. Open to senior students in the honors program. Students will write an essay on a topic relating to French literature under the supervision of a member of the faculty, during two consecutive quarters of their senior year. Credit and grade will be awarded upon completion of the sequence. The Staff (F, W, Sp)

199. Supervised Independent Study and Research for Advanced Undergraduates. (2–5)
Enrollment is restricted by regulations listed on page 87. Additional restriction: restricted to seniors with an overall 3.0 average and at least a 3.0 average in French. Individual instruction only in areas not covered by regularly scheduled courses. A grade of passed/not passed will be assigned. The Staff (F, W, Sp)

Upper Division Courses in English Translation

150A–150B–150C. French Literature in English Translation. (4–4–4)

Two 1 1/2-hour classes per week. Topics offered will vary from year to year. Mr. Putter (F, Sp)

Graduate Courses

201A–201B–201C. Historical Grammar. (4–4–4)
One 2-hour class and one 1-hour class per week. (Sp)

202A–202B. Studies in Medieval Literature. (4–4)
One 2-hour class per week. (F, W)

202C. Studies in Medieval Literature. (4)
Three hours of class meeting per week. Mr. Duggan (Sp)

203A–203B. French Syntax. (4–4)
One 2-hour class per week. Mr. Sandmann (F, W)

204A–204B. Studies in the Eighteenth Century. (4–4)
One 2-hour class per week. Miss Huet (F, W)

206A–206B. Reading and Interpretation of Typical Old French Texts. (4–4)
One 2-hour class per week. Mr. Bloch (W, Sp)

One 2-hour class per week. Mr. Guy (F, W)

208A–208B. Nineteenth-Century Poetry to the Symbolists. (4–4)
One 2-hour class per week. Mr. Putter (W)

209A–209B–209C. Modern Authors. (4–4–4)
One 2-hour class per week. (F, W, Sp)

210A–210B. Studies in the Eighteenth-Century Drama. (4–4)
One 2-hour class per week. (W, Sp)

212A–212B. Old Provencal Literature. (4–4)
Three hours of lecture per week. Reading and analysis of twelfth and thirteenth century texts written in the langue d’oc with special emphasis on troubadour lyric poetry. Mr. Duggan (W, Sp)

214A–214B. Seminar on Modern Drama. (4–4)
One 2-hour class per week. Prerequisite: consent of instructor.

215A–215B. Literary Symbolism and Its Twentieth-Century Developments. (4–4)
One 2-hour class per week. (F, Sp)

216A–216B. Poetry of the Renaissance. (4–4)
One 2-hour class per week. Mr. Johnson (Sp)

217A–217B. Humanism in the Renaissance. (4–4)
One 2-hour class per week.

218A–218B. Classicism. (4–4)
One 2-hour class per week. Mr. Calame (W, Sp)

219A–219B. Studies in Nineteenth-Century Prose. (4–4)
One 2-hour class per week. Mr. Terdiman (F, W)

220A–220B. Explication de Textes. (4–4)
Mr. Calame (F)

230A–230B. Literary Criticism. (4–4)
One 2-hour class per week.

230A. From the origins to the end of the eighteenth century.
230B. From 1800 to the present.

(4)

235. Methods of Literary Research. (4)
One 3-hour class per week. Methods and techniques of literary scholarship; theoretical aspects of, and practical work in, the following traditional fields: bibliography, literary history, periods and movements, sources and influences, critical editions, explication de textes, stylistics, preparation of theses, articles, etc. Recommended for all graduate students.

Mr. Eustis (F)

241A–241B. Studies in Surrealism. (4–4)
One 2-hour class per week. (W, Sp)

298A–298B. Special Study. (1–5; 1–5)

Designed for students engaged in exploration of a restricted field, involving the writing of a report. May not be substituted for available seminars or graduate courses. A–B sequence may be used by students who will need more than one quarter in order to satisfy the “fifth period” requirement in the M.A. program. Credit and grade will be awarded upon completion of the full sequence. The Staff (F, W, Sp)

299. Individual Research. (5–9)

Individual appointments. Normally reserved for students directly engaged upon the doctoral dissertation. The Staff (Graduate Advisers in charge) (F, W, Sp)

601. Special Study for Graduate Students. (1–8)

Individual study for the comprehensive in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Graduate Advisers in charge) (F, W, Sp)
GENETICS

(Department Office, 345 Mulford Hall)

Professors:
Spencer W. Brown, Ph.D.
Seymour Fogel, Ph.D. (Chairman)
I. Michael Lerner, Ph.D., D.Sc. (hon.c.)
William J. Libby, Jr., Ph.D.
Donald R. Cameron, Ph.D. (Emeritus)
Everett R. Dempster, Ph.D. (Emeritus)
Curt Stern, Ph.D., D.Sc. (Emeritus)

Associate Professors:
James W. Fristrom, Ph.D.
Patricia St. Lawrence, Ph.D.

Assistant Professors:
Roberta N. Palmour, Ph.D.
Philip T. Spieth, Ph.D.

Undergraduate Major Adviser: Mr. Spieth.
Graduate Advisers: Mr. Brown, Mr. Fristrom, Mr. Libby.

The student may obtain a Bachelor of Science degree in genetics in the College of Agricultural Sciences, or a Bachelor of Arts degree in the genetics group major in the College of Letters and Science.

Undergraduate Major Requirements

The B.S. degree requirements in the genetics major, offered under the Agricultural Science Curriculum (see page 67), are:

Humanities and Social Science, 36 units as follows: English, rhetoric, or comparative literature (8); foreign language through course 3; additional courses, which may include not more than 8 units of foreign language (28).

Physical Sciences and Mathematics, 42 units as follows: chemistry (20); mathematics (6); statistics (4); physics (12).

No units are indicated for this requirement since it may be met wholly or in part by work taken in high school. If satisfied at the collegiate level, units may be used where applicable.

NOTE: For key to footnote symbols, see page 86.
Biological and Agricultural Sciences, 37 units as follows: biology (12); biochemistry (4); microbiology (4); additional biological sciences (17).

Major Field, 22 units as follows: cytology (4); genetics (18).

Additional courses, (43) units.

Total units, 180.

Certain courses may be required in satisfaction of the above. The undergraduate adviser will provide this information and any other details about the major.

The A.B. degree in genetics may be obtained by fulfilling the breadth requirements of the College of Letters and Science and completing for the group major in genetics the courses listed below (some of which satisfy in part the breadth requirements):

**Lower Division Courses**  
*Required:* Biology 1A, 1B, Chemistry 1A, 1B, 1C; Chemistry 8A–8B (or 12A–12B–112); Physics 6A–6B; Mathematics 16A–16B. *Recommended:* Chemistry 5, 14; Physics 6C.

**Upper Division Courses**  
*Required:* Bacteriology 100A; Biochemistry 102 (or 100A–100B–100C); Botany 130A–130B (or Zoology 110A–110B); Genetics 100 (or 150A–150B); Genetics 101, 101L; at least 13 units from the following, including one undergraduate course from the Department of Genetics: Genetics 130, 131, 140, 159, 191, 196; any graduate course in genetics; Biology 150, 153; Entomology 105; Molecular Biology 110A, 110B, 120; Nutrition 160; Public Health 160A–160B–160C; any upper division course in the Department of Statistics; Zoology 104, 140.

**Honors Program**

An honors course sequence extending over three quarters will be required in addition to the major requirements. Genetics 101 may be waived for Honors students. The minimum Honors course sequence will be one quarter of Genetics H180, followed by two quarters of Genetics H195, for a combined total of six units. These courses may be repeated for credit to a combined maximum of 12 units with the consent of the Honors Adviser. Upon completion of the Honors course sequence, the student will prepare an Honors Thesis on the subject matter covered in H195. The thesis will be reviewed by a committee consisting of three faculty members. A student may elect to enter the Honors Program, but subsequently leave the Program prior to completion. *Pass/Not Pass* or letter grades will be assigned for work completed. Graduation “With Honors” will not be conferred without the satisfactory completion of the Honors Thesis.

**Graduate Programs**

Students frequently elect genetics as their major subject only at the graduate level, and may enter the field from a diverse range of undergraduate majors, including certain physical sciences or mathematics as well as the biological sciences. The program of courses in genetics and other course work necessary in the student’s specialty may be completed after admission to graduate standing. Students interested in graduate work in genetics are strongly advised, however, to gain a background in mathematics and biochemistry and in one foreign language. For both the master’s and the doctor’s degrees, a thorough background in the basic aspects of genetics is essential. This can usually be achieved through completion of a course in general genetics, plus three or more courses in biochemical genetics, biometrical or population genetics, cytogenetics, developmental genetics, evolution, and human genetics. Because of the highly diverse nature of the field, each student’s individual program must be carefully arranged on consultation with his guiding committee and the graduate adviser.

For further details, consult the graduate adviser.
Lectures, 3 hours per week; two 1-hour section meetings per week. Primarily for students not specializing in biology. Inheritance, variation and evolution in plants, animals, and man. Social implications of genetics and evolution. Mr. Libby (W)

Upper Division Courses

100. General Genetics (5)
Lectures, four hours per week; section, one hour per week. Prerequisite: Biology IA-1B. The fundamentals of genetics at the molecular, organismal, and population levels. May be suitable as a terminal course for nonmajors.
Mr. Spieth (F), Mr. Fristrom (Sp)

100L. Genetics Laboratory (4)
Two hours of guided discussions and six hours of laboratory per week. Prerequisite: course 100, or 150A-150B (may be taken concurrently). Principles of genetics utilizing chiefly microorganisms and Drosophila with emphasis on both the molecular and organismal aspects of the subject.
Miss St. Lawrence (Sp)

101. Advanced General Genetics (3)
Lecture, 1 hour per week; section, 2 hours per week. Prerequisite: course 100 or 150A-150B. This course covers in greater depth some of the subject matter previously presented in 100, for students requiring additional training in the fundamentals of genetics.
Mr. Fogel (Sp)

130. Population Genetics (4)
Lectures, four hours per week. Prerequisite: course 100 or 150A-150B; elementary probability or consent of instructor. A theoretical foundation in population genetics. Emphasis on the use of one and two locus models for developing the mathematical theory of the behavior of gene frequencies and genetic variation under micro-evolutionary processes.
Mr. Spieth (W)

131. Organic Evolution (5)
Lectures, four hours per week; discussion, one hour per week. Prerequisite: course 100 or 150A-150B. Given in alternate years. A general introduction to the multidisciplinary contributions to the field with emphasis on underlying genetic and ecological processes.
Mr. Brown (F)

140. Cytogenetics (5)
Lectures, four hours per week; demonstration, one hour per week. Prerequisite: course 100 or 150A-150B; and general cytology. Given in alternate years.
Mr. Brown (W)

150A-150B. Human Genetics (3-3)
Three hours of lecture per week. Prerequisite: one course in a biological science. Principles of inheritance as applied to the physical and mental characteristics of man, to the heredity-environment problem, and to the genetic constitutions of population.
Mrs. Pamlour (W, Sp)

159. Advanced Human Genetics (4)
Three hours of lecture and one hour of discussion per week. Prerequisite: consent of instructor; knowledge of basic genetic principles required. A detailed study of the genetics process in man. Emphasis on chromosomal structure and function, human biochemical genetics and gene regulation, the mutation process, and human behavioral studies. Includes functions, as well as clinical dysfunctions.
Mrs. Pamlour (W)

H180. Departmental Seminar and Discussion for Honor Students (2)
Discussion, one hour per week; seminar, one hour per week. Prerequisite: course 100 or its equivalent with a grade of B or higher. An overall grade-point average of B or higher, or the consent of the Honors Adviser. Oral presentation required of students in the discussion groups. Pass/Not Pass grading; may be repeated for credit to a maximum of six units. Discussion will involve subjects from the departmental seminars, augmented by outside reading suggested by discussion leader (faculty member).
Mr. Brown in charge (F, W, Sp)

191. Experimental Courses in Genetics (2-5)
Prerequisite: consent of the instructor. Recent developments in genetics of special interest to staff and students. Intended for majors in genetics. May be repeated for credit. To be taken on a passed/not passed basis.
The Staff (F, W, Sp)

H195. Research for Honors Thesis (2-5)
Prerequisite: one quarter of course H180. Individual research of literature, or laboratory work, as arranged with Honors Adviser and individual faculty. Must be taken for at least two consecutive quarters, for a maximum of ten units.
Mr. Lerner in charge (F, W, Sp)

196. Lectures in Advanced Genetics (4)
Lectures, 4 hours per week. Prerequisite: consent of instructor. May be repeated for credit. Selected topics in advanced genetics.
The Staff (W, Sp)

198. Directed Group Study (1-5)
Prerequisite: consent of instructor. The Staff (Mr. Spieth in charge) (F, W, Sp)

199. Supervised Independent Study and Research (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.
The Staff (Mr. Spieth in charge) (F, W, Sp)

Graduate Courses

210. Developmental Genetics (2)
Lectures, 2 hours per week. Prerequisite: consent of instructor. Gene action and development.
Mr. Fristrom (Sp)

*230. Advanced Population Genetics (3)
Lectures, 2 hours per week; laboratory; 3 hours per week. Prerequisite: course 130. Quantitative genetic analysis and experimental design.

290A–290B–290C–290D–290E. Graduate Seminar in Genetics (1-4)
(Formerly numbered 280)
One and one-half hours of lecture per week. 290A: Molecular or cellular genetics; 290B: Developmental genetics; 290C: Cytogenetics; 290D: Population or evolution genetics; 290E: Human genetics.
The Staff (F, W, Sp)

291. Experimental Courses in Genetics (2-5)
Prerequisite: consent of the instructor. Recent developments in genetics of special interest to the staff and students. May be repeated for credit. To be taken on a passed/not passed basis.
The Staff (F, W, Sp)
298. Directed Group Study. (1–6)
  Prerequisite: consent of instructor.
  The Staff (Mr. Libby in charge) (F, W, Sp)

299. Research in Genetics. (1–12)
  The Staff (Mr. Libby in charge) (F, W, Sp)

601. Individual Study for Master’s Students. (1–8)
  Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis.
  The Staff (Mr. Libby in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
  Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or resident requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
  The Staff (Mr. Libby in charge) (F, W, Sp)

IDS 104–108–10C. Man and His Environment—Crisis and Conflicts. (5–5–5)
  See Interdepartmental Studies for complete description of this course.

Staff Seminar in Genetics. (No credit)
  The Staff (F, W, Sp)

Other courses in genetics or in closely related subjects are given in the departments of Anthropology, Bacteriology, Biochemistry, Botany, Medical Physics, Molecular Biology, Psychology, Public Health, and Zoology.

GEOGRAPHY

(Department Office, 501 Earth Sciences Building)

Professors:
Clarence J. Glacken, Ph.D.
David J. M. Hooson, Ph.D. (Chairman)
James J. Parsons, Ph.D.
Allan Fred, Ph.D.
Hilgard O’R. Sternberg, Ph.D.
James E. Vance, Jr., Ph.D.
John E. Kesseli, Ph.D. (Emeritus)
John Leighly, Ph.D., LL.D., Sc.D. (Emeritus)
Carl O. Sauer, Ph.D., D.Phil. (hon.c.), LL.D. (Emeritus)

Associate Professors:
Mario B. Giovinetto, Ph.D.
Theodore M. Oberlander, Ph.D.

Assistant Professors:
Risa I. K. Palm, Ph.D.
Robert R. Reed, Ph.D.

Lecturers:
Daniel B. Luten, Ph.D.
J. Ralph Audy, M.D. (Visiting)

Departmental Undergraduate Advisers: Mr. Oberlander, Mr. Reed.
Departmental Graduate Advisers: Mr. Sternberg, Mr. Parsons, Mr. Glacken.

Advice concerning requirements for undergraduate and graduate students is administered by the departmental advisers; guidance in the student’s special field of interest is administered by the appropriate member of the staff. New students entering the Department at any level must consult with the departmental advisers until a specialty adviser has been selected or assigned to them.

The Department of Geography aims to provide students with an understanding of what is involved in the study of the earth as the home of Man, in itself (climate, land forms, vegetation) and as related to human occupancy (rural landscapes, the physical structure of cities, spatial organization and distribution, and environmental quality). The geographer must also take account of historical and cultural processes, including Man’s diverse attitudes toward the earth and how they have changed through time. He must take account of economic and social processes which influence such geographical conditions as industrial location, innovation diffusion, urbanization, urban morphology, settlement pattern, and the use of resources. And because of his concern for the surface of the earth and the balance of nature conditioning the human use of it, many must be able to employ the data of natural science. Those working in human geography will on the other hand be most concerned with the data of social science and the intelligence of history.

NOTE: For key to footnote symbols, see page 86.
The undergraduate major in geography therefore includes the study of cultural, economic, physical, and regional geography as well as map laboratory, quantitative methods, and field work. Backgrounds in the natural and social sciences, history, and statistical methods are useful to the geography major.

Courses 150–171 are organized around the content and character of important regions of the earth; they are designed to provide the framework for integrated interpretation of the many-sided character and problems of major regions of the world, and thus to accommodate the needs of students in other fields, as well as in geography, who are interested in specific areas. Most other upper division courses are also open to nonmajors.

The Major

**Lower Division**  Geography 1, 4, and 7. (Transfer students who have had introductory courses elsewhere should consult with the Departmental Undergraduate Adviser in order to avoid repeating lower division work.)

**Upper Division**  A minimum of 40 units. The student must select one of four options. The order in which the courses are listed in each option does not imply a sequence:

- **Option I** (Cultural-Resources) — Geog 100, 101, 130A, 135 or 136 or 137, 141 or 183
- **Option II** (Urban-Economic) — Geog 110, or 111, 120, or 121, 125
- **Option III** (Physical) — Geog 140, 141, 144, 145
- **Option IV** (General) — Geog 100 or 101, 110 or 111, 120 or 121, 130A, 140 or 144

All geography majors must take Geog 180 or 181, 183 or 187, 189, and two regional courses numbered 150–171. Seniors with a grade-point average of at least 3.0 in the major may take graduate courses. Courses numbered 190–199 do not count toward completion of the major.

**Honors Program**  An overall grade-point average of at least 3.0 is required for admission to the honors program. Application for acceptance in the program should be made during the student's junior year. A senior in the honors program must complete Geog H 195, in which a thesis is required, and may take graduate seminars.

**Graduate Study**  Geography deals with a broad spectrum of questions relating to society, environment, and spatial order. A variety of previous backgrounds may prove sound as a foundation for advanced work in the field. Students entering the graduate program from fields other than geography should expect to take at least one upper division course in each of three areas—cultural, economic, and physical geography—during their first year of residence. Although the department offers graduate training in physical, cultural, economic, urban, and regional geography, it places strong emphasis on the interrelationships among these specialties and related approaches in other disciplines.

The M.A. program involves completion of not less than one year of residence, at least three graduate seminars or courses (not individual research), and an original thesis or a comprehensive exam. The Ph.D. candidate must complete a minimum of two years of residence (normally at least three for those entering from other disciplines) and pass a preliminary written examination in the systematic or regional area of his specialization as well as the oral qualifying examination. In the preparation of many
theses he must also be prepared to spend a year in field or archival research following the oral examination. Further details, including foreign language requirements, are available from the departmental office.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

1. Introduction to Physical Geography. (5)
   Three 1-hour lectures and two 2-hour laboratory periods per week. Origin of the Earth's major geological and climatic patterns and their influence upon the characteristics of landforms, vegetation, and soils. Problems relating to the interrelationships between physical factors in the principal natural regions of the Earth. Mr. Powell (F, Sp)

4. Introduction to Cultural and Historical Geography. (5)
   Three hours of lecture and one 2-hour section per week. The relationship between man and environment through time. Historical background and distribution of population, settlement, and resource utilization; processes which have transformed natural landscapes into cultural landscapes. Mr. Glacken (F, Sp)

7. Spatial Organization of Human Activity. (5)
   Three hours lecture and two 1-hour discussion sections per week. Processes relating to the localization of human activity. Interplay of location and social and economic problems. Mr. Reed (W)

14. The Atmosphere and Oceans. (4)
   Three hours lecture per week. Structure, behavior, and evolution of the atmosphere and oceans. Atmospheric-ocean interactions as controls of climate. Survey of climatic change. Mr. Giovinetti (F)

100. Principles of Cultural Geography: Culture and Rural Environments. (4)
   (Formerly numbered 100A)
   Three hours lecture per week. Short history of cultural geography; major themes concerning the relation of culture to environment; cultural attitudes toward nature; processes in the formation of landscapes; gardens. Mr. Glacken (F)

   (Formerly numbered 100B)
   Three hours lecture per week. Population, environment, and urbanization; religious geography and human settlement; cities as expressions of varying cultural traditions. Mr. Glacken, Mr. Reed (W)

103. The Relations between Nature and Culture. (4)
   Three hours lecture per week. A history of the great ideas in Western thought, from antiquity to the present, concerning the relationship of human culture to the natural environment. Mr. Glacken (Sp)

*110. Location Theory. (4)
   Three hours lecture per week. A review of theories pertaining to the locational pattern of agricultural activities, manufacturing, and business and service activities. The impact of non-optimal locational decision-making on real-world patterns.

111. Systems of Cities and Regional Development. (4)
   Three hours lecture per week. Processes of city-system development. Processes generating large-city concentration and regional economic and social inequalities. Regional development problems and policies in economically advanced and underdeveloped countries. Mr. Pred (Sp)

112. Historical Geography of Transportation. (4)
   Four hours of lecture per week. The influence of geographical factors in the creation, transformation, and maintenance of transportation technologies and patterns; the shaping of patterns of settlements and economy by transportation innovation; the role of transportation in regional development in Britain and Anglo-America. Mr. Vance (F)

113. Information Circulation and Innovation Diffusion. (4)
   Three hours lecture per week. The geographic spread of information under different technologies and stages of economic development. Processes generating the spatial diffusion of cultural and economic innovations. Mr. Pred (W)

*114. Industrial Localization. (4)
   Three hours lecture per week. Factors and trends in the geographic distribution of manufacturing industries. Mr. Pred

120. Morphogenesis of the Western City: Pre-industrial Urban Geography. (4)
   Three hours of lecture per week. Historical development of the physical structure of western cities and urban morphology theory from the Middle Ages to the Industrial Revolution. Specific attention is given to the morphological expression of society in the pre-industrial city. Mr. Vance (F)

121. Morphogenesis of the Western City: Urban Geography in the Industrial Age. (4)
   Three hours of lecture per week. Historical development of the physical and social structure of western cities and the shaping of urban morphology during and since the Industrial Revolution. Specific attention is given to the location of retailing, wholesaling, and housing. Mr. Vance (W)

125. Social Geography. (4)
   Three hours lecture per week. The interrelationships of social and physical space, with particular reference to migration and diffusion processes and environmental perception, attitudes, and behavior. Structure and process at the intrametropolitan and "urban field" scales of inquiry. Mrs. Palm (F)

130A. Natural Resources and Population. (4)
   Three hours lecture and one hour discussion per week. A study, with emphasis on current literature, of the problems stemming from the interactions of population growth, technology, and natural resources. Focus on agriculture and nutrition, forests, energy, water, and environmental contamination. Mr. Luten (F)
130B. Open Land as a Natural Resource. (4)
Three hours lecture and one hour discussion group per week. Recommended: 130A. The aesthetic resources: wildlife, parks, recreation, wilderness. The noneconomic criteria for decision. The growth, philosophy, and current action of the conservation movement.
Mr. Luten (Sp)

135. Energy as a Resource. (4)
Three hours lecture and one hour discussion per week. The development of the understanding of energy and of the technology of its use. Distribution of use in relation to (a) nature, magnitude, and location of the resource, (b) demand, (c) the developing technology of harvest, transport, storage, and conversion. Estimates of future conditions.
Mr. Luten (Sp)

*136. Water as a Resource. (4)
Three hours lecture and one hour discussion group per week. Recommended: Geography 130A. The nature of the water resource and of its use; the impact of use on the resource and on the quality of the environment. Institutions for management of the resource and criteria for decision. Major water development projects.
Mr. Luten

137. Environmental Contamination. (4)
Three hours lecture and one hour discussion per week. Recommended: course 130A. The reaction to heavy demands of the assimilative resource: air, water, land (solid wastes, litter). Sensual contamination: sound, sight, stench. Universal contaminants: radioactivity, pesticides, patterns; boundaries between goods and bads; commons and externalities; criteria for decision.
Mr. Luten (F)

138. Biogeography. (4)
Three hours lecture and one hour discussion per week. Factors influencing local and world-wide distributions of associations of natural fauna and flora at various scales including major biomes. Man's impact on vegetation and wildlife and on the productivity and stability of ecological systems.
The Staff (Mr. Parsons in charge) (F)

140. Analysis of Landforms. (4)
Four and one-half hours lecture per week. Prerequisite: course 1, or one or more courses in geology. Origin of landforms in varying geographical environments. Review of alternative interpretations of processes involved with emphasis on recent views. Concurrent enrollment in Geography 185 recommended.
Mr. Oberlander (F)

141. Topographic Map Interpretation. (4)
Six hours lecture and discussion per week. Prerequisite: course 140, which may be taken concurrently, or equivalent. The recognition and analysis of landforms portrayed on standard topographic maps.
Mr. Oberlander (F)

144. Principles of Meteorology. (4)
Three hours lecture per week. Weather development in relation to different scales of atmospheric circulation, with examples from the Northeastern Pacific—Western North America area.
Mr. Giovinetto (F)

145. Applied Micrometeorology. (4)
Two hours lecture and four days of field work per quarter. Prerequisite: course 144 or consent of instructor. Not open for credit to students who have taken course 140. Micrometeorological phenomena and resulting climates in areas with different topography, vegetation, and man-made structures.
Mr. Giovinetto (W)

146. Applied Physical Climatology. (4)
Two hours lecture per week and four days field work per quarter. Prerequisite: course 14 or consent of instructor. Not open for credit to students who have taken course 145. Energy and water balance of air masses, river and lake basins, particular ocean areas, and glaciers.
Mr. Giovinetto (W)

150. California. (4)
Four hours lecture per week. Geographic regions of the state; agricultural, urban, and industrial expansion as related to population growth and changing technology. Bases of current environmental crises.
Mr. Parsons (W)

151. Western United States. (4)
Three hours lecture per week. Mr. Parsons (F)

*152. Historical Economic Geography of the Eastern United States. (4)
Three hours lecture per week. Nineteenth-century processes of agricultural and industrial location. Migration and settlement spread processes. Development of the urban system.
Mr. Fred

*153. Geography of Canada. (4)
Three hours lecture per week. Mr. Vance

154. Middle America. (4)
Three hours lecture per week. Mexico, Central America, and the West Indies.
Mr. Parsons (W)

*155. Spanish South America. (4)
Three hours lecture per week. The Andean and La Plata countries.
Mr. Parsons

156. Brazil. (4)
Four hours lecture per week. Selected environmental and cultural themes in the contemporary landscape of Portuguese America, including a brief general survey of the problems that challenge the people of Brazil's major geographical regions.
Mr. Sternberg (F)

*157A. The Brazilian Amazon. (3)
Two hours lecture and one hour consultation per week. Prerequisite: course 156 or consent of instructor. Problem-oriented themes in a regional context. Environmental problems in the occupation and development of the world's largest continuous area of humid tropical lowlands.
Mr. Sternberg

*157B. The Nordeste. (3)
Two hours lecture and one hour consultation per week. Prerequisite: course 156 or consent of instructor. Problem-oriented themes in a regional context. Traditional and recent approaches to environmental problems of a diversified region, with emphasis on the "drought polygon"; water as a critical factor and its use in agriculture and industry.
Mr. Sternberg

*157C. Agricultural Frontiers in Brazil. (3)
Two hours lecture and one hour consultation per week. Prerequisite: course 156 or consent of instructor. Problem-oriented themes in a regional context. Environmental diversity and cultural variables in the characterization of present-day pioneer fronts, with emphasis on western Brazil.
Mr. Sternberg
158. The Mother Lode Country. (3)
Two hours of lecture per week plus field trips. Prerequisite: course 150 or consent of instructor. Man's impact on the landscape of the mountain counties of California; patterns of settlement and economic activity; the nature of recent water and land development schemes; changing values relating to rural life. Mr. Parsons

162A—162B. Soviet Union. (4—4)
Three hours lecture per week. *162A. A systematic survey. Mr. Hooson
*162B. Prerequisite: course 162A or consent of the instructor. Special problems in Soviet regional geography. Mr. Hooson

163. Southeast Asia. (4)
Three hours lecture per week. Mr. Reed (F)

*166. The Middle East. (4)
Three hours lecture per week. The human geography of the Middle East, from Egypt to Afghanistan. Physical, historical, and cultural background to current social and economic problems of individual countries and the area as a whole. Mr. Oberlander

169. Southwest Pacific. (4)
Three hours lecture per week. Australia, New Zealand, and the South Pacific islands. Mr. Hooson (Sp)

*170. The Arid Lands. (4)
Four hours lecture per week. A comparative survey of the arid and semi-arid regions of the world. Climate, land forms, water, soils, and vegetation; population and resources.

*171. The Humid Tropics. (4)
Four hours lecture per week. An analysis of the resources of the warm and wet lands of the equatorial regions; the economic potentialities of the tropics and the obstacles to their exploitation inherent in the physical and cultural environment. Mr. Sternberg

180. Field Geography. (4)
All day Saturday. Prerequisite: senior standing. A geographical survey of selected physical and cultural landscapes in the Bay Area and adjacent parts of Northern California. Mr. Powell (F, Sp)

181. Urban Field Geography. (4)
9 a.m.—1 p.m. Saturday. One hour of preparation per week. Prerequisite: course 120 or consent of instructor. Analysis of the structural components of the urban environment of the San Francisco-Oakland Metropolitan Area. Mrs. Palm (Sp)

183. Cartographic Representation. (4)
Two lecture hours and five laboratory hours per week. Problems in the representation of quantitative and qualitative data on thematic maps. Mr. Oberlander (W, Sp)

187. Introduction to Quantitative Methods in Geography. (4)
Three hours lecture per week. Prerequisite: Statistics 2 or consent of instructor. Application of some elementary concepts of scaling and the measurement of relationships to geographical problems. Topics to be considered may include areal classification, spatial interaction, analysis of networks. Mrs. Palm (W)

189. Geographic Thought. (4)
Three hours lecture per week. Prerequisite: three upper division courses in geography. Selected themes in the history of geographic thought from classical times to the present. Mr. Glacken (W)

*191A. Geography of Human Health and Disease (3 or 4)
Three hours lecture-discussion per week on principles of medical geography and landscape epidemiology including changing patterns of human health and disease in the context of physical, biotic, and sociocultural environments and in relation to human settlement. Several weekly sessions will be offered on specific diseases of global importance. Term papers will be required, subject to be chosen by each student in discussion. Mr. Andy and the Staff (F)

H195. Honors Course. (1—5)
Requirements for honors in Geography and satisfied by a thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1—5)
Enrollment is restricted by regulations listed on page 87. Additional limitations: Students must have senior standing and have an overall grade-point average in the major of at least 3.00. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses
Admission to graduate courses requires in all cases consent of the instructor. Undergraduate courses are not prerequisite to graduate courses unless so indicated.

*200. Advanced Cultural Geography. (4)
Three hours per week. Mr. Glacken

210. Problems in Economic Geography. (4)
Three hours per week. Mrs. Palm, Mr. Fred (F)

*220. Advanced Urban Geography. (4)
Three hours per week. Mr. Vance

*230. Geographical Problems in Regional Development and Resource Utilization. (4)
Three hours per week. Physical, biotic, and cultural factors in the development of the tropics. Mr. Sternberg

*240. Problems in Physical Geography. (4)
Three hours per week. Intensive reading with weekly discussion of selected problems in physical geography. Mr. Oberlander (Sp)

*248. Paleoclimatology. (4)
Two 1-hour lectures and two hour discussion per week. Prerequisite: consent of instructor. Types of evidence and techniques of analysis. Historical climatology. Prehistoric environments. Characteristics and distribution of paleoclimates inferred from associated biological, geological, and marine phenomena. Theories on climatic change. Field work to be arranged. Mr. Giovinetto

Graduate Research Seminars

251. Cultural Geography. (4)
Three hours per week. Mr. Glacken (F); Mr. Reed (Sp)
252. Economic Geography. (4)  
(Formerly numbered 252A–252B)  
Three hours per week.  
Mr. Pred (W)

253. Urban Geography. (4)  
Three hours per week.  
Mrs. Palm (W);  
Mr. Vance (Sp)

254. Natural Resources and Population. (4)  
Three hours per week.  
Mr. Luten (W)

255. Historical Geography. (4)  
Three hours per week.  
Mr. Parsons (Sp)

256. Climatology. (4)  
Three hours per week.  
Prerequisite: consent of instructor.  
Mr. Giovinoetto (Sp)

257. Geomorphology. (4)  
Three hours per week.  
Mr. Oberlander (Sp)

*258. Biogeography. (4)  
Three hours per week.  
Mr. Parsons

*260. History of Geography. (4)  
Three hours per week.  
Mr. Hooson

271. Latin America. (4)  
(Formerly numbered 271A–271B)  
Three hours per week.  
Seminar on Latin America.  
Mr. Sternberg (F)

*275. Soviet Union. (4)  
Three hours per week.  
Mr. Hooson

280. Advanced Field Study in Geography. (5–1Q)  
All day Saturday. Course may be repeated for credit.  
The Staff (F, W, Sp)

289. Problems in Geographical Thought. (5)  
Three hours per week.  
Mr. Hooson (W)

299. Individual Research. (1–6)  
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)  
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

GEOLOGY AND GEOPHYSICS

(Department Office, 301 Earth Sciences Building)

Professors:
Bruce A. Bolt, Ph.D., D.Sc.
Ian S. E. Carmichael, Ph.D.
Garniss H. Curtis, Ph.D.
Charles M. Gilbert, Ph.D.
Richard L. Hav, Ph.D.
Harold C. Helgeson, Ph.D.
Luna B. Leopold, Ph.D.
Charles Meyer, Ph.D.
John Verhoogen, Ph.D.
Clyde Wahrhaftig, Ph.D.
Lionel E. Weiss, Sc.D., Ph.D.
Perry Byerly, Ph.D., LL.D. (Emeritus)

Adolf Pabst, Ph.D. (Emeritus)
Francis J. Turner, Sc.D. (Emeritus)
Howell Williams, Sc.D., LL.D. (Emeritus)

Associate Professors:
Frederick A. F. Berry, Ph.D.
Mark N. Christensen, Ph.D.
Thomas V. McEvilly, Ph.D.
Chi-yuen Wang, Ph.D.
Hans-Rudolf Wenk, Ph.D.

Assistant Professor:
Lane R. Johnson, Ph.D.

The Department of Geology and Geophysics offers the student excellent opportunities to acquire a broad background of knowledge and experience in the study of the structure and evolution of the earth. The department emphasizes the physical and chemical aspects of geological processes, and attaches much importance to direct observation (e.g., field work) combined with rigorous analysis.

Geology

The major in geology is designed around a relatively small number of required courses so as to give the student maximum freedom to pursue in depth his special field of interest: geochemistry, petrology, structural geology, geomorphology, stratigraphy, etc.

The Major

Lower Division Courses  Geology 5A–5B or 10 and 101, Paleontology 1 or equivalent, 40 units of lower division courses in physics, chemistry, mathematics (including statis-
Geology and Geophysics

Upper Division Courses
Geology 150 and 118, plus 24 units of upper division courses in geology, geophysics, paleontology, physics, chemistry, mathematics or engineering as approved by the major adviser. Geology 102 and 151 are strongly recommended for all students.

Honors Program
Students with an overall grade-point average of 3.0 may apply for admission to the honors program. Application should be made through the student's adviser not later than the end of the student's junior year. Candidates for graduation with honors in geology are required to take, in addition to the regular program, 5 units of Geology 199 (independent study) in the senior year plus a summary thesis report which may be based in part on work done during the course.

Geophysics
The major in geophysics is designed for students with facility in mathematics and an interest in geology; it provides a general background in the physical sciences, with emphasis on the physics of the earth.

The Major

Lower Division Courses
Chemistry 1A; Physics 4A–4B–4C–4D–4E; Geology 5A; Mathematics 1A–1B–1C, 51A–51B–51C.

Upper Division Courses

Honors Program
Students with an overall grade-point average of 3.0 may apply for admission to the honors program. Application should be made through the student's major adviser not later than the end of the student's junior year. Candidates for graduation with honors in geophysics are required to take Geophysics 121B, 122B, and one of Geophysics 123, 199, or Geology 105 in addition to the regular program, and either write a research paper or plan a comprehensive examination.

Engineering Geoscience
The College of Engineering with the cooperation of the Department of Geology and Geophysics offers a curriculum in engineering geoscience leading to the degree of Bachelor of Science (see section on Engineering Science in this Catalogue).

Graduate Programs
The central objective of the graduate program is to encourage creative thinking and develop the capacity for independent and original research.

Student Background
The student is expected to have as a background:

1. Two years of college mathematics including at least one year of calculus at the level of Mathematics 51A, 51B, 51C and an introductory course in computer programming.
2. One year each of college chemistry and physics at the level of Chemistry 14 and Physics 4A, 4B, 4C.
3. For geology students, broad undergraduate training in geology, including paleontology, geophysics, and geochemistry.

4. For geophysics students, additional mathematics and physics at the upper division level.

Students may be admitted with deficiencies in their prior training, but they are expected to correct these during their first year of graduate work.

Geology. Each student must plan to cover a broad spectrum of advanced courses, selected with the approval of the Graduate Adviser. Each program includes a minimum of eight formal upper division or graduate courses of which at least three are normally taken outside the Department of Geology and Geophysics in related fields. Courses taken within the Department should include several diverse areas of study in addition to the area of the student's major research interest. All incoming graduate students are required to enroll in Geology 202, Field Study.

For the Master's degree, thirty units of course work and a thesis are required. The courses must include at least twelve units of graduate work in the major subject.

For the Ph.D., the student must pass an oral qualifying examination covering a broad field of knowledge and carry out a substantial piece of fundamental research. In addition, he must demonstrate ability to translate original scientific literature in at least one foreign language (generally French, German, or Russian). He is expected to take the foreign language examination during the first year of graduate work, to take the oral qualifying examination within the first two years, and to submit the dissertation within four years. A Master's degree is not a prerequisite to a Ph.D.

Geophysics. The master's degree is given by examination. Candidates must also complete a minimum of 36 units of upper division and graduate courses, of which at least 18 must be strictly graduate work. The degree usually requires between one and two years of full-time study. The examination must be taken before the end of the second academic year of studies.

Candidates for the Ph.D. degree must pass the examination for the master's degree, satisfy the foreign language requirement, and pass an oral qualifying examination covering a broad field of knowledge in the physical sciences. There is no formal course requirement for the degree, except that candidates are encouraged to take at least 8 units of graduate work in mathematics, and a comparable number of units related to their field of interest (e.g., advanced dynamics, electromagnetism, etc.) in other departments. The qualifying examination is taken early in the third year of graduate work. By that time the language requirement has been satisfied and a research adviser selected. The preparation of a thesis requires at least a full academic year.

Seismographic Stations The University operates 16 seismographic stations in northern California to study the seismicity here and in adjacent parts of Nevada and Oregon and to conduct other research in seismology. Research includes the study of earthquake wave propagation, the nature of the waves, their relation to earth structure, the nature of earthquake sources, eigenvibrations of the earth, and the theory of the seismograph. Offices are in the Earth Sciences Building; seismographs and laboratories are in Haviland Hall and in an underground vault in Strawberry Canyon.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Geology

Lower Division Courses

Lower Division courses in Geology are designed to serve both general and specific interest in Earth Science, and they can be taken in any order. Credit is not allowed for both 5A and 10, which are alternative presentations of classical geology; enrollment is limited in 5A.

1. The Changing Earth. (4)

Three 1-hour lectures and one 1-hour discussion and demonstration period per week. The Earth, its present and past states with particular reference to the processes that change it.
5A. General Geology. (5)
Two 1½-hour lectures and two afternoon field trips per week; field trips occupy the entire afternoon. Prerequisite: course 5A or consent of instructor. Designed for but not limited to students in natural science and engineering. Introduction to geology through field mapping with supplementary laboratory study. Minerals, rocks, geologic structures and processes.

Mr. Leopold (F)

5B. General Geology. (2)
One 2-hour discussion period per week plus individual assignments. Prerequisite: course 5A or 101 with grade of C or better. Designed for geology majors. Interpretation of geologic maps and structure sections.

Mr. Meyer (W)

10. Introduction to Geology. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Designed for students not majoring in physical science. Accepted as the lower division prerequisite for the geology major. Introduction to geology through laboratory study with at least one supplementary field trip. Minerals, rocks, geologic structures and processes.

Mr. Gilbert (F); Mr. Curtis (Sp)

11.Introductory Geology. (4)
Three 1-hour discussion meetings per week with optional supplementary laboratory and field trips. Introduction to geology through investigation of a geological topic of personal interest, the investigation to be reported as a term paper in lieu of examinations.

Mr. Berry (Sp)

Upper Division Courses

Courses 106 and 110 are general interest courses with minimum prerequisites and are appropriate for non-science majors in the College of Letters and Science.

100. Mineralogy. (4)
Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: Chemistry 1A or consent of instructor. Introduction to crystallography and systematic mineralogy; mineral identification of hand specimens.

Mr. Wenk (F)

101. Field Geology. (4)
Two 4-hour field trips and one 1-hour discussion period per week. Prerequisite: a course in general geology and consent of the instructor. Geology of the Berkeley Hills and vicinity. Not open to students who have completed course 5A at Berkeley.

Mr. Meyer (F); Mr. Wahrhaftig (Sp)

102. Optical Mineralogy. (4)
Two hours of lecture and three hours of laboratory per week. Prerequisite: course 150 or equivalent.

Mr. Weiss (F); Mr. Gilbert (Sp)

103. Igneous Petrology. (4)
Two hours of lecture and two 3-hour laboratory sessions per week. Prerequisite: courses 150, and 102. Introduction to problems of origin and evolution of igneous rocks. Study of igneous rocks using petrographic microscope.

Mr. Carmichael (W)

104. Metamorphic Petrology. (4)
Two hours of lecture and two 3-hour laboratory periods per week. Prerequisite: course 150 and 102. Introduction to problems of origin of metamorphic rocks. Study of metamorphic rocks using the petrographic microscope.

Mr. Meyer (Sp)

105. Sedimentary Petrology. (5)
Two 1-hour lectures and two 3-hour laboratory periods per week; one or more field trips. Prerequisite: courses 150, 102. 102 may be taken concurrently. Origin, classification, and relationship of sedimentary rocks. Microscopic examination of sedimentary rocks. Physical stratigraphy.

106. Mineral Resources. (4)
Three hours of lectures and demonstrations per week, plus two 1-day and one 3-day field trip. Prerequisite: a college course in geology or consent of instructor. Non-renewable resources. Geologic environments, economic mineral deposits, and fossil fuels. Some impacts of these factors on history and human affairs.

Mr. Meyer (Sp)

107. Evolution of Continents and Oceans. (5)
Three 1-hour lectures and two 1-hour discussion periods per week. Prerequisite: junior standing in geology. The structure and evolution of the surface of the earth.

Mr. Weiss (Sp)

110. California. (4)
Three hours of lecture and discussion per week; occasional field trips. Prerequisite: a college course in geology. Geologic framework and history of California; the geology of California in relation to man.

Mr. Berry (F)

112A. Stratigraphy and Structure. (3)
Two 2-hour lecture and discussion periods per week. Prerequisite: consent of the instructor. Interpretation of sedimentary rocks and geologic maps with respect to structural history. Student is required to take course 112B. Credit and grade will be awarded upon completion of the sequence.

Mr. Berry (W)

112B. Stratigraphy and Structure. (3)
Prerequisite: course 112A—may be taken concurrently. Independent study from the literature of the sediments of a given time interval over an extensive region, such as a state. Maps and cross-sections will be constructed and an interpretation of the structural history will be made.

Mr. Berry (W, Sp)

1116. Structural Geology. (3)
Two 1-hour lectures and one 3-hour laboratory period per week. Prerequisite: course 5A or 101.

Mr. Weiss (W)

1117. Geomorphology. (4)
Two 1-hour lectures and one 3-hour laboratory per week; two weekend field trips. Prerequisite: consent of instructor; course 5A or 101 and 150 recommended. Weathering, erosion, and development of landscape. Glacial geology and Pleistocene history. Interpretation of topographic maps and aerial photographs.

Mr. Wahrhaftig (F)
118. Summer Field Course. (8)
Prerequisite: course 5A (or 101), 5B, and 150; 116 recommended; or consent of instructor. A detailed geological investigation of a selected area. Five weeks in the field. Mr. Gilbert, Mr. Meyer

119. Geologic Field Studies. (2)
Prerequisite: course 5A (or 101), 5B, 150, and consent of the instructor. Two or three weekend field trips to localities of geological interest. Mr. Curtis (F); Mr. Meyer (Sp)

Eight hours of laboratory per week. Prerequisite: courses 102, 103, 104, and consent of the instructor. The analysis of associations of common minerals in igneous metamorphic and sedimentary rocks. Mr. Carmichael (F, W, Sp)

124. Geochronology. (3)
One 3-hour lecture and discussion period per week. Radiotopes in geology: age and origin of the earth and solar system; evolution of continents; problems in developing a geologic time scale; dating the evolution of man. Mr. Curtis (W)

126. Deformed Rocks and Minerals. (3)
Two 1½-hour lectures per week. Prerequisite: consent of the instructor. Introduction to deformed rocks and minerals. Mr. Weiss (F)

131. Introduction to Theoretical Geochemistry. (5)
Three hours of lecture and two hours of laboratory per week. Prerequisite: Chemistry 14 or the equivalent. Thermodynamics and solution chemistry in a geologic context; phase equilibria, interpretation of chemical potential, prediction of mineral solubilities, computer calculations, etc., with emphasis on practical application to the study of rocks and geochemical processes. Mr. Helgeson (W)

135. Introduction to X-Ray Crystallography. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Elementary methods of X-ray analysis and their application in mineral identification. Emphasis is in practical work with the powder method. Determination of lattice constants for cubic crystals. X-ray study of solid solutions and polymorphism. The course is designed for general geologists, crystallographers, mineralogists, petrologists, metalurgists, and chemists should take Geology 235, Mr. Wenk (W)

150. Minerals and Rocks. (4)
Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: course 5A (or 101). Laboratory study of minerals and rocks. Mr. Gilbert (W)

151. The Earth. (4)
Three 1-hour lectures and one 2-hour discussion period per week. Prerequisite: one year each of college calculus and physics; course 5A or 101. The earth as a whole; its internal constitution and evolution. Mr. Verhoogen (Sp)

H195. Senior Honors Course. (3)
Prerequisite: limited to Honors candidates. Original research and preparation of an acceptable thesis. May be taken during two consecutive quarters at the end of senior year and may be substituted for six units of the upper division requirement with consent of the major adviser. The Staff (W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.

Graduate Courses

201. Seminar in Geochemistry. (4)
Two 2-hour discussion periods per week. Prerequisite: consent of instructor. Principles and problems in geochemistry. Mr. Helgeson (Sp)

202. Field Study. (4)
Two 4-hour field trips per week. Prerequisite: consent of instructor. Supervised field study for graduate students with prior experience. Mr. Wenk (F), Mr. Wahrhaftig (Sp)

205A–205B. Processes of Ore Deposition. (4–4)
Two 1-hour lectures per week and two 3-hour laboratory periods per week. Detailed geological, mineralogical, chemical, and experimental evaluation of theories of genesis of ore bodies.
Sequence beginning (F) Mr. Meyer

209. Stratigraphy and Tectonics. (3)
One 3-hour meeting per week. Prerequisite: course 112 or consent of instructor. Regional tectonic interpretation as deduced from stratigraphy, sedimentation, and geomorphology. Mr. Berry (F)

211. Geology of Fluids. (3)
One 1-hour lecture and one 2-hour discussion period. Prerequisite: consent of instructor. Course 111 recommended. Content will vary from year to year. Mr. Berry (Sp)

213. Quaternary Stratigraphy. (3)
(Formerly numbered 213B)
One 3-hour lecture per week and one 3-day field trip. Prerequisite: consent of instructor. Mr. Wahrhaftig (Sp)

214A–214B. Advanced Petrology. (3–3)
One 2-hour lecture and two 3-hour laboratory periods per week. Prerequisite: adequate training in microscopic petrology and physical chemistry (thermodynamics).
214A. Igneous Petrology. Mr. Carmichael (Sp)
214B. Metamorphic Petrology. (Sp)

214L. Advanced Petrology Laboratory. (3)
Six hours of laboratory per week. Prerequisite: open only to students taking 214A lecture. Igneous petrology—laboratory examination of igneous rocks. Mr. Carmichael (Sp)

214M. Advanced Petrology Laboratory. (3)
Six hours of laboratory per week. Prerequisite: open only to students taking 214B lecture. Metamorphic petrology—laboratory examination of metamorphic rocks. (Sp)

One 2-hour lecture and one 3-hour laboratory period per week. Prerequisite: course 105 or equivalent; adequate training in the use of the petrographic microscope.
215A. Processes and products of sedimentation in water. Mr. Gilbert (W)
215B. Petrology of nonvolcanic sedimentary rocks. Mr. Hay (W)
215C. Petrology of volcanic sedimentary rocks. Mr. Hay (Sp)
601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Su, F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirement for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Su, F, W, Sp)

IDS 210. Assessment of the Environment. (4)
See Interdepartmental Studies for the complete description of this course.

IDS 211. Geological and Engineering Factors in Environmental Planning. (4)
See Interdepartmental Studies for the complete description of this course.

Geophysics

Upper Division Courses

104A–104B. Mathematical Methods in Geophysics. (4-4)
Three 1-hour lectures per week and computer laboratory. Prerequisite: Mathematics 51A–51B–51C.

104A. Method of least squares; Fourier analysis; probability and scientific inference; treatment of observational errors.
Mr. Bolt (F)

104B. Special functions; spherical harmonics; transforms; differential equations of geophysics. Examples are drawn from the whole field of geophysics.
Mr. Bolt (W)

120. Mechanics of Earthquakes and Faulting. (3)
Two 1-hour lectures per week. General discussion of earthquakes and their occurrence; seismicity; applications to earthquake engineering.
(F)

121A–121B. Seismology.

121A (5) Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: Physics 4A–4B, Mathematics 51A–51B–51C. Causes, effects, and distribution of earthquakes; the seismogram; interpretation of seismographic records in terms of earthquake mechanism and structure of the earth.
Mr. McEvilly (F)

121B (4) Two 1-hour lectures and one 3-hour laboratory period per week. Prerequisite: Physics 4A–4B, Mathematics 51A–51B–51C. Paths and types of seismic waves; travel times; velocity distributions; reflection and refraction; seismic prospecting. Sequence beginning fall.

122A–122B. Physics of the Earth. (4-4)
Three 1-hour lectures per week and discussion periods. Prerequisite: course 104B (may be taken concurrently). Physics 110A–110B is prerequisite to course 122B.

122A. The earth's gravitational field, density distribution; internal constitution; heat transfer; temperature distribution.
Mr. Wang (W)

122B. The earth's magnetic field; its origin and history.
Mr. Verhoogen (Sp)
123. Mechanics of the Earth. (4)
Three 1-hour lectures per week. Prerequisite: course 121A-121B-122A. Course 122B is recommended but may be taken concurrently. State of stress and deformation in the crust and mantle; geophysical discussion of major problems of the structure of the earth. Topics may vary from year to year.
Mr. Wang (F)

Graduate Courses

204A-204B-204C. Elastic Waves. (4-4-4)
Three 1-hour lectures per week. Prerequisite: Geophysics 104 or equivalent; Geophysics 121A; Physics 105A.
204A. Stress; infinitesimal and finite strain; wave motion in isotropic solids; water waves; effects of anelasticity and anisotropy; propagation in layered media. Sequence beginning (W). Mr. Bolt (W)
204B. Spherical waves; terrestrial oscillations; Lamb's problem; model earthquake sources.
204C. Theory of spherical waves; eigenvibrations of the earth; diffraction of waves; difference and finite-element methods of wave modeling; synthetic seismograms for a spherical earth; dislocation theory; Volterra theory; source models; expansion in multipole; moving sources; effect on surface waves. Mr. Bolt (Sp) alternate years.

208. Physical Properties of Rocks and Minerals. (3)
Three hours of lecture per week. Prerequisite: consent of instructor. Physical properties of rocks and minerals at high pressure and high temperature, including equation of state, elasticity, fracture and flow, heat transfer, magnetic and other properties of interest to earth sciences. Content will vary from year to year.
Mr. Wang (F)

217. Advanced Seismometry. (4)
Two 1-hour lectures and two 3-hour laboratory periods per week. Mathematical theory of the pendulum and other seismographs. Techniques of modern seismometry.
Mr. McEvilly (Sp)

218. Seminar in Seismology. (3)
Three 1-hour discussion periods per week. Critical study of problems in current seismological research. Topic will vary from quarter to quarter.

Graduate Courses

285. Research. (2-12)
The Staff (F, W, Sp, Su)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Su, F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirement for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Su, F, W, Sp)

IDS 145. Physical Problems about the Earth. (4)
See Interdepartmental Studies for the complete description of this course.

GERMAN

(Department Office, 5317 Dwinelle Hall)

Professors:
Richard Brinkmann, D.Phil.
Andrew O. Jässzi, Ph.D.
Michael Mann, Ph.D.
Herbert Penzl, D.Phil.
Heinz Politzer, Ph.D.
Blake Lee Spahr, Ph.D.
Frederic C. Tubach, Ph.D.
Philip Motley Palmer, Ph.D. (Emeritus)
Archer Taylor, Ph.D., D.Phil. (h.c.), L.L.D. (Emeritus)

Associate Professors:
Marianne Bonwit, Ph.D.
Bluma Goldstein,† Ph.D.

Gerd Hillen, Ph.D.
Winfried Kudszus, Ph.D.
Joseph Mileck, Ph.D.
Franz Schneider, Ph.D. (Emeritus)
Hinrich C. Seeba, D.Phil.
Johan P. Snapper, Ph.D. (Holder of Princess Beatrix Chair of Dutch Literature)

Assistant Professors:
Daniel Brink, Ph.D.
Reinhard Hennig, Ph.D.
Kenneth D. Weisinger, Ph.D.

Senior Lecturer:
Klaus A. Mueller, M.A.

The Department of German offers the undergraduate the opportunity to obtain a broad background in the field of German language, literature, and culture, and intro-

NOTE: For key to footnote symbols, see page 86.
duces him to the principles of literary analysis and criticism. German language instruction ranges from the elementary courses to advanced courses in German style. The literature courses cover the area from earliest times to the present, with emphasis upon the period since 1700. The graduate program emphasizes literature seminars which concentrate on the deeper penetration of more limited areas. The graduate offerings in linguistics provide a complete program of study in the Germanic languages. Instruction in methodology is provided for prospective teachers and teaching assistants.

The Major

Lower Division    German 1, 2, 3, 4, 5 or their equivalent.

Upper Division—10 courses (40 units) in upper division from Group II, including: German 139A–139B (8 units); 2 courses selected from German 103A–103B–103C–103D (8 units).

Honors Program    Senior students who have a 3.0 overall grade-point average may enroll in the honors program. The honors program will include completion of three quarters of German H195 and a comprehensive examination.

Graduate Study

Preparation for Graduate Study Those interested in the graduate program in German at Berkeley must have an undergraduate major in German or its equivalent. Prospective graduate students in the field of German are strongly urged to acquire as thorough a speaking, reading, and writing knowledge of the German language as they can. They are also strongly urged to acquire a working knowledge of French and Latin.

Master of Arts in German The degree of Master of Arts in German is granted after satisfactory completion of 9 courses (36 units) beyond an A.B., after passing an examination in French, and after passing a comprehensive examination covering the field.

LITERATURE

Upper Division    Required: 3 courses (12 units): German 142 (Composition and Style), German 145 (Introduction to Descriptive German Grammar), and German 148A (Middle High German).

Graduate         A minimum of 5 courses (20 units).

LINGUISTICS

Upper Division    Required: same as above.

Graduate         A minimum of 5 courses (20 units) including German 271 (Historical Phonology and Morphology of German).

All new teaching assistants in German are required to take German 301 (The Teaching of German in College).

Master of Arts in Teaching (M.A.T.) in German The program is specifically designed for future school and college teachers in German. It includes a summer quarter in Germany and a year of employment in a participating public school in the Greater San Francisco Bay Area. The program is administered jointly by the Departments of German and Education. For a complete description please refer to the ANNOUNCEMENT OF THE SCHOOL OF EDUCATION.

Program Adviser: Mr. Mueller.

Doctor of Philosophy in German The initial requirement for this degree is a Master of Arts degree in German and a two-hour oral exploratory examination. After the master's
degree there are no specific course requirements. There are two curricula leading to the degree of Doctor of Philosophy in German, one in the field of history and criticism of German literature, and the other in the field of Germanic languages and linguistics. The student is advanced to candidacy after passing an examination in Latin then a comprehensive examination, both oral and written, covering the field. Interested students are urged to consult one of the graduate advisers of the department.

*t12B. Intermediate German. Intensive Course. (10)
Five 2-hour class meetings and two 1-hour sessions in the Language Laboratory per week. Prerequisite: course 2 or 12A or the equivalent. This course is equivalent to courses 3 and 4.
Mr. Mueller in charge (W, Sp)

14A–14B–14C–14D. Individualized Instruction.
(1-5; 1-5; 1-5; 1-5)
This course covers the material of German 1–4. Basic Course. Students may enter at any level. Divided into 20 units (14A: 1–5 units; 14B: 1–5 units; 14C: 1–5 units; 14D: 1–5 units). A minimum of one unit is required. Open to any student whose program including this course, meets the minimum study list requirement. If a student completes more units than he contracts for, he is given credit for them.
Mr. Mueller in charge (F, W, Sp)

39A. The Works of Bertolt Brecht. (4)
Three 1-hour lectures per week. Small discussion groups once per week. Course will include writings of Brecht, both theoretical and creative. Poetry, dramas, theoretical works about the theater, other prose—including short stories and parables—will be studied.
Miss Goldstein (W)

39B. German Literature in English Translation. (4)
Three 1-hour lectures and one hour of discussion per week. Topic: Thomas Mann and Franz Kafka. A study and comparison of the fictional and discursive works of these two authors.
Miss Goldstein (Sp)

39D. German Literature in English Translation—Twentieth Century. (4)
Four 1-hour lectures per week. Mr. Tubach (W)

Upper Division Courses

Group I

Courses given in English and open to all upper division and graduate students.

125. Introduction to Germanic Folklore. (4)
Four 1-hour lectures per week. Mr. Tubach (Sp)

133A–133B. German Cultural History and Political Institutions. (4–4)
Four 1-hour lectures per week. Mr. Tubach (Sp)

140. Introduction to the Linguistic Study of German. (4)
Four 1-hour lectures per week.

160. Issues and Problems in German Literary and Cultural History. (4)
Four 1-hour lectures per week. The topic will vary from year to year.
Topic: Fascism in German Literature.
Miss Goldstein (F)
Topic: Hermann Hesse, Man and Artist.
Mr. Mileck (Sp)

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

1. Elementary German. Basic Course. (5)
Five 1-hour class meetings and two 1-hour sessions in the Language Laboratory per week.
Mr. Mueller in charge (F, W, Sp)

1R. Elementary German (Emphasizing Reading). (5)
The purpose of the sequence 1R, 2R, 3R, and 4R is to serve those students who want to develop their reading ability in German rapidly, so that the study of literature or the translation and analysis of scientific or other prose texts can be carried out as soon as possible. Five 1-hour class meetings per week.
Mr. Mueller in charge (F, W, Sp)

2. Elementary German. (5)
Five 1-hour class meetings and two 1-hour sessions in the Language Laboratory per week. Prerequisite: course 1 or its equivalent.
Mr. Mueller in charge (F, W, Sp)

2R. Elementary German (Emphasizing Reading). (5)
Five 1-hour class meetings per week. Prerequisite: course 1, 1R or the equivalent.
Mr. Mueller in charge (F, W, Sp)

3. Elementary German. (5)
Five 1-hour class meetings and two 1-hour sessions in the Language Laboratory per week. Prerequisite: course 2 or its equivalent.
Mr. Mueller in charge (F, W, Sp)

*3R. Elementary German (Emphasizing Reading). (5)
Five 1-hour class meetings per week. Prerequisite: course 2, 2R or the equivalent.
Mr. Mueller in charge (F, W, Sp)

4. Intermediate German. (5)
Five 1-hour class meetings and two 1-hour sessions in the Language Laboratory per week. Prerequisite: course 3 or 3R or the equivalent.
Mr. Mueller in charge (F, W, Sp)

*4R. Intermediate German (Emphasizing Reading). (5)
Five 1-hour class meetings per week. Prerequisite: course 3, 3R or the equivalent.
Mr. Mueller in charge (F, W, Sp)

5. Advanced German. (5)
Five 1-hour class meetings per week. Prerequisite: course 4, 4R or the equivalent.
Mr. Seeba in charge (F, W, Sp)

*12A. Elementary German. Intensive Course. (10)
Five 2-hour class meetings and two 1-hour sessions in the Language Laboratory per week. This course is equivalent to courses 1 and 2.
Mr. Mueller in charge (F, W)
Group II

Prerequisite: unless otherwise stated, five courses (25 units) of lower division German language courses, or their equivalent. It is recommended that students take a survey course (103A, 103B, 103C, 103D) before proceeding to a more restricted course in a given period.

100. Introduction to German Literature. (4)
Four 1-hour lectures per week. Designed primarily for students majoring in German.
Mr. Hennig (F, Sp)

103A–103B–103C–103D. Survey of German Literature.
Four 1-hour lectures per week.
103A. To 1500. (4) Mr. Hennig (Sp)
103B. From 1500 to 1700. (4)
103C. Eighteenth Century. (4) Miss Bonwit (W)
103D. Nineteenth Century. (4) Mr. Seeba (F)

106. Lessing. (4)
Four 1-hour lectures per week.
Mr. Hillen (F)

109. Schiller. (4)
Four 1-hour lectures per week.
Mr. Snapper (W)

*112A–*112B. Goethe.
Four 1-hour lectures per week.
112A. To 1808. (4) Miss Bonwit (F)
112B. 1808–1832. (4) Miss Bonwit (W)

114. Romanticism. (4)
Four 1-hour lectures per week.
Mr. Weisinger (F)

*115A–115B. Nineteenth-Century German Drama. (4-4)
Four 1-hour lectures per week.
Mr. Brinkmann (W)

118A–*118B. Nineteenth-Century German Prose. (4-4)
Four 1-hour lectures per week.
Mr. Jaszi (Sp)

121A–121B. Twentieth-Century German Drama. (4-4)
Four 1-hour lectures per week.
121A. 1890–1945. (4) Mr. Seeba (F)
121B. Since 1945. (4) Mr. Mileck (W)

124A–124B. Twentieth-Century German Prose. (4-4)
Four 1-hour lectures per week.
124A. 1890–1945. (4) Mr. Kudsuz (W)
124B. Since 1945 (4) Mr. Kudsuz (Sp)

*127. German Lyric Poetry. (4)
Four 1-hour lectures per week. Readings in German poetry from the Enlightenment to the present day. Given every other year.
Mr. Politzer (Sp)

130. German Poetry of the Twentieth Century. (4)
Four 1-hour lectures per week. Given every other year.
Mr. Kudsuz (W)

136. Advanced German Conversation. (4)
Four 1-hour meetings per week. Not open to native speakers except with the consent of the instructor.
Mr. Seeba (W)

139A–139B. Advanced Grammar and Composition. (4-4)
Four 1-hour meetings per week. Not open to native speakers except with consent of the instructor. Sequence beginning (F).

142. Composition and Style. (4)
Prerequisite: course 139B or consent of instructor. Required of all candidates for the M.A. in German.
Four 1-hour meetings per week. Mr. Mann (Sp)

145. Introduction to Descriptive German Grammar. (4)
Four 1-hour lectures per week. Recommended for prospective teachers. Required of all candidates for the M.A. in German.
Mr. Brink (W)

148A–*148B. Middle High German. (4-4)
Four 1-hour meetings per week.
148A. Outlines of grammar; the Nibelungenlied and selected readings. 148A is required of all candidates for the M.A. in German.
Section 1 for undergraduates. Mr. Brink (F)
Section 2 for graduates. Mr. Spahr (F)
*148B. Selected readings in Middle High German Literature. Prerequisite: course 148A or equivalent. Recommended for students planning to take German 203.

*155. Social and Political Rhetoric. (4)
A study of the rhetorical aspects of the language and its use for propaganda purposes.
Mr. Seeba

195. Special Study for Honors Candidates. (4)
Prerequisite: a 3.5 grade-point average in at least 5 courses (20 units) of upper division German and a 3.0 overall grade-point average.
Mr. Jaszi (Sp)

199. Supervised Independent Study and Research. (1–4)
Enrollment is restricted by regulations listed on page 87. Additional limitation: overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis.

Graduate Courses

(Contacting conditions for admission to graduate courses see page 27.)

Literature: All graduate courses in literature will meet three hours a week: a 2-hour seminar and a 1-hour tutorial.

*203. Studies in Middle High German Literature. (4)
Prerequisite: course 148A.
Topics will vary from year to year.
Mr. Spahr (Sp)

*206. German Literature of the Renaissance and Reformation. (4)

203. German Literature of the Seventeenth Century. (4)
Mr. Spahr (W)

*212. Lessing. (4)

*215. Goethe to 1808. (4)
Mr. Jaszi

218. Goethe. 1808–1832. (4)
Mr. Jaszi (Sp)

*224. Schiller. (4)
Mr. Mann
227. German Romanticism. (4)
230. Kleist, Büchner, Grabbe. (4)  Mr. Jaszi (W)
*233. Grillparzer and the Austrian Drama of the Nineteenth Century. (4)  Mr. Politzer
*236. German Realism. 1850–1900. (4)  Miss Bonwit
237. German Oral Style. (4)
   Four class hours per week.  Prerequisite: course 136 or equivalent. The course is designed for future teachers and all others who wish or need to have a comprehensive oral command of German. Conducted entirely in German with intensive practice in speaking and understanding the language. Required for all M.A.T. candidates.  Mr. Mueller (F)
239. German Naturalism. (4)  Mr. Mann (Sp)
*242. Hofmannsthal and the Austrian Drama of the Twentieth Century. (4)  Mr. Politzer (W)
245. Interpretation and Criticism of German Poetry. (4)  Mr. Kudszus (Sp)
   248A. Hermann Hesse. (4)  Mr. Mileck (W)
   248B. Thomas Mann. (4)  Mr. Mileck (Sp)
   248C. Franz Kafka. (4)  Mr. Politzer (F)
250. Aspects of German Literary and Cultural History. (4)
   Four hours of lecturing per week. The course is comparative in nature, stressing and discussing literary and cultural patterns of Germany and present-day American culture. A research paper and several brief lectures are required of the student to develop his ability to teach cultural and literary material.  Mr. Tubach (W)
260. Seminar in German Literature. (4)
   Topic will vary from year to year.
   Topic: Literature and Politics in the German Vormärz (1815–1848).  Mr. Seeba (F)
   Topic: Freud and Literature.  Mr. Politzer (W)
*261A–*261B. Seminar in German Literature. (4–4)
   Three hours of lecture per week. Credit and grade will be awarded upon completion of the full sequence. Topic will vary from year to year.
   Topic: Der deutsche Bildungsroman.  Miss Bonwit (F, W)

LINGUISTICS

270. Introduction to the History of the German Language. (4)
   Three 1-hour lectures per week.  Mr. Penzl (F)
271. Historical Phonology and Morphology of German. (4)
   Two 1½-hour lectures per week. Required of all candidates for the M.A. with linguistic emphasis.  Mr. Penzl (W)
273. Gothic. (4)
   Two 1½-hour meetings per week.  Mr. Penzl (F)

276. Old High German. (4)
   Three 1-hour meetings per week.  Mr. Brink (Sp)

282. Old Saxon. (4)
   Three 1-hour meetings per week.

285. Descriptive German Grammar. (4)
   Three class hours per week.  Prerequisite: course 145. Deals with the grammatical structure and the sounds of Modern German in contrast to the corresponding features of American English. Required of all M.A.T. candidates.  Mr. Brink (Sp)

290. Seminar in Germanic Linguistics. (4)
   Prerequisite: consent of instructor. The subject matter of this course will vary from time to time.  Topic: Phonological Analysis of Contemporary German.  (F)
   Topic: Linguistics and Literature.  Mr. Penzl (Sp)

299. Individual Study for Graduate Students in Literature or Linguistics. (1–8)
   Prerequisite: graduate standing. Primarily for post-M.A. students engaged in exploration of a restricted field, involving the writing of a report.  The Staff (F, W, Sp)

601. Individual Study for Master's Students. (4)
   Hours to be arranged.  Prerequisite: graduate standing. Independent study in consultation with graduate adviser, to provide an opportunity for M.A. candidates to prepare for the comprehensive examination. Units may not be used to meet the unit requirements for the master's degree. Must be taken on a satisfactory/unsatisfactory basis.  The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (4)
   Hours to be arranged.  Prerequisite: M.A. in German. Independent study in consultation with graduate adviser to provide an opportunity for Ph.D. candidates to prepare for the qualifying examination. Must be taken on a satisfactory/unsatisfactory basis. May not be used for unit or residence requirements for the doctoral degree.  The Staff (F, W, Sp)

Courses in the Teaching of German

300. The Teaching of German in Elementary and Secondary Schools. (4)
   Four 1-hour meetings per week; either lecture, demonstration class, or Language Laboratory. For credential candidates. Open to senior and graduate students.  Mr. Mueller (W)

301A–301B–301C. The Teaching of German in College. (2–1–1)
   Lecture and demonstration class, Language Laboratory. For all new teaching assistants. Open to all graduate students. Credit and grade will be awarded upon completion of the full sequence.  Mr. Mueller (F, W, Sp)

*303A–*303B–*303C. The Teaching of German. (2–1–1)
   One hour class per week. A seminar designed for the discussion of specific teaching problems and theories during the period of employed teaching. The seminar fulfills the residence requirement in which the writing project is completed.  Mr. Mueller (F, W, Sp)
303X. The Teaching of German. (4)
Three hours of lecture per week. A seminar designed for the discussion of specific teaching problems and theories during the period of employed teaching. The seminar fulfills the residence requirement in which the writing project is completed. Not open to students taking 303A–303B–303C.
Mr. Mueller (F)

Courses to Prepare Graduate Students for Reading Examinations
Each course: one hour daily, five times a week. No unit credit for these courses. Must be taken on pass or fail basis.
16. Elementary German. (0)
Mr. Mueller (in charge) (F, W, Sp)
26. Intermediate German. (0)
Mr. Mueller (in charge) (F, W)

Dutch
101. Elementary Dutch. (5)
Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Open to freshmen.
Mr. Snapper (in charge) (F)
102. Elementary Dutch. (5)
Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Prerequisite: course 101 or equivalent.
Mr. Snapper (in charge) (W)
103. Intermediate Dutch. (5)
Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Prerequisite: course 102 or equivalent.
Mr. Snapper (in charge) (Sp)
104. Intermediate Dutch. (5)
Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Prerequisite: course 103 or equivalent. Mr. Snapper (in charge) (F)

*110. Intensive Dutch. (10)
Five 2-hour class meetings and two hours in the Language Laboratory per week. An intensive language course with emphasis on the audio-lingual approach. Course is equivalent to Dutch 101 and 102.
Mr. Snapper (F)

130. Advanced Composition and Conversation. (4)
Four 1-hour meetings per week. Prerequisite: course 104 or consent of the instructor. An intensive course in the development of oral and written style.
Mr. Snapper (W)

150. Introduction to the Literature of the Netherlands. (4)
Three hours of lecture and one hour tutorial per week. Prerequisite: course 104 or consent of the instructor. A literary-historical survey of Dutch literature from the Middle Ages to the present. Selective readings in poetry, prose, and drama. Given in Dutch.
Mr. Snapper (Sp)

160. Literature of the Lowlands in English Translation. (4)
(Formerly Dutch 39)
Four 1-hour lectures per week. Study of the major contemporary Dutch and Flemish writers and their works.
Mr. Snapper (Sp)

170. The Netherlands: Culture and Institutions. (4)
Four 1-hour lectures per week. A historical study of the cultural contributions of the Netherlands and an analysis of the political system. Special emphasis on the social and political aspects of the contemporary scene. Lectures in English. Mr. Snapper (Sp)

198. Directed Group Study. (1–4)
One to four hours of lecture per week.
Mr. Snapper (F, W, Sp)

199. Special Studies in Dutch. (1–4)
Enrollment is restricted by regulations listed on page 87. Additional limitations: overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis.
Mr. Snapper (F, W, Sp)

Related Courses in Other Departments
Comparative Literature 210A–210B. Studies in Medieval Literature.

HISTORY

(Department Office, 3229 Dwinelle Hall)

Professors:
Richard M. Abrams, Ph.D.
Paul J. Alexander, Ph.D.
Thomas G. Barnes, D.Phil.
Gunther P. Barth,† Ph.D.
Walter E. Bean, Ph.D.
Thomas N. Bisson, Ph.D.
Woodrow W. Borah, Ph.D.
William J. Bouwsma, Ph.D. (Sather Professor)
Robert J. Brentano, D.Phil.
Dorothy M. Brown, Ph.D. (Chairman)

Gene A. Brucker,† Ph.D.
L. Perry Curtis, Jr., D.Phil.
Natalie Z. Davis, Ph.D.
Gerald D. Feldman,† Ph.D.
Erich S. Gruen,† Ph.D.
Tulio Halperin, Ph.D.
Richard Hers, Ph.D.
Winthrop D. Jordan, Ph.D.
James F. King, Ph.D.
Ira M. Lapidus, Ph.D.
Lawrence W. Levine,† Ph.D.
Leon F. Litwack, Ph.D.

NOTE: For key to footnote symbols, see page 86.
Martin E. Malia,† Ph.D.
Henry F. May, Ph.D. (Margaret Byrne Professor)
Robert L. Middlekauff,† Ph.D.
Nicholas V. Riasanovsky, D.Phil. (Sidney Hellman Ehrman Professor)
Wolfgang Sauer, Dr.Phil.
H. Franz Schurmann, Ph.D.
Raphael Sealey, M.A.
Charles Sellers, Ph.D.
William B. Slottman, Ph.D.
Engel Sluiter, Ph.D.
Thomas C. Smith,† Ph.D. (Ford Professor of History and Comparative Studies)
Kenneth M. Stampp, Ph.D. (A. F. and May T. Morrison Professor)
Frederic E. Wakeman, Jr.,† Ph.D.
Richard A. Webster,† Ph.D.
Woodbridge Bingham, Ph.D., LL.D. (Emeritus)
George P. Hammond, Ph.D. (Emeritus)
Lawrence A. Harper, J.D., Ph.D. (Emeritus)
Lawrence Kinnaird, Ph.D. (Emeritus)
Franklin C. Palm, Ph.D. (Emeritus)
Hans W. Rosenberg, Ph.D. (Shepard Professor, Emeritus)

Associate Professors:
Gerard E. Caspary, Ph.D.

Departmental Major Advisers: Consult Undergraduate Secretary’s Office.

The Major

The major program in history shall total at least 60 quarter units, or the equivalent (usually 12 courses), and shall include the following:

1. By the end of the sophomore year: (a) two courses in European history, at least one of which must be in a period before 1600. One at least must be from the following: 4A, 4B, 4C, or 4D (by permission of the major adviser, History 5 may be substituted for one of these courses, but it should be noted that History 4D and 5 cannot both be taken for credit); one may be a seminar (History 39) in European history; (b) two additional quarter courses, at least one of which must be chosen from the following: History 17C, 17D, 18A, 18B, 19A, 19B, 49A, 49B; one may be a seminar (History 39) in American, Latin American, African, or Asian history.

2. In the junior and senior years: four upper division lecture courses to be selected from the following—all upper division lecture courses offered by the Department of History, Economics 112A–112B (Economic History of Europe), and Economics 113 (Economic History of the United States). In addition, two sections of History 103 (Proseminar) in two different fields of history (Ancient, Europe to 1600, Europe since 1600, Britain, U. S., Latin America, Asia, Africa, History of Science), and History 101A–101B (Introduction to Historical Method) in one of the fields selected for History 103.

Upper Division Honors Program  The honors program is intended for students of high ability in history who will profit from individual work with a member of the faculty and discussions with students of similar interests. It is a one-year program for senior majors, but certain prerequisites should be fulfilled in the junior year. A departmental Honors Committee is in charge of the program.
Seniors will take History H102 unless exempted by the Committee. Each student will also spend two quarters writing an honors essay, which is normally the product of original research into a historical question, under the supervision of a member of the department who has consented to direct it. For this purpose the student will take History H198A–H198B or, with consent of the instructor, a two-quarter graduate research seminar, History 285. After completing his essay, he will receive a grade for these courses from his faculty supervisor. The Honors Committee will determine if the essay fulfills the requirements for successful completion of the honors program, and if the quality of the essay and the student’s general achievement deserve the additional citation of “Distinction” or “Great Distinction.” These facts will be noted on his diploma.

Junior majors should notify the chairman of the Committee of their interest in the program. They must take History 101A–B their junior year if they are on campus. The Honors Committee will review applicants in the spring quarter each year.

**Teaching Training**  See the **Announcement of the School of Education**.

**Higher Degrees**  Students planning to work toward the degrees of M.A. and Ph.D. should address inquiries to the Graduate Secretary, Department of History, for the Department of History bulletin entitled “Higher Degrees in History.” The deadline for receipt of applications for graduate admissions is January 15. February 15 is the deadline for receipt of supplementary materials (transcripts, letters of recommendation from two professors who have instructed the applicant in history, results of the Aptitude Test in the Graduate Record Examination). Candidates will be admitted for the fall quarters only.

**Further Information**  The **Schedule of Classes** issued prior to each quarter and the Department Catalogue issued at the beginning of the fall quarter provide further detailed information about the courses offered by the History Department, including when and by whom each course will be given.

**Letters and Science List:** for regulations governing this list, see the **Announcement of the College of Letters and Science**.

**Lower Division Courses**

4. **European Civilization.**

Two 1-hour lectures and two 1-hour section meetings per week. Introductory study of periods of major historical significance in the course of European history. Emphasis on class discussions, readings in the sources, and writing of essays.

4A. Ancient. (5)  Mr. Sealey (Sp)
4B. Medieval. (5)  Mr. Caspary (F)
4C. Renaissance and Reformation. (5)  (W)
4D. Enlightenment and Revolutions. (5)  (Sp)

5. **Modern Europe. (5)**

Three hours of lecture and one 1-hour section meeting per week. A survey of modern Europe primarily for students not going on in history.

17A–17B. The United States. (3–3)

*Prerequisite: sophomore standing.*

17A. Three hours of lecture; two term papers. Emphasis on writing.
17B. Three hours of lecture.

17C–17D. The United States. (5–5)

*Prerequisite: sophomore standing.*

17C. Three hours of lecture and one hour of section meeting per week.

17D. Three hours of lecture and one hour of section meeting per week.

18A–18B. Latin-American History. (5–5)

Three hours of lecture and one 1-hour section meeting per week. *Prerequisite: sophomore standing.*  Mr. King (F, W)

19A–19B. Asian History. (5–5)

Two 1-hour lectures and one 2-hour section per week. *Prerequisite: sophomore standing.*  Students will enroll in sections conducted by faculty members and limited to 20, all sections meeting together for weekly lectures by one instructor. Work in sections includes reading, discussion, reports on historical problems. Grading based on section and lecture work. For an indication of the title of each section to be offered see the department catalogue at the beginning of the quarter.

19A: Mr. Brown, Mr. Tu (F);  19B: Mr. King (F, W)

33A–33B–33C. American Studies. (5–5–5)

One 1-hour lecture and one 2-hour seminar per week. *Prerequisite: open to sophomores; limited to fifteen students. Admission by interview with the three instructors during registration.*  An honors course in the study of American culture. The class will study significant ideas and issues, drawing on material from history, literature, political science, philosophy, and other fields. The course will emphasize discussion and the writing of essays and will include occasional joint meetings with the staff and students of the two equivalent courses. (English 33A–33B–33C and Political Science 33A–33B–33C).
39. Seminars for Freshmen and Sophomores. (5)
   One 3-hour meeting per week. Seminars in the
   various fields of history designed to introduce begin­
   ning undergraduates to problems of historical meth­
  ods and interpretations. Work in the course will
   include research and a research paper. Limited to
   fifteen students per section. May be repeated once
   for credit but not with the same instructor. Prereq­
   uisite: prior consent of instructor.
   For precise schedule of offerings see department
catalogue during pre-enrollment week each quarter.

*49A—*49B. Studies in American History. (5—5)
   Section 2—3 hours per week. Intended to introduce
   students to the problems and methods of studying
   American history. Relies almost completely on the
   use of primary materials.

Upper Division Courses

Group I—Unrestricted Courses

(Open to all students in the upper division;
prerequisites as noted.)

108A—108B—108C. History of Christianity. (5—5—5)
   Three hours of lecture and one hour required
   section per week. Christianity as an institutional,
   social, and intellectual force in the development
   of western culture and as it has responded to changing
   social and cultural needs from antiquity to the
   present. 108A: beginnings to ca. 1000 A.D., 108B:
   1000 to ca. 1650, 108C: ca. 1650 to the present.
   Mr. Bouwmana (F, W, Sp)

*110A—110B. Ancient Greece. (5—5)
   Three hours of lecture and 1 hour of consultation
   per week. 110B: Mr. Sealey (W)

*111A—*111B. Ancient Rome. (5—5)
   Three hours of lecture and 1 hour of consultation
   per week.

*112. The Age of Cicero. (5)
   Three hours of lecture and 1 hour of consultation
   per week. Examination of events, forces, trends in­
   volved in fall of Roman Republic in crucial years
   between deaths of Sulla and Cicero. Analysis of
   Cicero’s speeches, essays and correspondence. Politi­
   cal, social, economic struggles in light of intellectual
   and cultural currents.

*114A—*114B. Byzantium. (5—5)
   Three hours of lecture and 1 hour of consultation
   per week.

*115A—*115B. Medieval Europe. (5—5)
   Three hours of lecture and 1 hour of consultation
   per week.

*117A—*117B. Medieval European Intellectual
   History. (5—5)
   Three hours of lecture and one hour of consulta­
   tion per week.

119. Society and the Sexes in Early Modern Europe.
   (5)
   Three hours of lecture and one hour of discussion
   per week. This course examines the significance of
   sex roles and sexual symbolism in European social,
   political, economic, and cultural life from the 15th
   through the 18th centuries. Limited to 100 students.
   Mrs. Davis (F)

120. The Renaissance. (5)
   Three hours of lecture and 1 hour of consultation
   per week. (Sp)

121. The Reformation. (5)
   Three hours of lecture and 1 hour of consultation
   per week.

*122. Age of Absolutism and Enlightenment. (5)
   Three hours of lecture and 1 hour of consultation
   per week.

*123. Modern Europe (1789—1870). (5)
   Three hours of lecture and 1 hour of consultation
   per week.

124. Modern Europe (1870—1914). (5)
   Three hours of lecture and 1 hour of consultation
   per week.

*125. Modern Europe (1914—Present). (5)
   Three hours of lecture and 1 hour of consultation
   per week.

126A—126B. European Economic History Since
   1750. (5—5)
   Three 1-hour lectures and 1 hour of consultation
   per week.

127A—127B. European Diplomatic History. (5—5)
   Three 1-hour lectures and 1 hour of consultation
   per week.

*128A—128B—*128C—128D. European Intellectual
   History Since 1300. (5—5—5—5)
   Three hours of lecture and one hour of discussion
   per week. Thought and art considered in their social
   and political contexts. 128A, 1300—1600.
   128B. 1600—1800.
   128C. 1800—1900.
   128D. 1900—present.

*129A—*129B. Social History of Western Europe.
   (5—5)
   Three hours of lecture and 1 hour of consultation
   per week.

130. Development of Scientific Thought and
   Technique.
   Three hours of lecture and 1 hour of consultation
   per week.

*130A. Ancient and Medieval Science. (5)
   130B. Scientific Revolution (1450—1750). (5)
   Mr. Heilbron (W)

*130C. Science since 1750. (5)

131. Topics in the History of the Physical
   Sciences. (5)
   Three hours of lecture and 1 hour of consultation
   per week. Prerequisite: high school or college phys­
   ics. Intensive study, using primary sources where
   possible, of a closely related series of episodes in
   the development of scientific thought. Mr. Heilbron (Sp)

132. Topics in the History of Biological Science. (5)
   Three hours of lecture and 1 hour of consultation
   per week.
136. Russia.
Three hours of lecture and 1 hour of consultation per week.
*136A. Russia to 1613. (5)
136B. Russia 1613-1801. (5) Mr. Riisanovsky (F)
136C. Russia 1801-1917. (5) Mr. Zelnik (W)
136D. Russia 1917 to Present. (5)

137A—137B. Russian Intellectual History. (5—5)
Two 1½-hour discussion group meetings and one hour of consultation per week. A two-quarter pro-seminar course in social and political thought, with attention also to literature and philosophy: eighteenth century to 1917. Open to qualified graduates and undergraduates. Limited to 30 students.

140A-140B. Hapsburg Monarchy and Succession States. (5—5)
Three hours of lecture and 1 hour of consultation per week.

141A. Medieval France. (5)

141B–141C. Modern France. (5—5)
Three hours of lecture and 1 hour of consultation per week.

142. Rise of the Dutch Republic and Empire. (5)
Three hours of lecture and 1 hour of consultation per week. Economic, political, religious, and cultural history of the Netherlands from the Burgundian and Hapsburg periods through the Dutch Revolt and Golden Age of the Republic, including overseas expansion and establishment of the Dutch colonial empire.

143B–143C. Modern Germany. (5—5)
Three hours of lecture and 1 hour of consultation per week.

*147A—147B. Spain and Portugal. (5—5)
Three hours of lecture and 1 hour of consultation per week.

*148. Modern Italy. (5)
Three hours of lecture and 1 hour of consultation per week.

150A–150B–150C. Medieval England. (5—5—5)
Three hours of lecture and 1 hour of consultation per week. Emphasis will be placed on constitutional and intellectual developments.

Three hours of lecture and one hour of consultation per week. Prerequisite: an elementary knowledge of the history of Western Europe.
151A. Britain, 1485–1603.
151B. Britain, 1603–1714.
151C. Britain, 1714–1832.
151D. Britain, 1832 to Present.

*154. British Empire and Commonwealth. (5)
Three hours of lecture and 1 hour of consultation per week. Prerequisite: course 151D or equivalent.

*155. Modern Ireland. (5)
Three hours of lecture and one hour of discussion per week. An examination of modern Irish society and culture with emphasis on political and economic developments since 1800. The nature of the English “conquest” and settlement of Ireland is examined in the context of the nationalist struggle for independence.

156A–156B. Social History of Latin America. (5–5)
Three hours of lecture and 1 hour of consultation per week.

*157A—157B. The Central Andean Region. (5)
Three hours of lecture and 1 hour of consultation per week. History of the Andean region, the area that now comprises modern Peru, Bolivia and Ecuador, from the Indian period (fifteenth century) to the present.

*158. The Opening of the Pacific 1513–1800. (5)
Three hours of lecture and 1 hour of consultation per week. A survey of European penetration, trade, rivalry, empire-building, and influence in the Pacific Area, with attention to the cultural impact of West upon East, and vice versa.

160A–160B. Mexico. (5—5)
Three hours of lecture and 1 hour of consultation per week.

*162A—162B. Caribbean Area. (5—5)
Three hours of lecture and 1 hour of consultation per week.

*163A—163B. Brazil. (5—5)
Three hours of lecture and 1 hour of consultation per week.

164. Modern Argentina. (5)
Three hours of lecture and 1 hour of consultation per week.

*165A–165B. The Colonial Period and American Revolution. (5—5)
Three hours of lecture and 1 hour of consultation per week.

165A. The Colonial Period.
165B. The American Revolution.

166. The United States, 1787–1845. (5)
Three hours of lecture and 1 hour of consultation per week.

167. Era of Sectional Conflict. (5)
Three hours of lecture and 1 hour of consultation per week. Mr. Stampp (F)

168B. Reconstruction and the New Nation. (5)
Three hours of lecture and 1 hour of consultation per week.

168A–168B–168C. Recent United States History. (5—5—5)
Three hours of lecture and one hour of discussion per week.

168A. 1900–World War I.
168B. World War I–World War II.
168C. Post World War II.
169A—169B. History of Black People and Race Relations in the United States, 1550 to the Present. (5-5)

Three hours of lecture and one hour of consultation per week. History of Afro-Americans: their African backgrounds, slave experience, social and cultural experience since emancipation. The course will consider race relations, particularly between Blacks and whites in America.

Mr. Jordan (F)
169A. 1550 to 1865.
169B. 1865 to present.

170A—170B. The West in United States History. (5-5)

Three hours of lecture and one hour of consultation per week.

171. California. (5)

Three hours of lecture and one hour of consultation per week.

Mr. Bean (F, Sp)

173A—173B. Diplomatic History of the United States, (5-5)

Three hours of lecture and one hour of consultation per week.

175A—175B. Intellectual History of the United States. (5-5)

Three hours of lecture and one hour of discussion per week.

177A—177B. The Age of the City. (5-5)

Three hours of lecture and one hour of discussion per week. A social history of urban life in America, with emphasis on the nineteenth century.

180A—180B. Africa. (5-5)

Three hours of lecture and one hour of consultation per week.

181. Northwest and West Africa to 1900. (5)

Three hours of lecture and one hour of consultation per week. Regional introductory course in history of area whose people have been in intermittent contact for over two thousand years. Emphasis will be placed on two important themes: development of regional trading network, and cultivation of Islamic tradition and institutions. Prerequisite: a reading knowledge of French; or one of the following courses: History 182A, 182B, 183A, 183B; or prior consent of instructor.

182A—182B. Islamic History. (5-5)

A history of the Middle East from the 7th to the 13th centuries; the Arab conquests, the Islamic Empires, the successor states, and the formation of Islam as a religion and culture.

Three hours of lecture and one hour of consultation per week.

183A—183B. The Middle East. (5-5)

The background, origins, and rise of the Ottomans; the Ottoman Empire, its Arab provinces, Persia and the modern Middle East.

Three hours of lecture and one hour of consultation per week.

Mr. J. Smith (W, Sp)

184A—184B—184C. China. (5-5-5)

Three hours of lecture and one hour of consultation per week.

184A. China to 906.
184B. China 906 to 1796.
184C. China 1796 to present.

185A—185B—185C. Japan. (5-5-5)

Three hours of lecture and one hour of consultation per week.

186. Chinese Historical Texts: The Early Period. (5)

Three hours of lecture and one hour of discussion per week. Prerequisite: 2 or 3 years of modern Chinese; some familiarity with classical texts, such as the Mencius. An introduction to Chou and Han historical texts, grammar, classical commentaries, and modern scholarly aids. Emphasis is on rigorous translation and the use of the texts as historical sources.

Mr. Keightley (F)

187A—187B—187C. India. (5-5-5)

Three hours of lecture and one hour of discussion per week.

Mr. Irshick, Mr. Metcalf (F, W, Sp)

188. Inner Asia. (5)

Three hours of lecture and one hour of consultation per week. History of the peoples and states of the Eurasian steppe: Scythians, Huns, Turks, Mongols, and others.

Mr. J. Smith (F)

189A—189B. Social History of China and Japan. (5-5)

Three hours of lecture and one hour of consultation per week. Prerequisite: consent of instructor.

189A. China.
189B. Japan.

Mr. Schurmann (Sp)

190. Modern Chinese Intellectual History. (5)

Three hours of lecture and one hour of discussion per week. Intended to study the intellectual development of modern China from the Opium War to the People's Republic. Issues to be explored include "culturalism," nationalism, scientism, and socialism.

Mr. Tu (W)

Group II—Restricted Courses

COURSES IN HISTORICAL METHOD AND THOUGHT

(Designed primarily for students whose major subject is history.)

100. Historiography. (5)

Three hours of lecture and/or seminar per week. The problems of writing history; the philosophy of history; and historical method. This course is intended for history majors to enrich their studies and to enable them to establish a general framework for understanding theory.

101A—101B. Introduction to Historical Method. (5-5)

Lengthy individual research projects carried on in seminar sections in limited historical fields, with readings, discussions, etc., on general problems of historical inquiry. The two quarters must be taken consecutively. Credit and grade will be assigned only upon completion of the full sequence.

H102. Colloquium on Historical Thought. (5)

Consideration of the nature and function of historical thought as manifested in major historical classics and selected historical problems. Required of honors program juniors; open, by permission of instructor, to nonhonors program seniors upon completion of History 101A—101B.
PROSEMINARS IN HISTORY

103. Proseminar: Problems in Interpretation and Research in the Several Fields of History. (5)
One 2 to 3-hour meeting or two 1½-hour meetings per week. Designed primarily to give majors in history elementary training in historical criticism and research. Emphasis will be placed on writing and discussion. With consent of instructor may be repeated without duplication of credit. Prerequisite: prior consent of instructor.
For precise schedule of offerings see department catalogue during preenrollment week each quarter.
103A, Ancient; 103B, Europe; 103C, England; 103D, United States; 103E, Latin America; 103F, Asia; 103H, Africa; 103S, History of Science.

LIMITED ENROLLMENT LECTURE COURSES

104. Special Topics in the Various Fields of History. (5)
Three to four hours per week. Designed primarily to permit the instructor to deal with a topic with which he is especially concerned, usually more restricted than the subject matter of a regular lecture course. A combination of informal lectures, class discussions, term papers, and examinations, with all grading by the instructor himself. Limited to 25 to 30 students. Instructors and subjects to vary.
For precise schedule of offerings see department catalogue during preenrollment week each quarter.

HONORS COURSES

H198A–H198B. Senior Honors. (5–5)
Limited to senior honors candidates. Directed study centering upon the preparation of an honors thesis. Supervisors will be assigned to each student after consultation with the honors committee. Credit and grade will be assigned upon completion of the full sequence. (F, W, Sp)

SPECIAL INDIVIDUAL STUDY

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. (F, W, Sp)

Graduate Courses
(Concerning conditions for admission to graduate courses see page 27.)

Group I. Bibliography and Historiography Courses

280. Advanced Studies in the Sources and General Literature of the Several Fields of History. (5)
One 2-3 hour meeting per week. For precise schedule of offerings see department catalogue during preenrollment week each quarter.
280A, Ancient; 280B, Europe; 280C, England; 280D, United States; 280E, Latin America; 280F, Asia (for M.A. candidates); 280G, Asia (for Ph.D. candidates); 280H, Africa (for Ph.D. candidates); 280S, History of Science; 280T, Economic History.

281A–281B. Paleography and Other Auxiliary Sciences. (5–5)
One 2- to 3-hour meeting per week.

282. Numismatics. (5)
Two 1½-hour meetings per week. The use of coins as an historical source; theory and practice. Open to graduates and undergraduates.

283. Historical Method and Theory. (5)
One 2- to 3-hour meeting per week. Designed especially for candidates for higher degrees in History. Stress is laid on practical exercises.
For precise schedule of offerings see department catalogue during preenrollment week each quarter.

284. Quantitative Approaches to History. (5)
Two to three hours of lecture per week. Prerequisite: Mathematics to and including calculus desirable, or elementary statistics. Study and application of quantitative methods and theories in historical research, the New Economic history, ideas and techniques from demographic history. Mr. Herr (Sp)

Group II. Research Seminars

285. Research Seminars. (5–5)
The following research seminars extend over two consecutive quarters. A final grade will be assigned upon completion of both quarters' work. One 2- to 3-hour meetings per week.
For precise schedule of offerings see department catalogue during preenrollment week each quarter.

Research Seminars. (5)
The following research seminar is limited to one quarter. One 2- to 3-hour meeting per week.

Group III. Individual Research and Study

293. Special Study for Graduate Students Leading to the M.A. Degree. (3–6)
Individual study in consultation with the adviser intended to prepare qualified students for the M.A. comprehensive examination. An in-progress grade will be assigned until the student has passed the comprehensive, when a letter grade will be assigned. Students may take 3 to 6 units per term but a total of 6 units will be required to fulfill unit and residence requirements for the M.A.
The Staff (F, W, Sp)

296. Directed Dissertation Research. (3–12)
Open to qualified students directly engaged upon the doctoral dissertation. To be taken on a passed/not passed basis. May be repeated for credit.
The Staff (F, W, Sp)
299. Independent Study for Graduate Students in History. (3–8)
(Formerly numbered 290 and 294)
The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1–8)
Individual study, in consultation with the graduate adviser, to prepare students for language examinations and the master's examination. May not be used for unit or resident requirements for the M.A. degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study, in consultation with the graduate adviser, to prepare students for language examinations and the doctoral examination. May not be used for unit or resident requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

HISTORY OF SCIENCE

The following courses are acceptable for major credit in history and most of them are acceptable for major credit in philosophy as well. (For details see the cross-listings in the philosophy and history sections of this bulletin): 103S, 130A, 130B, 130C, 131, 132, 280S, 285S. Students interested in graduate programs in the history of science should consult the adviser.

RELATED COURSES

Economic History The following courses are acceptable for major credit in history. (For details see the listing in Economics. Students interested in graduate programs in economic history should consult the adviser.)

Economic History of Europe (Economics 112A–112B, 5–5).

Economic History of the United States (Economics 113. 5).


Medieval Studies The Committee on Medieval Studies in conjunction with the Department of History and Boalt School of Law plans to offer interdisciplinary work in medieval studies during the academic year 1973–74.

IDS 109. Political and Ecclesiastical Symbolism in the Middle Ages. (4) Mr. Ladner (Sp)

IDS 213. Renewal Ideas and Movements from the Age of the Barbarian Invasions to the Carolingian Age. (4) Mr. Ladner (Sp)

See Interdepartmental Studies for the complete descriptions of these courses.

Other Interdepartment Studies Courses.


IDS 44A–44B–44C, European History and Literature: Topics in the Greco-Roman, Medieval, and Early Modern Background. (10–10–10)


IDS 138. Michelangelo and His Age, 1475–1564, (5)
See Interdepartmental Studies for the complete descriptions of these courses.

HUMANITIES

Humanities courses and the Humanities Field Major are described under Interdisciplinary and General Studies, Division of (DIGS).

HUNGARIAN

(For courses in the Hungarian language and literature, see listing under Department of Slavic Languages and Literatures.)

INTERDEPARTMENTAL STUDIES

Lower Division Courses

7. Self-Paced Study in Introductory Physics and Calculus. (2–20)
Two hours of lecture and two to six hours of workshop per week. Prerequisite: high school physics

NOTE: For key to footnote symbols, see page 86.
mechanics, electricity, and magnetism. May be repeated for credit up to a total of 20 units. Reduced credit for students who have taken part(s) of Math 1A—1B—1C and/or Physics 4A—4B. Unit credit and grades assigned at the end of each quarter (no more than 12 units per quarter), depending on the number of study units completed.

Mr. Helmholz, Mr. Chernoff (F, W, Sp)

10A—10B—10C. Man and His Environment—Crises and Conflicts. (5—5—5)

Two 1½-hour lectures and two 1½-hour discussion periods per week. 10A is not prerequisite to 10B. 10B is not prerequisite to 10C. Orientation into human ecology. Areas of current conflict are presented from diverse viewpoints. Debate and discussion groups permit students to make value judgments on critical issues involving the quality of the environment and competition for resources.

The Staff (F, W, Sp)

For courses numbered 39, 44, and 45 see the listing under Residential Program.

39A—39B—39C. Freshman Seminars. (2—2—2)

Approximately two hours of discussion once each week. Enrollment in each seminar limited to twelve. Priority given to students in the Residential Program but other students may be admitted when enrollment permits. Topics include themes from history, literature, education, art, music, and dance. Topics vary each quarter according to mutual interests of students and faculty. Study of topic will involve directed reading, discussion and/or oral and written reports. May be repeated for credit with a different instructor. Up to three sections may be taken simultaneously. A grade is assigned at the end of each quarter. Any quarter of this course may be taken independently. Mr. Slottman (in charge) (F, W, Sp)

44A—44B—44C. European History and Literature: Topics in the Greco-Roman, Medieval, and Early Modern Background. (5, 7, 10; 5, 7, 10; 5, 7, 10)

One lecture, two tutorials, and two seminars per week. Detailed study of the history and literature of Europe from the fall of Rome to the French Revolution. An interdisciplinary approach with instruction in small groups; individual projects directed by the staff rather than examinations. Mr. Slottman (in charge) (F, W, Sp)

*45A—45B—45C. Romanticism and the New Industrial Society. (5—7—10; 5—7—10; 5—7—10)

One hour of lecture, two tutorials, and two seminars per week. Prerequisite: Reading and Composition 1A—1B, History 4C—4D, or equivalents. Detailed study of the history and literature of Europe, especially England, France, and Germany, from 1770 to 1800.

Mr. Slottman (in charge) (F, W, Sp)

Upper Division Courses

100. Problems in Marine Biology. (15)

Full-time study at the Bodega Marine Laboratory. Prerequisite: Biology 1 or 1I and consent of instructor. Lectures, laboratory, field work, and directed study on selected topics, stressing experience in original research.

Mr. Simmons, Mr. Ghiselin (Sp)

*104. Storm and Stress in Opera and Drama. (4)

Two 1½-hour meetings and one 1-hour discussion period per week. A study of the theatrical movement in the 1770’s, particularly at Mannheim, that culminated in Schiller’s Die Räuber and Mozart’s Idomeneo. With consideration of antecedents (melodrama, Shakespeare revival, the Encyclopedists) and relations to subsequent developments (Romantic realism, Gesamtkunstwerk). Mr. Heartz, Mr. Mann


Four to four and one-half hours of lecture per week. A study of the inter-relationships of literature and the visual arts in eighteenth-century England, concentrating on major figures such as Hogarth, Pope, Reynolds, Walpole, Fielding, Thomson, and Blake. Enrollment limited to twenty students majoring in English or History of Art. Admission by consent of the instructors.

108. Computers and Society. (3)

Three hours of lecture per week. Prerequisites: none. No initial knowledge of computers is assumed. This is not an introductory programming course. An inspection of the role of computers in industrialized society, their present impact on the technology and social organization of American society, and their likely and possible impact on the future.

Mr. Hoffman (F)

109. Political and Ecclesiastical Symbolism in the Middle Ages. (4)

Three hours of lecture and one hour of discussion. Symbolism of the Middle Ages as it appears in literature and art, in insigia, ritual and ceremonial, in worship and thought: a study of integrated exemplarism in the medieval view of State and Church, of Cosmos and Mysterium.

Mr. Laddner (Sp)

114. Elements of Digital Computers. (4)

Three hours of lecture per week. Prerequisite: Physics 4C. Introduction to digital logic elements, memory elements, and recording methods. Emphasis on factors which influence the logical design and organization of digital computers.

Mr. Graham, Mr. Morton (Sp)

*115. Music and Poetry of the English Renaissance. (4)

(Formerly English 115 and Music 115) Four hours of lecture per week. Prerequisite: major in English or music or consent of instructor. English music, from the carol to the madrigal and "recitative music," and English poetry, from late medieval forms to the sonnet and the masque, will be studied to explore their relationships.

120. Environmental Education and Design. (5)

Group discussions, visitor presentations: two 2½-hour meetings per week; six hours per week, student-selected field experience. Prerequisite: consent of instructor. Curriculum and resource development. Environmental play, learning, and design in urban and non-urban environments, both natural and man-made. Teaching methods. An experiential process of shared learning. May be repeated twice for credit.

Mr. Moore (F); Mr. Hurst (W); Mr. Hancock (Sp)

124. Chemical Methods in Nuclear Technology. (3)

One and one-half hours of lecture and one 4½-hour laboratory per week. Prerequisite: Nuclear Engineering 102 or Chemistry 123. Experimental illustrations of the inter-relation between chemical and nuclear science and technology; fission process;
chemistry of fission fragments; chemical effects of nuclear transformation; application of radioactivity to study of chemical problems; neutron activation analysis.

Mr. Street, Mr. Prussin (Sp)

131. Systems, Graphs, and Combinatorics in Design. (4)

Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: elementary knowledge of computer programming. An introduction to the use of dynamic programming in the formulation and solution of combinatorial and optimization problems in design. Emphasis on the use of the computer for the solution of complex systems.

Mr. Distefano (F)

136. Biological Deterioration of Wood. (3)

One 3-hour tutorial per week with guided reading. Prerequisite: consent of instructor. Enrollment limited. Study of the deterioration of wood in use by fungi, bacteria, and insects, and its control or prevention.

Mr. Wilcox, Mr. Wood (Sp)

137. The Age of Charlemagne: Tradition and Innovation. (5)

Three hours of lecture per week. Prerequisite: open to all students in all disciplines. In focusing upon a common theme in three different fields of cultural expression—music, literature, and the visual arts—this course will attempt to identify significant cultural forces striking through the whole of the age of Charlemagne.

138. Michelangelo and His Age, 1475–1564. (5)

Three hours of lecture and 1 hour of discussion per week. An in-depth analysis of the works of Michelangelo in sculpture, painting, architecture, and poetry, and the historical and cultural context within which they were produced.

145. Physical Problems about the Earth. (4)

Three 1-hour lectures and one discussion period per week. Prerequisite: Physics 105A–105B. A treatment of some central problems on the evolution and structure of the Earth from a physical viewpoint. An analysis of the dynamics and deformation of the Earth will be based on analytical mechanics, wave theory, thermodynamics, and nuclear physics. Problems may vary from year to year.

Mr. Bolt (Sp)

155. Philosophies of India. (4)

Three hours of lecture per week. The philosophy of India, Hindu and Buddhist, beginning with the Vedic period and concentrating on the classical systems.

Mr. Staal (W)

175. A Nontechnical Introduction to Operations Research. (4)

Two lecture hours and two discussion hours per week. The course introduces to students in professional schools, basic concepts of systems science and operations research. A number of models and conceptual ideas are presented with illustrations and evaluations of the application of operations research in government, business, education, etc.

Mr. Churchman, Mr. Bailey, Mr. Holloway (W)

180. Economic and Biological Feedback Systems. (3)

Three hours of lecture per week. Prerequisite: Mathematics 51A or equivalent. Feedback sequences, system responses to exogenous changes, estimation, simulation, and prediction. Examples in government, economics, business, and biology. Growth dynamics, phase-plane methods, state variables, statistical signals, sampled data, stability, root locus, gradient methods, and computer simulation of large systems.

Mr. Smith (W)

186. Remote Sensing of Earth Resources. (5)

Three 1-hour lectures per week, one term paper, and one weekend field trip. The identification and mapping of earth resource features (timber, forage, minerals, soils, and water) on aerial photographs, space photographs, and other forms of remote sensing data.

Mr. Colwell (Sp)

§191C. Community Health. (2–10)

Prerequisite: consent of instructor. An introduction to the basic issues and problems of community health care. Students will combine individual study with group research projects. These projects will deal with specific issues (e.g., health care delivery, health care manpower, or health care technology).

Mr. Macey, Mr. Hayes-Bautista, Mr. Mishell (F, W, Sp)

§191D–191E. Seminar in Community Health. (2–10)

Hours commensurate with credit received. Prerequisite: course 191C or consent of instructor. Depth study of broad issues in health care. Specific topics will be announced at beginning of each quarter. Students will combine individual study with group research projects. Participation may be for one or two quarters.

Mr. Macey, Mr. Hayes-Bautista, Mr. Mishell (F, W, Sp)

H195A–H195B. Senior Honors Thesis. (4–4)

Open only to honors students with an individual group major in the College of Letters and Science. The senior thesis will be written while a student is enrolled in IDS H195A–H195B. Credit and grades will be assigned only upon completion of the full sequence. The thesis serves to integrate and synthesize the principal theme common to the courses comprising the major.

Adviser for the major in charge (F, W, Sp)

Graduate Courses

200. Comparative Neurophysiology (4)

(Formerly Zoology 225)

Three 1-hour lectures and one discussion period per week. Prerequisite: consent of instructor. Comparative structure and function of nervous systems. Emphasis on the analysis of membrane phenomena, sensory information processing, central integration, control of motor systems, and the development of neuronal circuitry.

Mr. Bowell, Mr. Steinhardt, Mr. Bentley (F)

200L. Advanced Laboratory in Neurophysiology. (5)

(Formerly Zoology 225L)

Two 6-hour laboratories per week. Prerequisite: course 200L (may be taken concurrently) or consent of instructor. Intended to provide the student with a working knowledge of current neurophysiological techniques through demonstrations, exercises, and special problems.

Mr. Bowell, Mr. Steinhardt, Mr. Bentley (F)

201. Cellular Mechanism Underlying Nervous Activity. (3)

Three hours of lecture per week. Prerequisite: Zoology 225 or consent of instructor. The first part of the course deals with the physical basis of how nerves, muscles, and synapses work. The second part
considers how the specialized membrane properties of neurons mediate transduction in photoreceptors, audition olfaction, taste, and touch.

Mr. Werblin, Mr. Westheimer, Mr. Lewis (W)

201L Laboratory Cellular Mechanisms Underlying Nervous Activity. (3)

Two 3-hour laboratories per week. Prerequisite: Zoology 225, course 201 (may be taken concurrently) or consent of the instructor. Advanced laboratory involving use of electrophysiological tools in the investigation of excitable membrane biophysics and receptor physiology. Prospective students should consult instructors before considering this course.

Mr. Werblin, Mr. Westheimer, Mr. Lewis (W)

202L Advanced Laboratory in Neural Integration and Coordination. (3)

(Formerly Physiology 202L)

Three 3-hour lectures per week. Prerequisite: Zoology 225 or course 201, or consent of the instructor. The organization of neurons into functional aggregates; the physiological mechanisms of sensation, perception, coordination, and motor control. The organization of reflex activity; command control, rhythmic and patterned behavior, organization of coordination in learning and ontogeny. Outlines available.

Mr. Barlow, Mr. Stent, Mr. Keller (Sp)

204L Animal Behavior Research Reviews. (1)

One and one-half hours of lecture per week. Prerequisite: graduate standing, basic course in animal behavior, and consent of the instructor. Reports and discussions of original research or views, completed or in progress. Not all participants need report, but all are expected to attend and to enter into the discussions. Meetings during Fall and Spring will be at the Animal Behavior Field Station.

Mr. Glickman, Mr. Caldwell (F, W, Sp)

§205A–205B–205C. Clinical Correlates of Human Morphology, Physiology, and Biochemistry. (3–3–3)

Three 1½-hour lectures and clinical sessions per week. Prerequisite: consent of instructor. Correlation of normal and developmental anatomy, physiology, biochemistry, and genetics with clinical material. Readings, observations, and discussions of normal and abnormal changes in living subjects under joint direction of instructor and clinical preceptors.

Mr. Margen (in charge), Mr. Blum, Mrs. Timiras, Mr. Srebnik, Mrs. Palmour, Mr. Dekker (F, W, Sp)

§206A–206B–206C. Introduction to Patient Care. (2–2–2)

Eight hours of clinical sessions per week. Prerequisite: consent of instructor (to be taken concurrently with course 205A–205B–205C). Introduction to evaluation of health care delivery and extension of basic sciences to patient care. Extension of material covered in course 205A–205B–205C, in a clinical context.

Mr. Blum (in charge), Mr. Margen, Mrs. Timiras, Mr. Srebnik, Mrs. Palmour, Mr. Penhoet (F, W, Sp)

§207A–207B–207C. Psycho-social and Behavioral Science Correlates of Health and Disease. (3–3–3)

One 3-hour seminar per week. Prerequisite: consent of instructor. The seminar will consist of weekly discussions of family dynamics, medical care and health systems, normal psychosocial and physiological development and the role of an interviewer; from the viewpoint of the individual recipient of services.

Mr. Duhl, Mr. Blum, Mr. Lindheim (F, W, Sp)


Three to four hours of lecture per week. Prerequisite: Mathematics 190A–190B–190C, Statistics 131L, Economics 201A–201B–201C. Primarily for doctoral students in the Departments of Economics and Business Administration. 209A. Representation of individual preferences, Individual choice under uncertainty. The value of information to an individual decision-maker. Introduction to the theory of games. (F) 209B. Prerequisite: course 209A or Business Administration 292C. Theory of teams. Comparisons of adjustment processes in economies and teams; centralization and decentralization. Further topics in the theory of games. (W) 209C, Prerequisite: course 209B. Seminar in economics of decision, information and organization. Discussion of current problems, including the study of information technology and information cost. (Sp)

209B, Mr. Marschak (W)

210. Assessment of the Environment. (4)

(Formerly IDS 222)

One 4-hour lecture and one 4-hour laboratory per week. Enrollment limited to 25 students. Prerequisite: consent of instructor. Students in Landscape Architecture will be given priority. An environmental planner oriented interpretation of the physical, chemical, and biotic factors of the environment, and the vegetative mosaic.

Mr. Stone, Mr. Schultz, Mr. Arkley, Mr. McBride, Mr. Wahrhaftig (F)

211. Geological and Engineering Factors in Environmental Planning. (4)

(Formerly IDS 220)

Three hours of lecture and discussion and one half-day field trip per week. Prerequisite: consent of instructor. Consideration of the influence of geology and site conditions on urban land use. Field trips and discussions of procedures for incorporating geologic and engineering considerations into planning to avoid problems such as landslides, flooding, and earthquake damage. Term paper required.

Mr. Wahrhaftig, Mr. Twiss, Mr. Harder (W)

212. Advanced Seminar in Buddhist Studies. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. Specialized topics in Buddhist studies, involving the use of Sanskrit, Tibetan, and Chinese materials.

Mr. Staal, Mr. Lancaster (F)

213. Renewal Ideas and Movements from the Age of the Barbarian Invasions to the Carolingian Age. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: consent of instructor; knowl-
edge of Latin. A seminar centered around the study and interpretation of sources which document or represent the interaction between Roman restoration and Barbarian rebellion.

Mr. Ladner (Sp)


Two hours of lecture per week. Prerequisite: limited to law students and social science graduate students doing advanced graduate work in the area of law and society. Introduction to cross-disciplinary research on the role of law in society. Credit and grade to be awarded upon completion of the sequence.

Mr. Matza, Mr. Skolnick, Mr. Foote (F, W, Sp)

215A–215B. Faunal Analysis in Archaeology. (4–4)

One hour of lecture, one 3-hour laboratory, and three hours of independent laboratory work per week. Prerequisite: a course in comparative anatomy or Paleontology 126, which may be taken concurrently. Introduction to systematics of animals commonly found in archeological contexts, principles and procedures in faunal analysis of archeological sites, and practical training in osteology and research methods. May be taken on a pass/not pass basis.

Mr. Clemens, Mr. Isaac, Mr. Rodden, Mr. Savage (W, Sp)


Four hours of lecture per week. Laboratory variable Winter and Spring Quarters. Prerequisite: graduate standing or consent of instructor. Course dealing with approaches to design of projects requiring participation of several disciplines and design professions. Organization and conduct of multidisciplinary design teams. Interaction with community decision-making processes in establishing project goals, social and environmental.

Mr. Davis in charge (beginning F)


Three hours of lecture per week. Prerequisite: open to graduate students in Music, Classics, Sanskrit, and Ancient Near Eastern Studies. The musical systems of Ancient Greece and the Ancient Near East with particular focus on the emerging discoveries in Cuneiform texts concerning Sumero-Babylonian musicology.

Mr. Crocker, Mrs. Kilmer, Mr. Thraettte (F)

230. Amenity Resources Planning. (4)

Two 1½-hour seminars per week. Prerequisite: course 241 or consent of the instructor. The seminar will examine concepts of the environmental amenity including the health, esthetic, symbolic, and education functions of the environment. Subjective and objective scales of environmental quality. Legal, economic, behavioral community participation, and "design" methods of achieving environmental quality. Case studies of environmental planning and urban design agencies and projects.

Mr. Appleyard, Mr. Dickert (Sp)

240. Nutrition of Population Groups. (3)

One 3-hour lecture per week. Prerequisite: consent of instructor. Study of nutrition in contempo-
The Division of Interdisciplinary and General Studies offers a series of lower division sequences (1A–1B–1C–1D–1E–1F) in the Arts, Humanities, Sciences, and Social Sciences. Each of these sequences earns the student 18 units over a period of six quarters (3–3–3–3–3–3 units) and is designed to satisfy the following requirements of the College of Letters and Science: (a) English reading and composition for all students enrolled in the sequence, and Subject A for as many students in need of it as may be accommodated, and (b) four of the eight courses in humanities or natural science or social sciences required outside the area of the major. Credit and grade are normally assigned upon completion of the entire sequence, but other arrangements may be requested by petition. Special provisions may likewise be made for students who enroll in more than one sequence but wish to avoid duplication of certain aspects of the work which are carried on in all sequences. Beginning with the second quarter of each sequence, tutorial instruction (course 48) earning from 1 to 5 units a quarter is available to qualified students who wish to pursue a project or prepare themselves for a particular major.

The Division also offers majors in the Humanities and the Social Sciences, and hopes to make available by fall 1973 additional majors in the Arts and the Sciences. Information concerning these may be requested from the Division of Interdisciplinary and General Studies, 301 Campbell Hall, University of California, Berkeley, California 94720.

The Field Majors

I. THE FIELD MAJOR IN THE HUMANITIES

Lower Division Courses Required: Completion of Humanities 1A–1B–1C–1D–1E–1F or equivalent training in a similar course at another institution or in an approved combination of courses at Berkeley. Recommended: although no foreign language is required in the field major, interested students are advised (a) that training in at least one foreign language is highly desirable for anyone seriously concerned with the Humanities, (b) that training in two foreign languages, one of which must be Greek or Latin, is mandatory to the honors program, and (c) that certain graduate departments will not even consider for admission students who cannot claim a fair knowledge of at least two foreign languages.

Upper Division Courses Required: A minimum of 45 approved upper division units in the areas listed below (approved lower division courses may occasionally be substituted for upper division courses in satisfaction of certain requirements but may not be counted as part of the minimum total of 45 upper division units): (1) the Junior Course and the Senior Course (Humanities 103A–103B and 190); (2) either two courses in the Graeco-Roman humanities with special attention to at least two major philosophers (e.g., Classics 136A–136B; note that students doing the reading in the original Greek or Latin may substitute approved courses on nonphilosophical authors) and one course on the Bible (e.g., Near Eastern Studies 154C) or a one-year sequence in the ancient humanities with special attention to the Bible and at least
two major Graeco-Roman philosophers (e.g., Comparative Literature 151A–151B–151C); (3) a minimum of 18 units including either (a) three courses representing the high points of a national literary tradition (if selected from a foreign tradition, at least two of these must require reading of the texts in the original language) and one course on a related philosopher or philosophical area, or (b) three courses representing the high points of a humanistic philosophical tradition and one course on a related literary author or literary area (note that parts of this requirement may on occasion be automatically satisfied by completion of requirement 2 above); and (4) at least two related courses in Arts or Sciences or Social Sciences. Recommended: Prospective majors who have not completed Humanities 1A–1B–1C–1D–1E–1F with a grade of C+ or higher are urged to elect Humanities 100 before enrolling in Humanities 103A–103B.

Honors Program The requirements for graduation in the honors program are the same as those of the regular program with the following additions: the candidates for honors must (a) maintain a 3.00 general grade-point average, including the work completed during his last two years at Berkeley, (b) present at least one approved upper division course beyond the intermediate level in the original language in partial or total satisfaction of the requirement in a Greek or Roman author, (c) demonstrate a working knowledge of a second language, either through written examination or through completion of an approved upper division course beyond the intermediate level in the language, and (d) write an honors thesis (course HI98) under the direction of a member of the faculty.

Teaching Credential Students primarily interested in teaching in the Humanities at the senior high school and junior college level are advised to seek information concerning the M.A.T. program in Comparative Literature. Students primarily interested in teaching at the junior high school or grade school level should inquire from the chairman of the Teacher Training Committee of the Division of Interdisciplinary and General Studies.

II. THE FIELD MAJOR IN THE SOCIAL SCIENCES

Lower Division Courses Required: completion of Social Sciences 1A–1B–1C–1D–1E–1F or equivalent training in a similar course at another institution or in an approved combination of courses at Berkeley. Recommended: although no foreign language is required in the field major, interested students are advised (a) that training in at least one foreign language is highly desirable for anyone seriously concerned with the Social Sciences, (b) that training in two foreign languages, one of which must be Greek or Latin, is mandatory to the honors program, and (c) that certain graduate departments will not consider for admission students who cannot claim a fair knowledge of at least two foreign languages.

Upper Division Courses Required: A minimum of 45 approved upper division units in the areas listed below (approved lower division courses may occasionally be substituted for upper division courses in satisfaction of certain requirements but may not be counted as part of the minimum total of 45 upper division units): (1) the Junior Course and the Senior Course (Social Sciences 103A–103B and 190); (2) (a) one course each on two major areas of Greek or Roman History or both, or individual historians or social thinkers or political theorists or immediately related topics, and (b) one course dealing with the ancient Near East or any other ancient society other than but related to those of Greece and Rome; (3) a minimum of 18 units including either (a) at least three courses representing the high points of a coherent historical tradition (normally selected from the offerings of the Department of History, although approved
history courses in other departments may be substituted with the adviser's permission) and one course in an immediately related area of a non-historical social science or (b) at least three courses in a coherent area of a non-historical social science (normally selected from the offerings of the Departments of Anthropology, Demography, Economics, Geography, Linguistics, Political Science, Psychology, and Sociology) and one course in an immediately related area of a historical tradition; and (4) at least two related courses in the Arts or Humanities or Sciences. Recommended: Prospective majors who have not completed Social Sciences 1A-1B-1C-1D-1E-1F with a grade of C+ or higher are urged to elect Social Sciences 100 before enrolling in Social Sciences 103A-103B.

Although the foregoing requirements will normally be satisfied by courses in the College of Letters and Science, the Board of Advisers will consider petitions to substitute courses offered by other colleges and schools.

Honors Program The requirements for graduation in the honors program are the same as those of the regular program with the following additions: the candidate for honors must (a) maintain a 3.00 general grade-point average, including the work completed during the last two years at Berkeley, (b) present at least one approved upper division course in the original language beyond the intermediate level in partial or total satisfaction of the requirement in the Greek or Roman area, (c) demonstrate a working knowledge of a second language, either through written examination or through completion of an approved upper division course beyond the intermediate level in the original language, and (d) write an honors thesis (course H198) under the direction of a member of the faculty.

Teaching Credential Students interested in securing a teaching credential should inquire from the chairman of the Teaching Training Committee of the Division of Interdisciplinary and General Studies.

The Arts

Lower Division Courses

1A-1B-1C-1D-1E-1F. Creation and Transmission in the Arts. (3-3-3-3-3-3)

Two 1-hour lectures and two 1-hour laboratory and/or section meetings per week. Lectures and discussions concentrating upon topics of immediate significance represented in various forms of the ancient and modern arts. Materials will be drawn primarily from architecture, music, painting, and sculpture; practice in the written expression of ideas will be carried out throughout the sequence, and special instruction will be provided for students in need of remedial English. Credit and grade will normally be assigned upon completion of the entire sequence.

48. Special Projects in the Arts. (1-5)

Tutorial meetings to be arranged. Prerequisite: limited to students currently enrolled in Arts 1A-1B-1C-1D-1E-1F and doing honors-level work therein. Projects normally carried out in groups of not more than 5 students working under the direction of a qualified instructor. Grade and credit will normally be assigned upon completion of the project, regardless of the number of quarters and units involved. May be repeated six times for credit.

The Staff

Upper Division Courses

190. Senior Problems in the Humanities. (4)

Three 1-hour discussion periods per week. Prerequisites: Humanities 103A-103B and at least 12 upper division units in literature and philosophy, including at least one course on a Greek or Roman philosopher. Application of the methods of the humanities to a problem in literature, philosophy, or an immediately related area.

Mr. Forsyth, Mr. Felker (F, W, Sp)
198. Directed Group Study for Upper Division Students. (1–5)

Hours to be arranged. Prerequisite: consent of the instructor. Directed groups study on special topics approved by the Division.
Mr. Dillon in charge (F, W, Sp)

H198. Honors Course. (1–5)

Prerequisites: honors standing, 20 units of upper division literature and philosophy including course 103A–103B or the equivalent, and a knowledge of completion of the project, regardless of the number of quarters and units involved. May be repeated six times for credit.
Mr. Dillon in charge (F, W, Sp)

The Sciences

Lower Division Courses

1A–1B–1C–1D–1E–1F. Creation and Transmission in the Sciences. (3–3–3–3–3–3)

Two 1-hour lectures and two 1-hour laboratory and/or section meetings per week. Lectures and discussions concentrating upon topics of immediate significance represented in various forms of the ancient and modern sciences. Materials will be drawn primarily from the sciences, the history of science, and the philosophy of science; practice in the written expression of ideas will be carried out through the sequence, and special instruction will be provided for students in need of remedial English. Credit and grade will normally be assigned upon completion of the entire sequence.
Mr. Bremermann in charge (begins F)

48. Special Projects in the Sciences. (1–5)

Two hours of lectures and two hours of laboratory per week. Prerequisite: limited to students currently enrolled in Sciences 1A–1B–1C–1D–1E–1F and doing honors-level work therein. Projects normally carried out in groups of not more than 5 students working under the direction of a qualified instructor. Grade and credit will normally be assigned upon completion of the entire sequence.
Mr. Von Blum in charge (begins F)

The Social Sciences

Lower Division Courses

1A–1B–1C–1D–1E–1F. Creation and Transmission in the Social Sciences. (3–3–3–3–3–3)

Two 1-hour lectures and two 1-hour laboratory and/or section meetings per week. Lectures and discussions concentrating upon topics of immediate significance represented in various forms of the ancient and modern social sciences. Materials will be drawn primarily from history, the other social sciences, and the modern media of communication; practice in the written expression of ideas will be carried out throughout the sequence, and special instruction will be provided for students in need of remedial English. Credit and grade will normally be assigned upon completion of the entire sequence.
Mr. Bremermann in charge (begins F)

48. Special Projects in the Social Sciences. (1–5)

Tutorial meetings to be arranged. Prerequisite: limited to students currently enrolled in Social Sciences 1A–1B–1C–1D–1E–1F and doing honors-level work therein. Projects normally carried out in groups of not more than 5 students working under the direction of a qualified instructor. Grade and credit will normally be assigned upon completion of the project, regardless of the number of quarters and units involved. May be repeated six times for credit.
Mr. Coale in charge (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Class hours to be arranged. Enrollment is restricted by regulations on page 87. Must be taken on a passed or not passed basis.
Mr. Dillon in charge (F, W, Sp)

Upper Division Courses

191A. Introduction to Aquanautics. (4 or 5)

Two hours of lecture and one 3-hour pool laboratory meeting per week, and six 7-hour Saturday laboratory meetings. Prerequisites: University medical and swimming examinations, and consent of instructor. Required equipment to be supplied by student. History, theory, and practice of scientific diving. Adaptation to underwater environment, life support systems, instrumentation and control procedures in preparation for subtidal study and research. Students taking the course for 5 units will undertake directed projects in the application of aquanautics to individual disciplines.
Mr. Austin (F)

198. Directed Group Study for Upper-Division Students. (1–5)

Hours to be arranged. Prerequisite: consent of the instructor. Directed group study on special topics approved by the Division.
Mr. Karas in charge (F, W, Sp)

190. Senior Problems in the Social Sciences. (4)

Three 1-hour discussion periods per week. Prerequisites: Social Sciences 100A–100B and at least 12 additional upper division units in history and other social sciences, including at least one course in the Greek or Roman area. Application of the methods of the social sciences to a problem in history, the other social sciences, or an immediately related area.
The Staff (F, W, Sp)

198. Directed Group Study for Upper-Division Students. (1–5)

Hours to be arranged. Prerequisite: consent of the instructor. Directed group study on special topics approved by the Division.
Mr. Coale in charge (F, W, Sp)

H198. Honors Course. (1–5)

Prerequisites: honors standing, 20 units of upper division history and other social sciences including course 103A–103B or the equivalent, and a knowledge of two foreign languages including either classical Greek or classical Latin. Preparation and writing of an honors thesis under the supervision of a member of the faculty.
Mr. Coale in charge (F, W, Sp)
I. **INTERNATIONAL EDUCATION**

(Department Office, 2538 Channing Way, Room 104A, Building D)

The Education Abroad Program for undergraduates and graduates is under the Office of International Education. For additional information see page 62 (for undergraduates) and page 44 (for graduates).

The Office of International Education also sponsors the Professional Studies Program in New Delhi, India. Students from the professional schools spend at least two quarters working and studying in the program. Seminars are given each quarter by the program's director (a UC faculty member). The students also work as interns in local government agencies appropriate to their professional interest.

Upper Division Course

100. Cultural Traditions of India. (1-4)

One to four hours of seminar per week, plus field trips. An interdisciplinary approach to the religious, historic, literary, artistic, and architectural achievements of Indian civilization. Activities will include: readings, lectures, slides, and discussions. Field trips to performances, museums, and historic sites will be included. Enrollment limited to participants in the Professional Studies Program: India.

Mr. McCormack (F, W, Sp)

Graduate Courses

200. Cultural Traditions of India. (1-4)

One to four hours of seminar per week, plus field trips. An interdisciplinary approach to the religious, historic, literary, artistic, and architectural achievements of Indian civilization. Activities will include: readings, lectures, slides, and discussions. Field trips to performances, museums, and historic sites will be included. Enrollment limited to participants in the Professional Studies Program: India.

Mr. McCormack (F, W, Sp)

II. **ITALIAN**

(Department Office, 5125 Dwinelle Hall)

Professors:

Louis George Clubb, Ph.D.

Gustavo Costa, Dottore in Filosofia (Chair-man)

Arnolfo B. Ferruolo, Dottore in Lettere

Nicolas J. Perella, Ph.D.

Michele De Filippis, Ph.D. (Emeritus)

Enrico De Negri, Dottore in Filosofia (Emeritus)

Major Adviser: Mr. Stefanini.

Graduate Advisers: Mr. Ferruolo, Mr. Perella.

The Department offers courses designed to lead to proficiency in the Italian language as well as to a critical appreciation of the literature of Italy from its beginnings to the present. It also provides courses on Italian civilization at the lower division level, and upper division courses of Italian literature in English translation. At the

NOTE: For key to footnote symbols, see page 86.
graduate level, students will find the opportunity for advanced work in philology as well as in literature.

The Major

Lower Division  1, 2, 3, 4, 5, or their equivalents.

Upper Division  40 units of upper division courses (of which 20 units must be taken in residence) including: 101A–101B and 103A–103B or their equivalent.

Honors Program  An honors program is open to senior students who have a 3.0 overall grade-point average and a 3.5 grade-point average in upper division courses in Italian. The honors program will include, in addition to the requirements for the major, Italian H195 for two quarters and a comprehensive examination.

Graduate Study

Master of Arts in Italian.  Requirements: 36 units of upper division and graduate courses in Italian of which at least 18 units must be in the 200 series. Italian 200 and Italian 203 are required. With the consent of the graduate adviser, a maximum of 4 units of course work outside the Department may be counted towards the over-all unit requirement. In the final quarter of residence candidates must pass the comprehensive written and oral examinations. Further information may be obtained from the departmental office.

Doctor of Philosophy in Italian.  The program for the Ph.D. degree in Italian is open to students holding an M.A. in Italian or in a program in which Italian was the major field of study. The student admitted to the program undertakes study and course work in preparation for: (1) a preliminary examination on Italian literature from the origins to the present which is to be taken within four quarters after admission to the program, (2) an Italian philology requirement to be satisfied by examination or prescribed course work before (3) a comprehensive qualifying examination on a major period of Italian literature and a minor in a related humanistic discipline. Before the qualifying examination can be taken, the student must also prove to have a reading knowledge of Latin and of a modern foreign language other than Italian (e.g., French, German, Spanish, Russian). For further information please contact the Department.

Doctor of Philosophy in Romance Languages and Literature.  (For this program, consult the publication issued by the Graduate Division on Languages and Literatures and the Fine Arts.)

*Letters and Science List:* for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

The first year of work in a foreign language in secondary school is considered to be equivalent to one quarter in college; each successive year in the same foreign language in secondary school is equal to one additional course in a sequence of four quarter courses in college.

Five 1-hour meetings and one laboratory period per week. Each of these courses combines language instruction with an introduction to the most important aspects of Italian civilization. Entrance into these courses 2, 3, and 4 depends only upon appropriate language proficiency.

1. Elementary language and Italian civilization from the origins to the Renaissance.  Mr. Ferrnolo in charge (F, W, Sp)
2. Elementary language and Italian civilization from the Renaissance to the present.  Prerequisite: course 1, or the equivalent.  Mr. Ferrnolo in charge (F, W, Sp)
3. Intermediate language and special topics on Italian civilization.  Prerequisite: course 2, or 12A, or the equivalent.  Mr. Ferrnolo in charge (F, W, Sp)
4. Intermediate language and special topics on Italian civilization.  Prerequisite: course 3, or the equivalent.  Mr. Ferrnolo in charge (F, W, Sp)
109A–109B–109C. Dante's "Divina Commedia." (4–4–4)
Three 1-hour meetings per week.

109A. Inferno. Mr. Stefanini (F)
109B. Purgatorio. Mr. Stefanini (W)
109C. Paradiso. Mr. Stefanini (Sp)

*110A–110B. Italian Literature of the Thirteenth and Fourteenth Centuries. (4–4)
Two 1½-hour meetings per week.

110A. Emphasis on the "Stil Nuovo" and Dante's minor works. Mr. Stefanini (F)
110B. Emphasis on Boccaccio's Decameron and Petrarch's Rime. Mr. Stefanini (W)

111. Italian Literature of the Fifteenth Century. (4)
Three 1-hour meetings per week. Humanism and the Early Renaissance. Mr. Ferruolo (Sp)

*112A–112B. Italian Literature of the Sixteenth Century. (4–4)
Three 1-hour meetings per week.

112A. The High Renaissance. Mr. Ferruolo (W)
112B. The Late Renaissance. Mr. Ferruolo (Sp)

*114. Italian Literature of the Eighteenth Century. (4)
Three 1-hour meetings per week. Emphasis on the works of Vico, Goldoni, Farini, and Alfieri. Mr. Costa (F)

*115A–115B. Italian Literature from 1800 to 1850. (4–4)
Three 1-hour meetings per week.

115A. From Neoclassicism to Romanticism. Mr. Perella (W)
115B. Romanticism. Mr. Perella (Sp)

116. Italian Literature from 1850 to 1900. (4)
Three 1-hour meetings per week. Main trends in poetry and prose. Mr. Perella (F)

117A–117B. Italian Literature of the Twentieth Century. (4–4)
Three 1-hour meetings per week.

117A. Poetry and the Drama, with emphasis on the Hermetic poets and Pirandello. Mr. Costa (W)
117B. The Novel from Svevo to the present. Mr. Rebay (Sp)

H195. Special Study for Honors Candidates. (2–4)
Individual conferences to be arranged. To be taken for two quarters in the senior year.
The Staff (Mr. Stefanini in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Restricted to senior honor students with a 3.0 overall grade-point average or better. Must be taken on a passed or not passed basis.
The Staff (Mr. Stefanini in charge) (F, W, Sp)
Courses for Non-Majors

The following courses are open to non-majors with at least a junior standing and, with consent of instructor, to properly qualified students with sophomore standing.

*130. Dante’s Divine Comedy. (4)
Three 1-hour meetings per week. An introduction to the thought and writings of Dante Alighieri with emphasis on a critical reading of the Divine Comedy.
Mr. Perella (F)

*131. The Language of Dante. (2)
Two 1-hour meetings per week. Instruction in the Italian language and stylistic analysis of selected texts of Dante in the original, to be taken only in conjunction with Italian 130.
Mr. Perella (F)

140. Petrarch. (4)
Three 1-hour meetings per week. Analysis and discussion of the Canzoniere and the Trionfi in translation, with reference to Medieval and Renaissance poetry.
Mrs. Clubb (Sp)

141. The Language of Petrarch. (2)
Two 1-hour meetings per week. Instruction in the Italian language and stylistic analysis of selected texts of Petrarch in the original, to be taken only in conjunction with Italian 140.
Mr. Clubb (Sp)

150. Machiavelli. (4)
Three 1-hour meetings per week. The political and literary works in the context of the thought and culture of his age.
Mr. Ferruolo (W)

151. The Language of Machiavelli. (2)
Two 1-hour meetings per week. Instruction in the Italian language and stylistic analysis of selected texts of Machiavelli in the original, to be taken only in conjunction with Italian 150.
Mr. Ferruolo (W)

*160. Italian Culture during the Fascist Period
(1922-45). (4)
Three 1-hour meetings per week. Prerequisite: consent of instructor. This course, in which professors of several disciplines will participate, will examine the cultural climate of the Fascist regime through a study of the literature, plastic arts, movies, politics, economics, and the social life of that age.
Mr. Costa, Mr. Webster (Sp)

*161. The Language of Futurism. (2)
Two 1-hour meetings per week. Instruction in the Italian language and stylistic analysis of selected texts (in the original) of the Futurist and Fascist periods. To be taken only in conjunction with course Italian 160.
Mr. Costa (Sp)

*170. Modern Italian Literature. (4)
Three 1-hour meetings per week. The individual, society, and the crisis in traditional values as revealed in the major literary works from the Romantic movement to the contemporary Italian scene.
Mr. Costa (W)

*171. The Language of Modern Italian Writers. (2)
Two 1-hour meetings per week. Instruction in the Italian language and stylistic analysis of selected Italian texts of one or more authors dealt with in the course. To be taken only in conjunction with Italian 170.
Mr. Costa (Sp)

180. Pirandello. (4)
Three 1-hour meetings per week. Analysis of five major plays in translation, in connection with the existential crisis in contemporary Italian culture.
Mr. Costa (F)

181. The Language of Pirandello. (2)
Two 1-hour meetings per week. Instruction in the Italian language and stylistic analysis of selected texts of Pirandello in the original, to be taken only in conjunction with Italian 190.
Mr. Costa (F)

Graduate Courses and Seminars

200. Syntax, Lexicon, and Stylistic Analysis. (4)
One 3-hour meeting per week. Study of literary language, poetic form and metre, and prose styles. Exercises in written stylistic analysis of texts. Required of all candidates for the M.A. in Italian.
Mr. Moses (W)

*201A–201B. Historical Grammar. (4-4)
One 3-hour meeting per week.

202. Minor Medieval Authors. (4)
One 3-hour meeting per week. Lyric, religious, didactic, and satirical poetry; chronicles, novelle, and treatises.
Mr. Stefanini (W)

*203. Literary Movements and Genres, Trends in Literary Criticism, Methods of Bibliography. (4)
One 3-hour meeting per week. Survey of genres and literary movements from 13th to 20th centuries; outline of trends in Italian literary criticism; introduction to tools of bibliographical research and library facilities. Required of all candidates for the M.A. in Italian.
Mr. Costa (F)

204. Literary Criticism. (4)
One 3-hour meeting per week. Mr. Costa (Sp)

*205. History of the Italian Language.
One 3-hour meeting per week. Mr. Stefanini (Sp)

*209. Seminar on Dante. (4)
One 3-hour meeting per week.

*211. Seminar on Petrarch. (4)
One 3-hour meeting per week. Mr. Ferruolo (W)

*213. Seminar on Boccaccio. (4)
One 3-hour meeting per week.

217. Studies in the Renaissance. (4)
One 3-hour meeting per week.
*217A. Humanism. ——— (F)
217B. The Theatre. Mrs. Clubb (F)
*217C. Ariosto. Mrs. Clubb (W)
*217D. Tasso. Mr. Ferruolo (F)

*218. The Age of the Baroque. (4)
One 3-hour meeting per week. Mr. Perella (Sp)

*219. The Age of Enlightenment. (4)
One 3-hour meeting per week. Mr. Costa (Sp)

*221. Studies in the Nineteenth Century. (4)
One 3-hour meeting per week.
*221A. Romanticism. Mr. Perella (Sp)
*221B. Leopardi. Mr. Perella (Sp)
*221C. Manzoni. Mr. Perella (F)
223. Studies in the Twentieth Century. (4)
   One 3-hour meeting per week.
   223A. Poetry and Theater. Mr. Rebay (Sp)  
   *223B. Prose.

*225. The Italian Lyric. (4)
   One 3-hour meeting per week. Forms and themes of the Italian lyric in relation to principal schools and movements. Mr. Perella (W)

299. Special Study for Graduate Students. (2–6)
   Individual conferences to be arranged, specifically designed for students who wish individually to pursue a special program of study and research not covered by any other course or seminar. Units of credit to be determined by the instructor.
   The Staff (Mr. Ferruolo in charge) (F, W, Sp)

601. Individual Study for Master's Candidates. (1–8)
   Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
   The Staff (Mr. Ferruolo in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
   Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
   The Staff (Mr. Ferruolo in charge) (F, W, Sp)

16. Beginning Italian for Graduate Students.
   (No credit)
   Mrs. Ross (F)

   (No credit)
   Mrs. Ross (W)

JOURNALISM

(Department Office, 607 Evans Hall)

Professors:
   Edwin R. Bayley, B.A. (Chairman)
   Joseph P. Lyford, B.A.
   Albert G. Pickerell, Ph.D.
   Bernard B. Taper, M.A.
   Robert W. Desmond, Ph.D. (Emeritus)
   Kenneth N. Stewart, B.Litt. (Emeritus)

Graduate Advisers: Mr. Bayley, Mr. Spaulding.

Undergraduate Advisers: Mr. Lyford, Mr. Pickerell, Mr. Sesser, Mr. Spaulding.

For more details on the program, write to the Dean, School of Journalism, 607 Evans Hall.

Upper Division Courses

100. Introduction to News Writing. (4)
   Three hours of lecture and discussion and eight hours of field work per week, with periodic tutorial sessions. Survey of journalistic principles and practices, and study and practice of methods of gathering, writing, and editing news. The Staff (F, W, Sp)

101. Advanced Writing for Journalists. (4)
   Three hours lecture and discussion and eight hours field work each week. Prerequisite: course 100. An extension of course 100 for students who seek additional instruction and practice in gathering, writing, and editing news, editorials, and features. Individual sections may be devoted to one or more specialized forms of journalistic writing, the topic will be announced each quarter by the School.
   Mr. Spaulding, Mr. Taper (W)

105. Introduction to News Editing. (2)
   Two hours of lecture and laboratory per week, with outside reading and editing assignments. Study of the principles and practice of editing news.
   Mr. Pickerell (Sp)

NOTE: For key to footnote symbols, see page 66.

ITALIAN; JOURNALISM / 345

Associate Professor:
   David Littlejohn, Ph.D.
   Assistant Professor:
   Stanford N. Sesser, M.A.

Senior Lecturers:
   James C. Spaulding, B.A.
   Andrew A. Stern, B.A.

110. Undergraduate Colloquium. (1)
   One and one-half hours lecture and discussion each week. Introduction to various branches of journalistic profession, by means of weekly meetings and discussions with the faculty of the School of Journalism and visitors. The Staff (Mr. Bayley in charge) (W)

140. History of American Journalism. (4)
   Three hours of lecture and discussion per week. Political, social, economic, technological, and cultural evolution of the press.
   Mr. Sesser (W)

141. The Mass Media and Society. (4)
   Three hours of lecture per week (attendance required) and three hours of discussion, for which attendance is voluntary. Critical analysis and discussion of contemporary trends, problems, and objectives of the media of mass communications.
   Mr. Lyford (F, Sp)

151. The Literature of Journalism. (4)
   Three hours lecture and discussion per week. Study of the selected works of outstanding writers for the American and European press, from the eighteenth century to the present.
   Mr. Littlejohn, Mr. Taper
165A. Legal Aspects of the News Media. (4)
Three hours lecture and discussion per week. Introduction to law of defamation and its application to news media; analysis of legal rights and restrictions on news media, including invasion of privacy, criminal libel, contempt, and confidence statutes.
Mr. Pickerell

165B. Legal Aspects of the News Media. (4)
Three hours lecture and discussion per week. Consideration of contemporary legal problems of the news media including free press-fair trial, obscenity and censorship, licensing and taxation, FCC and the Fairness Doctrine, access to meetings and judicial proceedings, and administrative regulations. (165A is not a prerequisite.) Mr. Pickerell

175. The Critical Review. (4)
Three hours of lecture and discussion or tutorial, and eight hours of field work per week. Prerequisite: consent of instructor. Limited to 15 students. Written assignments in the field of critical reviewing (books, film, drama, music, art, and architecture).
Mr. Littlejohn (Sp)

180. Issues in Television Journalism. (4)
Four hours of lecture and discussion per week. An evaluation of television news and documentaries from 1950 to the present. Course will analyze local and network news programs, examine problems newsmen face working within broadcast industry, role of the FCC, and the future of public television.
Mr. Stern

184. Reporting of Public Affairs. (4)
Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 100 or equivalent. Study of and practice in reporting news of judicial, legislative, and administrative functions of city, county, and state government.
The Staff (F, W, Sp)

185. Advanced Reporting of Public Affairs. (4)
Three hours of lecture and discussion and eight hours of field work each week. Prerequisite: course 184. An extension of course 184, for students who seek additional instruction and practice in the reporting of governmental functions.
Mr. Lyford, Mr. Spaulding (F)

190. Comparative World Journalism. (4)
Three hours of lecture and discussion per week. Examination of international news flow in nations and regions, with attention to sources of information, to media characteristics, and conditions of performance.
Mr. Pickerell

197. Field Study in Journalism. (1–5)
Supervised experience in the practice of journalism in off-campus organizations. Individual meetings with faculty sponsor and written reports required.
The Staff (F, W, Sp)

198. Directed Group Study in Journalism. (1–6)
Prerequisites: total grade-point average of not less than 3.0 and consent of committee in charge.
The Staff (F, W, Sp)

199. Supervised Individual Study and Research. (1–5)
Prerequisites: total grade-point average of not less than 3.0 and consent of committee in charge. Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)

200. News Writing. (4)
Three hours of seminar and eight hours of field work in news reporting per week. Periodical tutorial sessions. Required as prerequisite for advanced reporting and broadcasting courses.
The Staff (F, W, Sp)

205. News Editing. (2)
Two hours of lecture and laboratory per week, and outside assignments and reading. Study of the principles and practice of news editing, copyreading, head writing, and makeup.
Mr. Pickerell (Sp)

220. Public Affairs in Perspective. (4)
Three hours of seminar per week, with outside reading and field work. Study of and practice in the writing of opinion such as columns, commentaries, and editorials.
Mr. Bayley, Mr. Lyford (W)

225A–225B. Reporting on the American Community and Urban Affairs. (4–4)
Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200 or equivalent. Course 225A is prerequisite to 225B. Examination of the structure and the political and social character of communities, and practice in reporting on urban problems such as education, health, welfare, housing, and administration.
Mr. Lyford, Mr. Taper (W, Sp)

226. Reporting of Science and the Environment. (4)
(Formerly numbered 226A)
Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200 or equivalent. Course 225A is prerequisite to 225B. Examination of the structure and the political and social character of communities, and practice in reporting on urban problems such as education, health, welfare, housing, and administration.
Mr. Spaulding (W)

227. Reporting of Cultural Events. (4)
(Formerly numbered 227A)
Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200 or equivalent. Advanced study of methods of reporting developments in such fields as science, education, mental or physical health, psychology, or the environment.
Mr. Spaulding (W)

228. Political Reporting. (4)
(Formerly numbered 228A)
Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200 or equivalent. Study and discussion of politics and practice in reporting political events and campaigns. Offered in alternate years.
Mr. Bayley (Sp)

229. Reporting of Crime and the Courts. (4)
(Formerly numbered 229A)
Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200 or equivalent. Study of the function of the mass media in its relationship to the legal system, with field work in reporting news of the courts and other branches of the legal system.
Mr. Pickerell (W)

240. History of American Journalism. (4)
Three hours of lecture and discussion per week. Study of and research in the history of American journalism and its relation to social, economic, and political conditions of the period.
Mr. Sesser (Sp)
242. The Writing of Profiles, Personality Sketches, and Short Biographies. (4)

Three-hour seminar each week. Reading and discussion of eminent practitioners from Plutarch to the present, and research and writing projects. Mr. Taper

245. Social Aspects of the Mass Media. (4)

Two 1-1/2-hour lecture and discussion periods per week. Critical analysis of the mass media; discussion of problems of ethics and responsibility. Mr. Lyford

250. Investigative Reporting. (4)

Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200. Study of investigative reporting, analysis of its technique, with outside reporting assignments. Mr. Sessler (Sp)

251. Literature of Journalism. (4)

Two 1-1/2-hour seminars per week. A study of outstanding men whose journalistic work is of lasting historic and literary worth. Mr. Littlejohn, Mr. Taper

252. Magazine Article Writing. (4)

Three hours of lecture and discussion and eight hours of field work per week. Prerequisite: course 200. Study and analysis of the techniques of writing for magazines, research, writing and editing of articles for publication. Mr. Taper (F, Sp)


Two 1-1/2-hour discussion sessions per week. Study and analysis of public opinion, propaganda, and information techniques of the mass media and other agencies from World War II to the present. Mr. Littlejohn

265. The Law of Mass Communications. (4)

Two 1-1/2-hour lectures and discussion sessions and one hour consultation per week. Inquiry into contemporary legal controls affecting press, broadcasting, and films. Mr. Pickerell

282. Introduction to Television Reporting. (4)

Six hours of lecture and discussion and 14 hours of field work and laboratory per week. Prerequisites: course 200 or equivalent and consent of instructor. A study of the techniques, practices, and methods of handling television news. Field work, with 16 mm, sound and silent cameras, and videotape, on individual and group study assignments. Mr. Stern

283. Reporting for Television. (4)

Six hours of lecture and discussion and about 24 hours of field work and laboratory per week. Prerequisites: courses 282 and consent of instructor. Producing, directing, filming, and writing weekly television news programs. Mr. Stern

284. Documentary News Films. (4)

Twelve hours of field work and laboratory per week. Prerequisites: courses 282 and 283 and consent of instructor. Production of television documentary news films. Mr. Stern

290. International Communications—Foreign Press. (4)

Two 11/2-hour lectures and discussion per week. Cultural, economic, social, and political factors in development of national press systems; barriers to international communication; role of mass media in national development. Mr. Fickerell

295. Critical Writing. (4)

Three hours of lecture and discussion and eight hours of field work per week. Principles and practice of reviewing the arts. Mr. Littlejohn (W)

297. Field Study in Journalism. (1-5)

Supervised experience in the practice of journalism in off-campus organizations. Individual meetings with faculty sponsor and written reports required. The Staff (F, W, Sp)

298. Special Study for Graduate Students. (2-6)

For students who wish to pursue a special program of study and research not covered by any other course or seminar. Units of credit to be determined by the instructor. The Staff (F, W, Sp)

299. Individual Study in Mass Communications. (1-6)

Supervised research projects and reports. The Staff (F, W, Sp)

601. Individual Study for Master’s Students. (1-8)

Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

**LAW**

(Department Office, 225 Boalt Hall)

**Professors:**

Thomas G. Barnes, D.Phil.
Stephen R. Barnett, A.B., LL.B.
Babette B. Barton, B.S., LL.B.
Richard M. Buxbaum, A.B., LL.M.
Robert H. Cole, A.B., LL.B.
Rex A. Collings, Jr., M.A., J.D.
John E. Coons, B.A., J.D.
David Daube, Dr.Jur., Ph.D., D.C.L., M.A., LL.D., Dr.h.c.
Ronan E. Degnan, B.S.I., LL.B.

Bernard L. Diamond, A.B., M.D.
Albert A. Ehrenzweig, Dr.Jur., Dr.hon.causa, J.S.D. (Walter Perry Johnson Professor)
Melvin A. Eisenberg, A.B., LL.B.
David E. Feller, B.A., LL.B.
John G. Fleming, Ph.B., D.C.L.
Caleb Foote, M.A., LL.B.
Edward C. Halbach, Jr., A.B., LL.M. (Dean)
John R. Hetland, B.S.I., J.D.
Ira M. Heyman, B.A., LL.B.

**NOTE:** For key to footnote symbols, see page 86.
The following list indicates the courses usually offered each academic year, although changes in instructors and in course offerings are often necessary. After the title of each course is the credit value in semester units in parentheses, a brief description of the subject matter, and the names of the faculty who usually teach the course. Note: The term of instruction for the School of Law is fifteen weeks rather than ten weeks. Therefore, the units in Law, only, are indicated as semester units.

**Explanation of course numbering system:** (1) Courses are listed alphabetically, with two exceptions: Prescribed first-year courses are numbered 200 to 204, and special programs are numbered 295 to 299. (2) Courses that substantially are the same (although the emphasis or the number of units may differ) are given the same number, but a different identifying number following a hyphen. (3) Where no number is available at the place in the list at which a course belongs, the preceding number is assigned followed by a decimal point and another number. (4) Two-semester courses are identified by letters (e.g., 200A, 200B). Unless otherwise indicated, completion of the A part of the course is a prerequisite to taking the B part.

For requirements of the School of Law, see the Announcement of the School of Law, available without charge from the Law School Admissions Office, 220 Boalt Hall, Berkeley, California 94720.

**Professional Curriculum**

**First Year**

The first-year program is prescribed, consisting of five two-semester courses. Four of the classes are in large sections, with approximately 110 students in each. The fifth is a small section of 25 to 30 students. The program in the small section includes instruction in legal research and writing in the fall semester, and a moot court program in the spring. There are large sections and small sections in each of the first-year courses.

Thirty-one units are earned for satisfactory completion of the first-year program.

**200A-200B: Contracts.**

The law of contracts, dealing with the problems of formation, operation and termination.

Mr. Eisenberg, Mr. Kessler, Mr. Laube, Mr. Sweet

**201A-201B: Civil Procedure.**

The principles of pleading under the code system and the federal rules; modern trial practice, including venue, process, the jury, sufficiency of the evidence, instructions, verdicts, new trials, judgments; appellate procedure.

Mr. Degnan, Mr. Louisell, Mr. Stolz, Mr. Vetter

**202A-202B: Criminal Law and Procedure.**

An introduction to criminal law and procedure.

Mr. Foote, Mr. Johnson, Mr. Kadish, Mr. Ramsey, Mr. Sherry

**203A-203B: Property.**

An introduction to the law of real property including estates and other interests in land, real property marketing and conveyancing, land-use control, and landlord-tenant problems.

Mr. Coons, Mr. Hetland, Mr. Heyman, Mr. Riesenfeld, Mr. Sullivan

**204A-204B: Torts.**

The law of civil injuries, including both intended and unintended interference with personal and property interests as well as liability without fault.

Mr. Barnett, Mr. Cole, Mr. Fleming, Mr. Sugarman, Mr. Sweet

**Second and Third Year**

**206. Administrative Law. (2)**

A study of administrative procedure and of agency rules, orders, and discretion, federal and state. Emphasizes the problems that lawyers encounter when they deal with government agencies and their innumerable officers and employees.

Mr. Newman, Mr. Stolz

**208. American Legal History. (2)**

Selected problems in the legal history of California, such as the mining law of the Forty-niners, distribution of the public domain, and legal attacks on farm unionism.

Mr. Smith

**209. Antitrust Law. (3)**

Legal and economic problems of restraint of trade and monopoly; pricing and other marketing practices; Federal Trade Commission and private litigation.

Mr. Riesenfeld, Mr. Sullivan

**209.5. Antitrust Seminar. (2)**

Pre requisite: Law 209 (Antitrust Law) or equivalent; undergraduate background in microeconomics.

An inquiry into concepts and techniques that might be used to plan and implement a rational, consumer-oriented, antitrust enforcement policy.

Mr. Sullivan

**210. Appellate Advocacy. (2)**

Combines teaching by faculty, experienced practitioners and judges in the art of written and oral appellate argument, with exercises in that art under the supervision of members of the Moot Court Board and the faculty.

Mr. Feller and the members of the Moot Court Board

**211-1A-211-1B: Business and Nonbusiness Organizations, Law of. (3-2)**

A course designed for students who wish a basic introduction to problems of formation and operation of legal groups, and a general legal survey of the role of complex entities in modern society, but who do not expect to be involved in a general or business practice. It will stress organizational rather than financial problems, and the social aspects of corporate organization.

Mr. Buxbaum
211-2. Business Associations (Corporations). (5)
Basic problems in corporation law; formation of the corporation; issuance of shares; corporate control devices; authority of corporate executives; shareholders' derivative suits; obligations of management to corporations and shareholders, and of shareholders inter se; introduction to matters of corporate finance.
Mr. Choper

211-3A—211-3B. Business Associations (Corporations). (3—3)
A brief introduction to non-corporate forms of business organization is followed by a study of the basic materials on corporations in the federal system, with emphasis on the interaction of state and federal law on corporate regulation. Topics include formation of corporations, management-shareholder relations, shareholders' suits, issuance of shares, dividends and other distributions of assets, corporate reorganization and recapitalization, and alteration of shareholders' rights.

211-4A—211-4B. Business Associations (Corporations). (3—2)
Covers substantially the same material as Law 211-3A—211-3B, except that less attention is devoted to legal aspects of corporate finance.
Mr. Eisenberg

212. Business Planning. Selected Problems in. (2)
Prerequisites: Law 211-3A—211-3B (Business Associations [Corporations]); Law 250A—250B (Income Taxation I and II). Recommended: Law 272A—272B (Securities Regulation), which may be taken concurrently. Investigation of problems relating to the organization, financing and operations of partnerships and corporations. Business plans are devised and legal instruments drafted, analyzed and discussed with the cooperation of members of the corporate bar.
Mr. Carter

213. California Criminal Practice Seminar. (2)
Students work on criminal cases with practitioners, in addition to classroom sessions.
Mr. Johnson

214. California Marital Property. (2)
The law of California marital property, including separate property. The course includes a study of the general principles of classifying marital property, the management and control of community property, the liability of the marital property for debts and torts of the spouses, the division of the community property on divorce or death, and the property rights of putative and meretricious spouses.
Mr. Collings

215. Chinese Legal Institutions. (2)
A survey of legal and related administrative institutions in the People's Republic of China, from 1949 to the present, including informal and formal sanctions, civil dispute settlement, contracts, and family law. Considerable attention given to study of various forces which have shaped contemporary Chinese institutions, especially traditional Chinese institutions, Soviet influence, and Maoist ideology and political policies.
Mr. Lubman

215.5. Class Action Seminar. (2)
Class action procedures; proper use and defenses of class actions; problems of notice, distribution of awards, cross-complaints and counterclaims; fiduciary relationship between attorney, named plaintiffs and unnamed members of class; and problems of financing and settlement of class litigation.
Mr. Hetland

216. Clinical Studies. (5)
An opportunity for a direct working experience with poverty clients in both daily problems and major litigation. Course conducted in cooperation with the San Francisco Neighborhood Legal Assistance Foundation and the Alameda Legal Aid Society, with student-client interviewing taking place at neighborhood offices in San Francisco and Oakland.
Mr. Sitkin and Mr. Kayne

217. Collective Bargaining. Patterns in. (2)
A course for advanced students in the Department of Economics and the Schools of Law and Business Administration. An examination of economic, legal, structural, and institutional causes and effects of differing collective bargaining patterns, such as industrywide, coalition, and decentralized bargaining, and of current developments in these areas.
Mr. Feller, Mr. Strauss, Mr. Ulman

218A. Commercial Law I (Sales). (2)
Provides substantial familiarity with the Uniform Commercial Code except for the articles on commercial paper and on secured transactions. Explains commercial practices, including financing devices, in domestic and international settings. Deals not only with the relationship between buyer and seller, but also with incidental rights and obligations of creditors, collecting banks, and bona fide purchasers.
Mr. Fleming, Mr. Laube

218B. Commercial Law II (Secured Transactions, Documents of Title, Payment Transactions). (2)
Law 218A not a prerequisite. Covers topics governed by Uniform Commercial Code outside the law of sales. Principal focus is on secured transactions with personal property as collateral, commercial paper, documents of title and other aspects of payment- and security-transactions.
Mr. Riesenfeld

219. Communications Law Seminar. (2)
Consideration of selected problems of law and policy involving the mass media, particularly television. Study of media access, media control, the relationship between government and the press, and the functioning of today's communications media with respect to the purposes of the First Amendment.
Mr. Barnett

221. Comparative Jurisprudence Seminar. (2)
A seminar designed for those who wish to pursue their interests in a psychological (or sociological?) approach to law, jurisprudence, and law reform. Periodic individual discussions with the instructor; irregular group meetings.
Mr. Ehrenzweig

222. Comparative Law: Common and Civil Law. (1)
Topics selected according to the specific interests of participants, chiefly in view of current efforts toward international unification.
Mr. von Overbeek

222.5. Concept of Blame. The. (2)
A seminar devoted to an exploration of fundamental ingredients of the concept of blame and responsibility, with particular emphasis on criminal and tort law. Attention given to legal formulations and philosophic examinations of such root ideas as intention, risk, harm, causation, imputability, justification, and excuse.
Mr. Kadish

223. Conflict of Laws. (3)
Jurisdiction and choice of law in cases involving international, interstate and state-federal conflicts, particularly in the law of judgments, procedure, torts, workman's compensation, contracts, property, domestic relations, estates, and business associations.
Mr. Ehrenzweig, Mrs. Kay, Mr. McNulty
224-1. Constitutional Law. (5)
Covers substantially the same topics as Law 224-2A—224-2B, only in one semester instead of two.
Mr. Choper

224-2A—224-2B. Constitutional Law. (3–3)
Analysis of the judicial process in constitutional cases; examination, mainly in depth, of the nature of judicial review and limitations thereon; the sources and nature of national legislative power; limitations on state power to regulate and tax; application of the Bill of Rights to the states; freedoms of expression, association, and religion; equal protection.
Mr. Cole, Mr. Smith

224.3. Constitutional Law Seminar, (2)
Prerequisite: Law 224-1 or 224-2A—224-2B (Constitutional Law). Selected current problems of constitutional law. Emphasis placed on the institutional framework for judicial review of constitutionality (including particularly in the Supreme Court of the United States) and on currently evolving doctrines affecting individual rights.
Mr. Mishkin

224.6. Constitutional Law Seminar (Advanced), (2)
Considers why the U. S. Supreme Court decides as it has in constitutional cases, how its decisions actually affect the nation, and the useful methods of studying these questions.
Mr. Smith

225. Consumer Protection Seminar. (2)
Study of common problems and abuses confronting consumers, and evaluation of the existing as well as proposed societal responses to these concerns. The substantive coverage includes deceptive and misleading practices, and the efficacy of existing agencies (e.g., F.T.C., Attorney General) assigned to monitor these areas; problems of consumer credit, including a comparison of the protections offered by the Federal Truth in Lending Act, current state legislation, and the proposed UCCC; product safety problems; the unique factors contributing to the plight of ghetto shoppers.
Mr. Barton

226. Contemporary Jurisprudence, Seminar on. (2)
Deciding who is a person in the legal system. Discriminations based on natural characteristics of persons, particularly their age of life. Drawing lines—exceptions. Capability or responsibility for cooperation in an evil system. The coercive, challenging, and teaching functions of law. The relationship of law to love.
Mr. Noonan

226.3. Contracts Drafting Seminar. (2)
A selected enrollment seminar on the law office prelitigation cycle. Drafting of contracts, legal mem- oranda, opinion letters and legal reports to clients; oral presentations, office interviews, and conferences. Stress upon fact discrimination and development of drafting skills.
Mr. Sweet

226.6. Contracts—Selected Problems Seminar. (2)
A seminar in which students prepare and present major research papers in the area of contracts. Fundamental contract principles, non-judicial lawmak- ers, particular problems relating to particular types of contracts, comparative contracts materials, and the use of sociological techniques and legal research are the foci of the seminar.
Mr. Sweet

227. Copyright and Unfair Competition. (2)
Statutory and common law protection of literary, musical, and artistic works, including the principles of unfair competition and trademark protection.
Mr. Barnett

228. Corporate Regulation and Public Policy. (2)
A study of some of the broad issues of regulation of corporate enterprise at the state and federal level, including theories of managerial responsibility, insider-trading, dealing in control, tender offers, public policy implications of mutual fund growth and institutionalization of the securities markets, and use of the non-profit corporation to conduct corporate enterprise.
Mr. Jennings

229. Counseling Small Businesses in Poverty Areas. (2)
Provides the student who intends to engage in the practice of law in the ghetto, barrio, or other poverty area with some basic tools for advising his client who normally will be engaged in small business enterprises.
Mr. Buxbaum, Mr. Jennings, Mr. Sykes

230. Creditors' Remedies and Debtors' Protection. (3)
Enforcement of judgments, exemptions, fraudulent conveyances, general assignments, creditors' agreements, bankruptcy, and other forms of debtors' relief.
Mr. Lambe, Mr. Riesfeld

231. Criminal Cases and Prison Law, Dispositional Alternatives in. (2)
Study of various alternatives available to trial courts in disposing of criminal cases, e.g., probation, sentence to prison, referral to California Rehabilitation Center, or suspension of judgment. Class also discusses and attempts to develop materials dealing with judicial review of decisions of the California Department of Corrections and the California Adult and Youth Authorities.
Mr. Ramsey

232A—232B. Criminal Law and Administration, Seminar on. (2) or (1—2)
Legal problems relating to the criminal law and its administration. Open also to graduate students in the School of Criminology. Mr. Foote, Mr. Sherry

233. Criminal Law and Procedure (Advanced). (2)
A study of selected problems in criminal law and procedure. Students will work on individual or group projects which will be prepared for class presentation and submitted later in the form of papers. An at- tempt will be made to select topics which will be of current interest to the group as well as the individual students involved.
Mr. Collings

234. Criminal Law, Functions of the. (3)
Exploration of possible explanations for the perva- sive racial, economic, and cultural bias prevalent in both substantive criminal law and in its administration. Central focus will be on the origins, develop- ment, and perpetuation of a dual system of criminal law, starting from the existence in the first half of the nineteenth century of formal distinctions be- tween the legal status of slaves, Native-Americans, immigrants, and the poor, and the rights of the rest of the population.
Mr. Foote

235-1. Criminal Procedure. (3)
Not open to students who have taken (or are taking) Law 235-2. A study of the major legal issues in the functioning of the criminal justice system, including, among others: legal control over police practices (arresting, searching, interrogating, elec- tronic eavesdropping, etc.); prosecutorial discretion and its control; bail; the guilty plea process; sen- tencing; post-conviction remedies, and double jeopardy.
Mr. Johnson, Mr. Kadish
235-2. Criminal Procedure. (3)
Not open to students who have taken (or are taking) Law 235-1. A study of criminal procedure from the time of investigation until the time of judgment. The course utilizes for the most part United States Supreme Court decisions and California decisions both from the Supreme Court and Courts of Appeal. Topics include: investigation, arrest, search and seizure, jurisdiction and venue, complaints, bail and release, initial appearance, preliminary examination, indictment and information, arraignment and plea, motions before trial, trial preparation, publicity and fair trial, right to counsel, jury trial, public trial, presence of defendant, dismissals during trial, statements and arguments, conduct of prosecutor, instructions, conduct of jurors, verdict, judgment, and motion in arrest. Mr. Collin.

236. Discriminations and Distinctions Based on Age. (2)
An investigation into the rationality, constitutionality, and desirability of using age as a basis for legal classification for, e.g., voting, retirement, conscription, schooling, abortion, and marriage. Mr. Noonan.

237. Educational Policy and Law. (3)
A course for advanced students in the Graduate School of Public Policy and the School of Law, analyzing educational policy questions and their legal implications. Federal, state and local education finance; student civil liberties issues; integration; student classification (special education, testing, grouping); and school governance (decentralization, vouchers). Mr. Coons, Mr. Kirp, Mr. Sugarman.

238. Environmental Law. (2)
Primary emphasis is on the regulation of air and water pollution at national, state, and regional levels and through private law suits. Economic as well as legal concepts are studied. A portion of the course is devoted to conservation issues, litigation strategy, and the roles of lawyers in solving environmental problems. Mr. Heyman.

239-1. Estate and Gift Taxation. (1)
A short course on the statutory, judicial, and administrative material respecting the federal estate and gift taxes. Mr. Halbach.

239-2. Estate and Gift Taxation. (2)
The statutory, judicial, and administrative material respecting the federal estate and gift taxes, with references to parallel state taxes. Mrs. Barton, Mr. McNulty.

239-3. Estate Taxation and Planning. (3)
Prerequisite: Law 250A (Income Taxation I). A basic study of the federal estate and gift tax laws, and how they operate on, and affect planning for, gratuitous inter vivos and testamentary transfers. Mrs. Barton.

240. Estate Planning, Selected Problems in. (2)
Prerequisites: Law 241 (Estate and Trusts); Law 250A-250B (Income Taxation I and II); and either Law 239-3 (Estate Taxation and Planning) or Law 239-1 or 239-2 (Estate and Gift Taxation). Selected problems in estate analysis and planning; tax-conscious drafting of wills and trusts utilizing future interests as survivorship class gifts, incomplete dispositions and other recurring problems; powers of appointment; planning of insurance and disposition of business interests. Primary emphasis is on individual work in planning an estate, from interview to drafting of documents. Mrs. Barton.

241. Estates and Trusts. (3)
The law of intestate succession and wills; the nature, creation and termination of trusts; future interests, powers of appointment and perpetuities; problems of construction, administration of trusts and decedents’ estates. Mr. Halbach.

242-1A–242-1B. Evidence. (2–2)
A study of the theory and application of the rules of evidence, the problems of proof and the use of exclusionary rules to effect judicial, statutory, and constitutional policy. This course includes consideration of procedures for the admission and exclusion of evidence, evidentiary privileges, the hearsay rule and its exceptions, and the evidentiary principles of constitutional law. It is designed for those who do not plan to exclude litigation from their practice, and to equip the practitioner for trial work before juries in civil and criminal cases, before a court, and before administrative agencies. Mr. Louise, Mr. Sherry.

242-2. Evidence (Basic). (3)
The fundamental questions of evidence and theory of proof, including hearsay, business records, documentary proof, privileged communications, self-incrimination, relevance, presumptions, and judicial notice. Emphasis is on the making and preservation of proof; does not include manner of examination, cross-examination, or impeachment of witnesses. Mr. Degnan.

243. Family Law. (3)
Marriage, annulment, dissolution, and separation; parent and child; adoption and legitimation; minors’ contracts; guardian and ward; the Juvenile Court. Mr. Foote, Mrs. Kay, Mr. Noonan.

244. Family Law Seminar. (2)
Prerequisite: Law 253 (Family Law). Seminar offered jointly by the School of Law and the Langley-Porter Neuropsychiatric Institute, open to law students and psychiatric residents. Course centers around a particular problem area, such as divorce or child custody, and deals with the area from the dual perspectives of law and psychiatry. Mrs. Kay, Dr. Philips.

245. Federal Courts. (4)
Prerequisite: Law 224-1 or 224-2A–224-2B (Constitutional Law). The constitutional and statutory role of courts in the federal system, including their relationship to other branches of federal and state government; the interplay of federal and state law; and the distribution of judicial power between federal and state courts. Mr. Mishkin.

246. Functions of the American Lawyer: Selected Problems. (2)
A seminar to explore the roles of the lawyer in American society as representative of the public interest, as private advocate, as arbitrator in conflicts among groups he represents. The lawyer’s special relation to the poor. The social expectations of the lawyer will be analyzed together with a consideration of what the lawyer may aspire to himself as a free human being. Some attention will be paid to the historical evolution of the lawyer’s functions. Mr. Noonan.

247. Future Interests. (1)
Classification and characteristics of future interests; rules restricting the creation of future interests, including the rule against perpetuities; study of construction and drafting, including conditions of survivorship, class gifts, incomplete dispositions and other recurring problems; and powers of appointment. Mr. Halbach, Mrs. Barton.
248A—248B. Habeas Corpus Seminar. (1—1)

The seminar will explore the substantive law of state and federal habeas corpus, and other comparable procedures by which criminal convictions may be challenged. The case law and materials cover a range of problems, including questions of federal jurisdiction, finality of criminal judgments, civil discovery, waiver of constitutionally protected rights, exhaustion of state remedies, and stays of execution in capital cases. In addition, members of the seminar will, subject to the direction of a member of the bar, assist in the representation of a petitioner in a habeas corpus proceeding in a state or federal court.

248.5. Housing Law. (2)

An examination of the legal, political, economic, and social causes of urban poverty and housing deterioration and—drawing upon the experience of poverty lawyers and particularly the National Housing and Economic Development Law Project at Boalt Hall—the impact strategy potential of various federal programs, emerging landlord-tenant law doctrine, tenant organization developments, including federal planning programs, urban renewal, mortgage guarantees, public housing, Model Cities Program and community-based economic development.

Mr. Falk

249. Immigration Law and Practice. (2)

Prerequisites: Law 206 (Administrative Law); Law 224-1 or 224-2A/224-2B (Constitutional Law). Immigration and naturalization problems in practice, with some emphasis on matters frequently arising in California (agricultural laborer, merchant seaman, student, and illegal entrant issues).

Mr. Buxbaum

250A. Income Taxation I. (3)

A study of the statutory, judicial, and administrative material concerning the federal income tax as applicable to the individual.

Mrs. Barton, Mr. Kragen, Mr. McNulty, Mr. Stone

250B. Income Taxation II. (3)

Continuation of the study of federal income tax, the emphasis being upon the taxation of trusts and of business enterprises, including partnerships and corporations.

Mrs. Barton, Mr. Kragen, Mr. McNulty, Mr. Stone

251.2. International Conflicts Seminar. (2)

A seminar designed for those who wish to pursue their interests in international aspects of conflicts law.

Mr. Ehrenzweig

251.4. International Human Rights, Seminar on. (2)

A study of United Nations law concerning human rights and related U. S. problems and policies, as well as of regional and other transnational institutions that protect human rights (e.g., the European Commission and Court of Human Rights).

Mr. Newman

251.6. International Organizations, Seminar on. (2)

A study of law that affects the United Nations and other worldwide and regional organizations, and the impact of that law on the United States and its lawyers.

Mr. Newman

252. International Legal Process. (2)

Problems involving the State Department, the foreign relations law of the United States, and their impact on other governments (including the UN and the OAS), and on lawyers, treaties, Vietnam issues, war.

Mr. Newman

253. International Tax Seminar. (2)

Prerequisite: Law 250A—250B (Income Taxation I and II). A study of the tax problems faced by U. S. citizens and residents doing business in foreign countries, with emphasis on the U. S. taxation of income earned by U. S. taxpayers in foreign countries.

Mr. Kragen

254. Jurisprudence. (2)

An analysis of the "schools of jurisprudence" (particularly those of natural law and positivism) from a semantic and psychological viewpoint, leading up to a theory of justice and "justness" in analogy to aesthetics in general and in such specific applications as "gaps in the law," civil disobedience, and criminal obedience; a comparison of the concepts of "law" in the world's legal systems, particularly in the orbits of the common and civil law; a psychological theory of punishment based on a proposed distinction between types of crimes; a psychological evaluation of current proposals for the reform of tort law and tort insurance in automobile, products, and hospital liability; and juxtaposition of civilian and American civil procedures in terms of psychological attitudes to "the judge," the adversary process, and compromise.

Mr. Ehrenzweig

255. Labor Law. (3)

The labor-governing relations between employer and employee and the impact of state and federal legislation in the area of collective bargaining, including the law of the collective agreement, the strike, the boycott, and picketing.

Mr. Feller, Mr. Vetter

257A—257B. Land Use and Development. (2—2)

This course deals with land use planning and development control by local, state, and federal government. Students will also study land development finance, including problems of real estate syndication and other matters bearing upon the practical aspects of urban and suburban planning, development, finance, and preservation of open space. Consideration will be given to title insurance matters, problems of land use planning, use of joint venture and lease devices, and other subjects affecting land development and urban growth with an emphasis on practical considerations.

Mr. Elliman

258. Legal Accounting. (2)

Study of mechanics of dual bookkeeping including balance sheets, income statements, and the principal types of accruals and deferrals. Discussion of major substantive accounting issues, such as inventory pricing, depreciation, retained earnings, and the nature and meaning of profit.

Mr. Stone

260. Legal History. (2)

Major emphasis on the development of judicial institutions in England, twelfth-eleventh centuries, the development of English real property law to the end of the eighteenth century, and the emerging pattern of litigation, fifteenth-eleventh centuries, with respect to both substantive and adjective law and the growth of the legal profession in England and the American Colonies.

Mr. Barnes

261. Legal History. (2)

Primarily a research course; substantial paper required on topics selected by student in area of American legal history.

Mr. Smith
262. Legal Problems in Genetics and in Population Growth. (2)

Consideration of artificial insemination, artificial reproduction, cloning; consideration of tried and un-tried measures to control or distribute population. Role of lawyer in assessing risks, forming policy, and creating channels.

Mr. Noonan

263. Legal Process, The. (2)

A course designed to illuminate the major institutions and processes of the American legal system in the perspective of their everyday, working relationships, and to consider, in an introductory way, some basic jurisprudential concepts involved in the making of law.

Mr. Eisenberg

264. Legislative Process, The Lawyer in the. (2)

The course provides experience in the various roles of the lawyer in the modern legislative process, including policy development, committee work, and legislative drafting. Student legislative projects, prepared under faculty supervision, are submitted to the class in simulated committee hearings.

Mr. Stone

265. Natural Resources Law. (2)

Acquisition of water rights; federal and state legislation affecting the use of water, interstate water problems; pollution problems.

Mr. Sato

266. Oil and Gas Law. (2)

Study of various problems relating to oil and gas, including conveyances, leases, unitization and pooling, taxation, and legislative control over extraction.

Mr. Sato

266.5. Post-Conviction Procedures. (2)

A study of criminal procedure after verdict. Includes such subjects as mentally disordered sex offenders commitments, narcotics commitments, diagnostic commitments, probation, new trials, appeals, habeas corpus, writ of corum nobis, and—if time permits—procedures for reaching the United States Supreme Court.

Mr. Collings

267. Problems in the Law of Spending by the Federal Government. (2)

Examination of the legal structure that surrounds Congressional and Executive decisions on spending. Explores jurisdiction of substantive and appropriation committees, powers of the General Accounting Office and the Bureau of the Budget, the extent to which Congress or its committees can control expenditure of funds once appropriated, and the mechanics and operation of formulas for the allocation of funds to state and local government.

Mr. Stolz

268. Psychiatry and the Criminal Law. (2)

Legal, philosophical, and behavioral science aspects of criminal responsibility; historical development of the concept of mens rea; the psychology of punishment and guilt; problems of the criminal responsibility of the mentally ill.

Dr. Diamond

269. Real Property Security. (2)

Real property secured transactions, including the procedural, remedial, and economic attributes of various security devices; deficiency and subordination problems; limitations; priority; redemption; transfer; and allocation of ultimate loss.

Mr. Hetland

270. Remedies. (3)

Introduction to the forms of judicial remedies, principles governing their scope and availability, and consideration of grounds for choosing between alternative remedies. Includes general principles of damages, specific performance, and injunction.

Mr. Degnan

271. Roman Law. (2)

Introductory course on Roman law. Survey of history and sources, persons, property, obligations, succession, and a few general topics.

Mr. Daube

272A. Securities Regulation. (2)

Prerequisites: Law 211-1A-211-1B, 211-2, 211-3A-211-3B, or 211-4A-211-4B (Business Associations [Corporations]). The course concentrates on the regulation of the distribution of securities under the Securities Act of 1933 and under State Blue Sky Laws, including civil liabilities under the state and federal acts. Some attention also given to the development of the international capital markets and the regulation of the distribution of new issues of securities in other countries.

Mr. Jennings

272B. Securities Regulation. (2)

Prerequisites: Law 211-1A-211-1B, 211-2, 211-3A-211-3B, or 211-4A-211-4B (Business Associations [Corporations]). Law 272A is not a prerequisite. This course concentrates on the regulation of trading of securities on stock exchanges and in the over-the-counter market; broker-dealer regulations; insider trading under state and federal law; civil liabilities under federal and state securities acts; and regulation of investment companies and investment advisers.

Mr. Jennings

273. Selective Service Law. (2)

Examination of the administrative procedures within the Selective Service System, the criminal defense of draft resisters, and discharges from the military including Habeas Corpus actions. Mr. Regli

273.5. Slavery as an American Legal Institution. (2)

Constitutional provisions, federal and state legislation, and cases bearing on the creation and maintenance of slavery as a legal institution from colonial times to the Civil War.

Mr. Noonan

275. State and Local Government Law. (3)

Problems relating to intergovernmental allocation of power, governmental integrity, alternative techniques for governmental solutions to problems, and government's relationship to those governed.

Mr. Sato

275.5A–275.5B. State and Local Government, Seminar on. (1–1)

Primarily a research and drafting course, studying problems amenable to legislative solution either at the state or local government level. Course commences in the fall semester and continues through the spring, to allow ample time for field research if necessary. For administrative purposes, one unit is assigned each semester.

Mr. Sato

276. State and Local Taxation. (2)

The course is a study of substantive provisions and procedure relating to property tax, bank and corporation tax, income tax, sales and use tax, and other local taxes; attention will be given interstate tax problems, such as allocation of income among the states, jurisdiction to tax, and commerce clause restrictions.

Mr. Sato

278. Supreme Court Litigation. (2)

The purpose of this seminar is to develop an understanding of how litigation is conducted in the Supreme Court and the mechanics of decision-
making by the Court as well as to provide an opportunity for drafting Supreme Court papers. Consideration will be given to the Court's jurisdiction, the criteria which it uses in exercising that jurisdiction, practice before the Court, and tactical and strategic considerations in presenting cases to the Court. Mr. Heafey

282. Taxation of Business Enterprise, Selected Problems in. (3)


Mrs. Barton, Mr. Kragen

283. Taxation of the Individual, Seminar on. (2)

Advanced study of tax problems and planning for individuals.

Mrs. Barton

284. Taxation Theory and Public Finance. (2)

Supervised group and individual study of both the legal and the economic problems in public finance.

Mr. McNulty

285. Tax Problems (Advanced). (3)

Prerequisite: Law 250A-250B (Income Taxation I and II). Exposes student to role of the lawyer in applying his tax knowledge to the solution of problems as they may arise in a variety of situations. Law pertaining to particular problems researched in depth and used to its maximum.

Mr. Stone

285.5. Technology Assessment and the Law. (2)

This year the course will focus on the social, economic, and legal consequences of information processing, computers, and communications technology. Teas of students from law, computer science, and various social sciences will investigate specific topics within this general area, such as the implications for privacy, the impact on police and judicial behavior, and the effect of the possibly monopolistic organization of the computer industry.

Mr. Buxbaum

286. Trial Practice, Elements of. (1)

A one-semester course providing a general introduction to trial practice, procedures and strategies.

Mr. Heafey

287A-287B. Trial Practice. (1-2)

Preparation and presentation of a civil case for jury trial, including discovery and depositions, law and motion, pretrial conference with presiding judge, and the filing of all appropriate pleadings. A one-year course involving lectures in the fall and practice trials in the spring.

Mr. Heafey

289. Women and the Law. (2)

Examination of issues of sex-based discrimination having legal sources or legal implications: problems of employment; entry into the professions; family law; abortion; and personal status.

Mrs. Kay, Mrs. Walker

295. Student-Initiated Courses or Projects. (1-2)

Clinical work, field work, legal assistance, individual research and writing, writing or editing for professional journals, student-taught courses, or other legal projects of a serious, educational nature. Requires the approval of the Law 295 Administrator and the Dean. Open to students who have completed the first-year curriculum.

296. Legal Dissertation. (8-13)

Research and writing looking toward a major piece of legal scholarship under the direction of an individual faculty member pursuant to faculty consent. Open to third-year students who have completed a qualifying seminar in the second year.

The Staff

297. Self-Tutorial Seminar. (1-2)

A program to enable individual self-instruction, primarily in subject matter areas not covered by the regular curriculum. Requires the consent of a member of the faculty to serve as supervisor and approval of the Dean. Open to students who have completed the first-year curriculum.

The Staff

298. Group Research Projects. (1-2)

A program to enable groups of students to study or research special legal topics of common interest, primarily in subject matter areas not covered by the regular curriculum. Requires the consent of a member of the faculty to serve as supervisor and the approval of the Dean. Open to students who have completed the first-year curriculum.

The Staff

299. Individual Research Projects. (1-2)

A program to enable individual study and research in depth of selected topics under the supervision of a member of the faculty with a goal of producing an original paper or report. Requires the consent of a member of the faculty to serve as supervisor and the approval of the Dean. Open to students who have completed the first-year curriculum.

The Staff

LAW AND SOCIETY

Professors:
Richard M. Buxbaum, LL.M.
John E. Coons, J.D.
Bernard L. Diamond, M.D.
Melvin A. Eisenberg, LL.B.
Caleb Foote, LL.B.
David Matza, Ph.D.
Sheldon L. Messinger, Ph.D.
Laura Nader, Ph.D.

Nelson W. Polsby, Ph.D.
Philip Selznick, Ph.D.
Jerome H. Skolnick, Ph.D.
Jan Vetter, LL.B.

Associate Professors:
William K. Muir, Ph.D.
Philippe Nonet, Ph.D.

Assistant Professor:
Anthony Platt, D.Crim.

The Law and Society Program

The program is designed to provide intensive cross-disciplinary training and research experience in the field of law and society. It is open to selected law students

NOTE: For key to footnote symbols, see page 86.
who are interested in the M.A. in Law and Society, in addition to the J.D. degree; and to selected social science doctoral candidates, for whom it forms a substantive field of specialization within their Ph.D. program. The program emphasizes individual research and study with tutorial assistance. Tutorials are supplemented by a variety of courses currently offered in the Law School and the social science departments so that participating law students may receive basic methodological training in social science research, and social science students in legal research, and the students may have an opportunity to do intensive work in particular fields of specialization in law and social science.

**The Graduate Major**

The requirements for the M.A. degree in Law and Society are, in principle, a thesis and 30 units of course work or 36 units of course work and a comprehensive final examination. For law students it is possible to pursue the M.A. under a joint degree program which allows the student to take some courses that will count towards both the J.D. and the M.A. degrees. In addition to the Law School courses needed for the J.D., law students do the equivalent of one year of work in law and society, including a thesis, and receive both the J.D. and M.A. degrees at the end of approximately four years of graduate study.

In addition, social science students will be expected to gain adequate literacy in the handling of legal materials, and law students to gain facility in working with social science ideas and research methods. The details of each student’s program are arranged in consultation with the student’s adviser.

298. Individual Study and Research. (1–8)  
Individual conferences to be arranged. Prerequisite: primarily for law students and social science graduate students doing advanced work in the area of law and society. Individual research under tutorial supervision.  
The Staff (F, W, Sp)

**Related Courses in Other Departments**  
Law and Anthropology (Anthropology 157), Law and Anthropology (Anthropology 251), Legal Environment of Business (Business Administration 110), Law and Discretion in Criminal Sentencing (Criminology 127), Law Enforcement Policies and Social Structure (Criminology 126), Crime, Law and Public Order (Criminology 215A–215B), Seminar in Sociological Perspectives on the Criminal Justice System (Crim. 283), Constitutional History of U.S. (History 172A–172B), Legal Theory (Law 225), Legal History (Law 227), Psychiatry and the Criminal Law (Law 239), Law and Society (Law 243S), Jurisprudence (Law 251), Contemporary Jurisprudence (Law 251S), Law and Anthropology Seminar (261S), Legal Theory (Political Science 151), Legal Institutions (Political Science 152), Comparative Law (Political Science 250), Law and Society (Sociology 119), Deviance and Social Control (Sociology 212), Sociology of Law (Sociology 219).

**LIBRARIANSHIP**

Professors:

J. Periam Danton, Ph.D.  
M. E. Maron, Ph.D.  
Raynard Coe Swank, Ph.D., I.L.I.D. (hon.)  
Edward A. Wight, Ph.D. (Emeritus)

Associate Professors:

William S. Cooper, Ph.D.  
Robert D. Harlan, Ph.D.

Ray E. Held, Ph.D.  
Fredric John Mosher, Ph.D.  
Patrick Wilson, Ph.D. (Chairman)  
Anne Ethelyn Markley, M.A. in L.S. (Emeritus)

Assistant Professors:

Michael D. Cooper, Ph.D.  
Victor Rosenberg, Ph.D.

**NOTE:** For key to footnote symbols, see page 86.
Professor: Charles P. Bourne, M.S. (In Residence)
Lecturers: Fay M. Blake, Ph.D.

For information on programs offered, please see the ANNOUNCEMENT OF THE SCHOOL OF LIBRARIANSHIP.

Bibliography

1. How to Use the University of California Library. (3)
   Two hours of lecture per week. Students will learn how to approach the U.C. Library's resources in a systematic way to meet their needs, via lecture, section, problem sets, examinations and a term paper. They will learn to extend these techniques to future independent research.
   Mrs. Blake in charge (F, W, Sp)

128. Survey of Children's Literature. (3)
   Three hours of lecture per week. Children's literature as a genre of literature; its role in the lives of children. Historical perspective; milestones and the current scene in publication. All types of books read by children will be included. Not acceptable towards fulfillment of requirements for the M.L.S. degree.
   Mrs. Roger (F, W, Sp)

199. Individual Study. (1-5)
   Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.

255. Bibliography for Students of Literature. (3)
   Three hours of lecture per week. General bibliography and the bibliography of literary scholarship; introduction to descriptive and textual bibliography. Not acceptable towards fulfillment of requirements for the M.L.S. degree.
   (Sp)

Librarianship

   Three 1-hour lectures and one hour of laboratory per week. History of the book from the beginnings of writing to microphotography. Emphasis placed on all aspects of the history of the printed book.
   Mr. Mosher (F)

203A. Origins and Spread of Printing and Publishing in Europe. (4)
   Two hours of lecture and two hours of laboratory per week.
   Mr. Mosher (W)

203B. History of Printing and Publishing: 1500-1800. (4)
   Three hours of lecture and one hour of laboratory per week. Prerequisite: course 202. Mr. Harlan (F)

   Three hours of lecture and one hour of laboratory per week. Prerequisite: course 202.
   Mr. Mosher (Sp)

208. Library User Studies. (3)
   Two hours of lecture per week. Survey of studies that use the methods of the behavioral sciences to examine library and information service use and information gathering behavior.
   Mr. Rosenberg (Sp)

209. Library in the Community. (3)
   Three hours of lecture per week. Analysis of the community for the librarian. Relationships between various factors and library use. Methods of relating the library with the community.
   Mrs. Blake (W)

220. Reference and Bibliography. (4)
   Three hours of lecture per week. Reference and bibliographical service; general and special reference and bibliographical sources, including national and subject bibliography.
   Mr. Held, Mr. Mosher (W)

221. Special Topics in Reference and Bibliography. (4)
   Three hours of lecture per week. Prerequisite: consent of instructor. Specific topics may vary from section to section and from year to year. May be repeated for credit, with change of content. Enrollment limited.
   Mr. Held, Mr. Mosher (Sp)

225. Law Librarianship: Legal Research, Reference, and Bibliography. (3)
   Three hours of lecture per week. Prerequisite: open to students in the School of Librarianship and to third-year students in the School of Law. Introduction to legal bibliography; cases and reports, statutes, administrative regulations and decisions, legislative history, legal citators and digests, legal periodicals and indexes, secondary materials, legal bibliography tools.

228A. Children's Literature. (3)
   Three hours of lecture per week. Historical backgrounds and development; twentieth-century trends; criticism and evaluation; trends in use of illustration.
   Mrs. Roger (F, Sp)

228B. Library Work with Children and Young Adults. (3)
   Three hours of lecture per week. Prerequisite: course 228A. Reading interests; types of library material; levels of reading ability; book selection; library programs.
   Mrs. Roger (W, Sp)

228C. Children's Literature; Oral Interpretation. (3)
   One 1½-hour lecture per week. Prerequisite: consent of the instructor. Historical development and critical analysis of folklore, legends, myths, and modern imaginative literature; their role in the library program for children and young adults.
   Mrs. Roger (W)

234. Problems of Organization of Knowledge. (4)
   Three hours of lecture per week. Analytical investigation of concepts of knowledge, information, interpretation, meaning, and of related concepts, from the point of view of their bearing on basic problems of description and organization of recorded discourse.
   Mr. Wilson (Sp)
240. Introduction to the Information Sciences. (3)
Three hours of lecture per week. The library problem from the viewpoint of the information sciences, including those techniques and machines that deal with information and information processing. Relevance of the conceptual and physical tools of the information sciences to information analysis, indexing, retrieval, and dissemination. Mr. W. Cooper (F)

241. Theoretical Problems in Information Transfer and Retrieval, (4)
Three hours of lecture per week. Problems in the design and evaluation of automatic literature searching and question answering systems. Intended as a mature introduction for students with some background in logic, mathematics, and computing.

242A–242B. Principles of Information Retrieval. (3–3)
Two hours of lecture per week. Prerequisite: consent of instructor. Analysis of problems of information storage and retrieval. Stress on techniques that can in principle be programmed on a general purpose digital computer. Topics to be covered include: automatic indexing and classification; meaning and use of weighted indexes; associative searching. Credit and grade will be awarded upon completion of sequence.
Mr. W. Cooper (W, Sp)

243. Automatic Data Retrieval and Question-Answering. (3)
Two hours of lecture per week. Prerequisite: consent of instructor. A survey and analysis of current data retrieval and question-answering systems. An examination of some of the major logical, linguistic, programming and file organization problems relating to automatic question-answering. Mr. W. Cooper (Sp)

246. Evaluation of Information Systems and Services. (3)
Three hours of lecture per week. A general survey of principles and methodologies for evaluating libraries and other information systems. The meaning and logical role of measures of retrieval effectiveness. The concept of utility and techniques of cost-effectiveness analysis. Mr. M. Cooper, Mr. W. Cooper (Sp)

250. Introduction to Bibliography. (4)
Two 1-hour lectures and two 1-hour discussion meetings per week. Intensive analysis of central activities common to library and information services. Must be taken concurrently with course 250L.
The Staff (Mr. Wilson in charge) (F)

250L. Bibliography Laboratory. (2)
Six to eight hours of laboratory and tutorial instruction per week or equivalent individual or group study. Must be taken concurrently with course 250. Must be taken on a passed/not passed basis.
The Staff (Mr. Wilson in charge) (F)

251. Cataloging and Classification. (4)
Three hours of lecture and three hours of discussion per week. Open laboratory. Standard techniques of identification, description, and subject access to bibliographic units: emphasis on structure and uses of codes and schemes. Survey of cooperative and centralized cataloging activities.
Mrs. Frugé (W)

252. Special Problems, Policies, and Developments in Library Cataloging. (4)
Mrs. Frugé (Sp)

254. Descriptive Bibliography. (3)
Three hours of lecture per week. Historical and analytical bibliography as methods of investigation, based on McKerrow and Bowers; methods of bibliographical description based on Bowers and Greg; literature of analytical bibliography. Mr. Harlan (W)

256. Using Computers in Advanced Bibliographic Research. (4)
Three hours of lecture per week plus individual computer usage. The MARC record structure will be used as a means for defining a variety of bibliographic files (data bases for bibliographic research). No programming competence required, but familiarity with concepts of computer processing techniques would be helpful.

260. Libraries and Information Agencies. (3)
Three hours or lecture per week. The history, functions, and characteristics of libraries and information agencies; user requirements and socio-economic factors influencing the design of such agencies; existing and proposed types of agencies; concepts of administration and systems analysis.
Mr. Held (F)

262. History of Libraries. (4)
Three hours of lecture per week. A historical introduction to the libraries of the Western world, from antiquity to the present.
Mr. Held (W)

263A. History of Ancient and Medieval Libraries. (4)
Three hours of lecture per week.

263B. History of Scholarly Libraries. (3)
Three hours of lecture per week. Prerequisite: course 262.
Mr. Danton

263C. History of Popular Libraries. (4)
Three hours of lecture per week.
Mr. Held (Sp)

270. Library Management. (4)
Four hours of lecture per week. Basic management functions as applied in libraries of all types: planning, organizing and staffing, and controlling. Readings, lectures, and small group analyses of case studies.

271. Interlibrary Cooperation and Information Networks. (3)
Three hours of lecture per week. Need for, development, organization, and services of cooperative library and information systems and networks. Potentialities and problems of computer, telecommunications, and other technologies in network development. National network planning. Lectures, discussion, term projects.
Mr. Swank (Sp)

273. Introduction to Library Systems Analysis. (4)
Three hours of lecture per week. The system approach to decision making and policy analysis in libraries. The role of the systems analyst in library management. Mr. M. Cooper, Mr. Rosenberg (W, Sp)
274. Library Systems Analysis. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. Examples of library systems analysis will be discussed and evaluated including models of library functions (circulation, shelving, budget, etc.). Mr. M. Cooper (Sp)

275. Data Processing for Libraries. (4)

Three hours of lecture and two hours of laboratory per week. An introduction to the nature and capabilities of computers and related equipment, with emphasis on applications to the library processes.

Mr. M. Cooper (F)

276. Survey of Library Automation. (4)

Three hours of lecture per week. Prerequisite: course 275 or equivalent. A general survey of current and planned automation projects and methods in libraries and network processing centers. Particular attention will be given to specific processes such as serials, acquisitions, book catalogue and card catalogue production, and other systems. Mr. Bourne (Sp)

282A. Municipal and County Libraries. (3)

Three hours of lecture per week. Government, objectives, organization, and administration of municipal, county, and regional public libraries. Library service programs in relation to varying community patterns. Lectures, readings, reports, field trips. (Sp)

282B. Public Library Collections and Services. (3)

Three hours of lecture per week. Problems in the selection, acquisition, development, and maintenance of library collections and in the library’s program of service. (Sp)

283. Non-Print Media in Libraries. (4)

Three hours of lecture per week. Problems relating to the handling and use of non-print media. The role of the librarian in a modern media center, evaluation of materials, the use of media in education, design of media centers, and some aspects of media technology. Mr. Rosenberg (W)

284. School Libraries. (3)

Three hours of lecture per week. Prerequisite: consent of instructor. A general survey of elementary and secondary school libraries. Emphasis on the function, administration, organization, services, materials, and the planning and equipment of school libraries in relation to the modern school. Lectures, committee and individual reports, reading, class discussions, and field trips. Mrs. Roger (Sp)

286A. College and University Libraries. (3)

Three hours of lecture per week. Prerequisite: consent of instructor. A general introduction to the organization and administration of college and university libraries and their place in the institutions of which they are a part. Problems and practices with respect to the library’s government, functions, staff, collections, finances, and building are considered by means of written assignments, readings, and class discussion. Mr. Danton (Sp)

286B. Book Collecting for University Libraries. (3)

Two hours of lecture per week. Prerequisite: course 286A. Problems connected with the acquisition, development, and maintenance of the book, periodical, and other collections of university libraries.

Mr. Danton

290. The Librarian and the Society. (4)

Three hours of lecture per week. Professions and professional responsibility; technical competence and professional judgment; neutrality and commitment; censorship and propaganda; librarians as educators, libraries as educational institutions. These, and other related topics, will be explored through discussion, lectures, readings, and field investigations.

Mrs. Blake

296A–296B. Seminar. (3–4, 3–4)

One 2-hour meeting per week or two 1½-hour meetings. Topics in bibliography, information sciences, administration of libraries and information systems, history of printing and libraries, comparative librarianship, library education, and related fields. Specific topics vary from year to year. May be repeated for credit, with change of content. Some offerings may consist of a one-quarter sequence (296A–296B) in which case “in progress” grades may be assigned for the first quarter. (F, W, Sp)

297. Field Study in Librarianship. (1–5)

Supervised experience relevant to specific aspects of librarianship in off-campus organizations. Regular individual meetings with faculty sponsor and reports required. Mrs. Blake (F, W, Sp)

298. Directed Group Study. (1–4)

The Staff (Mr. Wilson in charge)

299. Individual Study. (1–8)

The Staff (Mr. Wilson in charge)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. and D.L.S. degrees. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Wilson in charge)

Colloquium (no credit).

Mr. Wilson in charge

Linguistics

(Department Office, 2337 Dwinelle Hall)

Professors:

Madison S. Beeler, Ph.D. (Acting Chairman)
Wallace L. Chafe, Ph.D. (Chairman)

Charles J. Fillmore, Ph.D.
Mary R. Haas, Ph.D.
George Lakoff, Ph.D.

NOTE: For key to footnote symbols, see page 86.
The Major

Required: Linguistics 20, 110, 120, 145, plus 26 additional units of which at least 22 must be upper division. Linguistics 106 cannot be used in fulfillment of these requirements. The following combinations of courses are suggested as ways of pursuing specialized interests. They are meant to be suggestive rather than restrictive, and are by no means mutually exclusive. Other combinations may be worked out in consultation with the major adviser. In each case electives must be added to produce the required unit totals.

Linguistic theories and methods: Linguistics 115, 116, 125, 126, 185.
Data collection and analysis: Linguistics 115, 125, 135, 175.
Indo-European studies: Linguistics 165, Sanskrit 100A–100B, and courses in Latin and/or Greek.
The structure of a particular language: courses dealing with the structure of one language selected from Linguistics and/or a foreign language department (including Classics).
The ties between linguistics and a related discipline: courses dealing with language selected from a single department such as Anthropology, Philosophy, Psychology, or Rhetoric.

The department believes that a student majoring in linguistics should also achieve a more than superficial acquaintance with some related but independent field, and therefore strongly recommends the election of three nonlinguistic courses within any one of the following areas: Anthropology Group III (social and cultural anthropology) and/or Group V (area courses); English literature; mathematics and/or computer science; philosophy; psychology; rhetoric; or the literature of a foreign language.

Honors Program Those whose overall grade-point average is 3.0 or higher at the end of the junior year may elect to take the senior honors course in Linguistics (H195). This consists of 2 or more units per quarter for at least two quarters. Under the direction of a faculty member, the student carries out an approved program of independent study in which he attains a reasonable mastery of an appropriate linguistic topic. As evidence of each quarter’s work, he must submit an acceptable term paper summarizing critically the material he has covered.

Graduate Programs

Preparation for Graduate Study in Linguistics A graduate student in linguistics should have had an undergraduate major in linguistics, a foreign language, or some equivalent acceptable to the department. He should be prepared to pass the required language reading examinations early in his graduate career.

Master’s Degree in Linguistics The program follows either Plan I or Plan II, as described on page 36 of this catalogue. Required courses include Linguistics 110, 115 or 116, 120, 125 or 126, 145, 165, and 211A–211B (courses which duplicate previous work need not be taken). Information on further requirements is obtainable from the department office.
Doctor's Degree in Linguistics. The program follows Plan B, as described on page 42 of this catalogue. Required courses include Linguistics 201A–201B and 211A–211B. The department encourages the use of Option 2 in fulfillment of the foreign language requirement (page 40), but permits the use of Option 1 in special cases. Information on further requirements is obtainable from the department office.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Course

20. Language and Linguistics. (5)
Three 1½-hour lectures and one 1½-hour section meeting per week. Prerequisite: sophomore standing. An introduction to the scientific study of language. The nature of language structure. How languages are alike and how they differ. Language change and the reconstruction of languages at earlier stages. The field of linguistics and its relation to other fields. Mr. Matisoff (F); Mr. Fillmore (W)

Upper Division Courses

Upper division status or consent of instructor is prerequisite to all upper division courses. Graduate students may enter upper division courses with consent of the instructor without meeting all of the prerequisites.

*106. Transformational Grammar. (4)
Three 1½-hour lectures. Introductory course for nonmajors.

110. Introduction to Phonetics and Phonology. (5)
Three 1½-hour lectures and one 1½-hour section meeting per week. Prerequisite: course 20 (may be taken concurrently). The use of phonetic symbols. Distinctive features. Underlying and phonetic representations and phonological rules. Mr. Wang (W)

*113. Experimental Methods in Linguistics. (4)
Two 1½-hour lectures per week. Prerequisite: course 110 or consent of instructor. The conduct of linguistic experiments in the areas of physiological and acoustic phonetics, perception, and the testing of phonological and syntactic rules.

114. The Biological Basis of Language. (4)
Two 1½-hour lectures per week. The dependence of language on biological attributes, considered by comparison of human and nonhuman communication. The physiological control of speech production and reception. Hereditary and environmental factors in language development. Language in the context of overall behavior. Mr. Wang (F)

115. Articulatory Phonetics. (5)
Three 1½-hour lectures and one 1½-hour section meeting. Prerequisite: course 20 (may be taken concurrently). Training in the ability to discriminate and transcribe speech sounds. Dictation by native speakers and use of tape in the Laboratory. Mr. Ohala (W)

116. Phonology. (4)
Three 1½-hour lectures per week. Prerequisite: course 110. Detailed study of underlying and phonetic representations and the form of the phonological rules. Mr. Ohala (Sp)

120. Introduction to Syntax and Semantics. (5)
Three 1½-hour lectures and one 1½-hour section meeting per week. Prerequisite: course 20 (may be taken concurrently). A nonformal discussion of the relationship between grammar, meaning, and context, including a detailed survey of basic syntactic and semantic phenomena. Mrs. Lakoff (F)

125. Linguistic Analysis. (5)
Three 1½-hour lectures and one 1½-hour section meeting per week. Prerequisite: Linguistics 110, 120 (may be taken concurrently). Methods and practice in the analysis of linguistic data. Mr. Fillmore (Sp)

126. Formal Theories of Syntax and Semantics. (5)
Three 1½-hour lectures and one 1½-hour section meeting per week. Prerequisite: Linguistics 120 or permission of instructor. Transformational, global, and transferential rules. Basic problems in natural logic. Rules of conversation. Mr. Lakoff (W)

128. Topics in Syntax and Semantics. (4)
Three 1½-hour lectures per week. Discussion of topics of current interest, which will vary from year to year. Mr. Lakoff (F)

135. Types of Linguistic Structures. (4)
Three 1½-hour lectures per week. Prerequisite: courses 110, 120. Discussion of, and practice in working with, several languages of diverse types. Mr. Zimmer (Sp)

145. Comparative and Historical Linguistics. (4)
Three 1½-hour lectures per week. Prerequisite: course 110. Methods of reconstruction. Types and explanations of language change. The establishment of language relationships and subgroupings. Dialectology. Mr. Malkiel (F)

*152. Introduction to Applied Linguistics. (3)
Three 1-hour lectures per week. Applications of linguistics to language teaching, the teaching of reading and writing, lexicography, and other practical concerns.

*153. Language and Society. (4)
Two 1½-hour lectures per week. Prerequisite: course 120 (may be taken concurrently). An exploration of various nondenotative aspects of language use: language in relation to women and minority groups; propaganda; advertising; jokes and linguistic games; sarcasm; etc.

154. Language and Cognition. (4)
Two 1½-hour lectures per week. Prerequisite: course 20. The relation between language and such cognitive, phenomena as perception, conceptualization, thought, and memory. Mr. Chafe (W)

157. Linguistics and aberrant literature. (4)
Three hours of lecture per week. Prerequisite: course 120 or equivalent, or consent of instructor. An examination of writings using, for literary effect, "aberrant" language (e.g. Carroll, Nabokov, Thomas Pynchon), in an attempt to define and contrast different types of aberrant language, and to explore its relevance in developing an adequate theory of language use. Mrs. Lakoff (W)
**165. Indo-European Comparative Linguistics. (4)**
Three 1½-hour lectures per week. **Prerequisite:** course 20. Mr. Beeler (F)

**175. American Indian Languages. (4)**
Three 1½-hour lectures per week. Miss Haas (Sp)

**185. Linguistic Theories in the Twentieth Century. (4)**
Three 1½-hour lectures per week. **Prerequisites:** courses 110, 120. Mr. Zimmer (W)

**H195. Special Study for Honors Candidates. (2–5)**
The Staff (F, W, Sp)

**196. Undergraduate Colloquium. (1)**
One 1½-hour lecture per week. Discussion by faculty members and advanced graduate students of their current research. May be repeated for credit. The Staff (W)

**198. Directed Group Study and Research. (1–5)**
Group study of a linguistic topic not included in the regular department curriculum. Must be taken on a passed/not passed basis. The Staff (F, W, Sp)

**199. Supervised Independent Study and Research. (1–5)**
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (F, W, Sp)

**Graduate Courses**

Senior standing and permission of the instructor are prerequisite to all graduate courses in Linguistics. (Some courses may be repeated with consent of instructor.)

**201A–201B. Problems in Synchronic and Diachronic Analysis. (4–4)**
Two 1½-hour lectures per week. **Prerequisites:** courses 110, 120, 145. Practice in the analysis of synchronic and diachronic data from selected languages and language families. Must be taken on a passed/not passed basis. The Staff (F, W, Sp)

**211A–211B. Linguistic Field Methods. (4–4)**
Two 2-hour section meetings per week. Sequence beginning in the fall and winter. **Prerequisites:** courses 115, 120. Credit and grade will be awarded on completion of sequence. Mr. Matiasson (F, Sp); Mr. Sawyer (F, W)

**220. Physiological Phonetics. (4)**
Two 1½-hour lectures per week. The neurophysiological basis of speech production and perception. The role of autonomous and feedback control of the speech production process. Intrinsic factors in speech production. Phonological questions in physiological phonetics.

**222. Acoustic Phonetics. (4)**
Two 1½-hour lectures per week. **Prerequisite:** course 110 or its equivalent. Mr. Wang (F)

**223. Advanced Phonological Analysis. (4)**
Two 1½-hour lectures per week. **Prerequisite:** course 116.

**224. Advanced Grammatical Analysis. (4)**
Two 1½-hour lectures per week. **Prerequisite:** course 126.

**227. English Syntax. (4)**
Two 1½-hour lectures per week.

**228. Word Formation. (4)**
Two 1½-hour lectures per week. An investigation of selected problems in derivation and compounding and their relevance to grammatical theory. Mr. Zimmer (W)

**230. Structure of a Particular Language. (4)**
Two 1½-hour lectures per week. An analysis of aspects of the structure of a particular language. The language investigated changes from year to year. Mr. Zimmer (F); Mr. Chafe (Sp)

**232. Linguistics of the Pacific. (4)**
Two 1½-hour section meetings per week.

**233. Germanic Linguistics. (4)**
Two 1½-hour lectures per week. **Prerequisite:** at least one of the older Germanic languages. Phonology, morphology, and lexicography of the Germanic languages; the reconstruction of Proto-Germanic; Proto-Germanic and Indo-European.

**235. Romance Historical Phonology. (4)**
A 2½-hour lecture per week. **Prerequisite:** graduate standing and consent of instructor. The key problems of Romance historical and comparative phonology, with full attention to their methodological applications.

**236. Romance Historical Inflection. (4)**
A 2½-hour lecture per week. **Prerequisite:** graduate standing and consent of instructor. The key problems of Romance historical and comparative inflection, with full attention to their methodological applications.

**237. Romance Historical Derivation. (4)**
A 2½-hour lecture per week. **Prerequisite:** graduate standing and consent of instructor. The key problems of Romance historical and comparative derivation, with full attention to their methodological applications.

**238. Comparative Grammar of Latin. (4)**
One 2½-hour lecture per week. **Prerequisite:** at least an elementary knowledge of Latin or permission of instructor.

**239. Comparative Grammar of Greek. (4)**
One 2½-hour lecture per week. **Prerequisite:** at least an elementary knowledge of Greek or permission of instructor.

**242. Advanced Diachronic Linguistics. (4)**
Two 1½-hour lectures per week. Miss Haas (Sp)

**244. Advanced Indo-European Comparative Linguistics. (4)**
Two 1½-hour lectures per week. May be repeated for credit. Mr. Beeler (F, W)

**245. Linguistics of Southeast Asia. (4)**
Two 1½-hour lectures per week. Mr. Matiasson (W)

**246. Tibeto-Burman Linguistics. (4)**
Two 1½-hour lectures per week. Mr. Matiasson (Sp)
LOGIC AND THE METHODOLOGY OF SCIENCE

(Professor's Office, 731 Evans Hall)

Professors:
Ernest W. Adams, Ph.D. (Philosophy)
John W. Addison, Jr., Ph.D. (Mathematics)
David Blackwell, Ph.D. (Statistics)
William Craig, Ph.D. (Philosophy)
Lester E. Dubins, Ph.D. (Mathematics and of Statistics)
John C. Harsanyi, Ph.D. (Business Administration and of Economics)
Leon A. Henkin, Ph.D. (Mathematics)
Benson Mates, Ph.D. (Philosophy)
Raphael M. Robinson, Ph.D. (Mathematics)
J. Frits Staal, Ph.D. (Philosophy and of South Asian Languages)
Alfred Tarski, Ph.D. (Mathematics)

Chairman: Mr. Silver.
Graduate Adviser: Mr. Craig.

The Group in Logic and the Methodology of Science offers an interdisciplinary program of study and research leading to the Ph.D. degree. Although the Department of Mathematics and the Department of Philosophy each offers a Ph.D. degree toward which a student may write a dissertation in logic, the interdisciplinary program is designed for those with a broad interest in logic and the methodology of science who wish to explore the subject in both its mathematical and philosophical aspects. "Methodology of science" is here understood to mean "metascience," the study of the methods of the sciences by logical and mathematical means. The program is administered by an interdepartmental group which cooperates closely with both the Department of Mathematics and the Department of Philosophy.

Preparation For admission to the graduate program the student shall have completed an undergraduate major in philosophy, or in mathematics, or a joint major in both, including at least one full year upper division course in logic. In addition, he or she shall have completed (a) at least one upper division course in some science, and (b) at least one full year upper division course in mathematics (other than logic) if

NOTE: For key to footnote symbols, see page 86.
his or her undergraduate major was philosophy, or in philosophy (other than logic) if his or her undergraduate major was mathematics. Exceptions to these requirements are permitted only at the discretion of the graduate adviser. Before advancement to candidacy, and preferably early in the student's doctoral career, written examinations in two foreign languages must be passed; students may choose from the following: French, German, or Russian. Students should prepare themselves for the language requirement in their undergraduate years.

Further information about the program, including a full statement of the requirements for advancement to candidacy, is given in the Announcement of the Group in Logic and the Methodology of Science, which is available upon request from the Group Office.

Courses Courses are chosen with the advice of the graduate adviser from among the offerings of the various departments of the University. In addition to the departments of Mathematics and Philosophy, attention is especially directed to courses in the various science departments, in statistics, and in linguistics.

Mathematics

(Department Office, 970 Evans Hall)

Professors:

John W. Addison, Jr., Ph.D.
William G. Bade, Ph.D.
Elwyn R. Berlekamp, Ph.D.
Hans J. Bremermann, Ph.D.
Paul L. Chambré,† Ph.D.
Shiing-shen Chern, D.Sc., LL.D.
Heinz O. Cordes, Ph.D.
René J. De Vogelaere,† Ph.D.
Stephen P. Diliberto, Ph.D.
Lester E. Dubins,‡ Ph.D.
István Fáry, Docteur ès Sciences
Jacob Feldman,‡ Ph.D.
David Gale, Ph.D.
Henry Helson, Ph.D.
Leon A. Henkin, Ph.D.
Morris W. Hirsch, Ph.D.
Gerhard P. Hochschild, Ph.D.
Wu-Yi Hsiang, Ph.D.
William Kahan, Ph.D.
Tosio Kato, D.Sc.
John L. Kelley, Ph.D.
Robion C. Kirby, Ph.D.
Shoshichi Kobayashi, Ph.D.
R. Sherman Lehman, Ph.D.
Michel Loève, Docteur ès Sciences
Calvin C. Moore, Ph.D.
Andrew P. Ogg,† Ph.D.
Edmund J. Pinney,‡ Ph.D.
Murray H. Protter, Ph.D.
John L. Rhodes,‡ Ph.D.

Maxwell A. Rosenlicht, Ph.D.
Rainer K. Sachs, Ph.D.
Donald E. Sarason, Ph.D.
Ichiro Satake,† Ph.D.
Abraham Seidenberg,† Ph.D.
Stephen Smale, Ph.D.
Robert M. Solovay, Ph.D.
Edwin H. Spanier,‡ Ph.D.
John R. Stallings, Jr., Ph.D.
Abraham H. Taub, Ph.D.
P. Emery Thomas, Ph.D.
Robert L. Vaught, Ph.D.
Joseph A. Wolf, Ph.D.
Griffith C. Evans, Ph.D., LL.D. (Emeritus)
Alfred L. Foster, Ph.D. (Emeritus)
Derrick H. Lehmer, Ph.D. (Emeritus)
Hans Lewy, Ph.D. (Emeritus)
Charles B. Morrey, Jr., Ph.D. (Emeritus)
Anthony P. Morse, Ph.D. (Emeritus)
Raphaël M. Robinson, Ph.D. (Emeritus)
Alfred Tarski, Ph.D. (Emeritus)
Frantisek Wolf, Ph.D. (Emeritus)

Logic Colloquium. (No credit)

Reports on current research and scholarly work by members of the staff, visitors, and graduate students. The Staff (F, W, Sp, Su)

Other Departments with Related Programs

Department of Mathematics and Department of Philosophy.

Associate Professors:

William B. Arveson,† Ph.D.
George M. Bergman, Ph.D.
Robert E. Bowen,‡ Ph.D.
Alexandre J. Chorin, Ph.D.
Robert G. Hartshorne, Ph.D.
Ronald B. Jensen, Ph.D.
Tsit-Yuen Lam, Ph.D.

NOTE: For key to footnote symbols, see page 86.
Oscar E. Lanford, III, Ph.D.
H. Blaine Lawson, Ph.D.
Jerold E. Marsden, Ph.D.
Ralph N. McKenzie, Ph.D.
Keith Miller, Ph.D.
Charles C. Pugh, Ph.D.
Marc A. Rieffel, Ph.D.
Haskell P. Rosenthal, Ph.D.
Jack H. Silver, Ph.D.
Alan D. Weinstein, Ph.D.
Hung-Hsi Wu, Ph.D.
Raymond H. Sciobereti, Ph.D. (Emeritus)
Arnold Kas, Ph.D.
Michael Schlessinger, Ph.D.
Michele Vergne, Doctorat d’Etat
John B. Wagoner, Ph.D.
Monsur A. Kenku, Ph.D. (Visiting)

Assistant Professors:
Paul R. Chernoff, Ph.D.
David M. Goldschmidt, Ph.D.

Undergraduate Programs

The department offers the undergraduate student a choice of three programs leading to the A.B. degree. The basic major program in mathematics gives the student the opportunity to obtain a strong, well-rounded mathematical background. The faculty of the department is strongly oriented toward research, and courses required for the major are oriented toward theory. For students with particular interest in the applications of mathematics, a special major program in applied mathematics is available. For prospective school teachers of mathematics there is a small, selective major program in mathematics for teachers.

General Major Requirements Each of the three major programs requires a minimum of 36 upper division units in the major in addition to a lower division base of 1A–1B–1C, 51A–51B–51C. Courses 111, 190A, 190B, 190C, and 190D are not acceptable toward the upper division major requirements. Additional requirements for these programs are as follows.

Major in Mathematics 113A–113B; 104A; 104B or 185; 130 or 140; 135; three additional upper division mathematics courses. Only one of courses 120A and 185 can be offered as part of the major.

The attention of students interested in logic is directed to Philosophy 12A–12B and Mathematics 125A–125B.

The following courses are of interest to many mathematics majors: Computer Science courses; Statistics 100A–100B–100C, 134; Physics 105A–105B; Electrical Engineering and Computer Sciences 148, 152A–152B.

Subject to the requirement of competence in the major, and with the approval of the major adviser, the student may count not more than two mathematically theoretical courses in computer science, statistics, astronomy, physics, or other sciences toward his requirements for the major in mathematics.

Major in Applied Mathematics 120A–120B–120C or three courses from 104A, 104B, 185, 105; 113A and 112; 128A; three additional upper division courses in mathematics or in an applied field (all subject to the approval of the major adviser), of which two must be in an applied field.

Major in Mathematics for Teachers Philosophy 12A; Statistics 20; special sections of 113A–113B–113C, 115A, 130, 132, 134, and 160; one additional upper division mathematics course.

Honors Program In addition to completing the requirements for the major in mathematics or major in applied mathematics, a student in the honors program must (a) earn a grade-point average of at least 3.3 in upper division and graduate courses in math-
emetics; (b) pass a graduate mathematics course with a grade of at least A--; (c) complete the course H196 in which he will write a senior thesis, or pass a second graduate course with a grade of at least A--; (d) receive the recommendation of the Honors Adviser. Students interested in the honors program should consult with the Honors Adviser at least two quarters before graduation.

**Preparation for Graduate Study**  Students preparing for graduate work in mathematics are strongly advised to acquire a reading knowledge of two foreign languages from among French, German, and Russian. This proficiency is required for most Ph.D. programs, but the graduate programs do not leave a large amount of time for language study. There is usually no language requirement for an M.A. degree.

Course 117, designed to challenge the student's ability to do creative thinking, is useful for students preparing for graduate work. It is also desirable for such students to take some graduate courses while still in undergraduate status; courses 202A, 202B, 250A, and 250B are recommended.

**Graduate Programs**

The department offers the M.A. degree in mathematics and the Cand.Phil. and Ph.D. degrees in both mathematics and applied mathematics. Detailed information concerning admission, teaching assistantships and fellowships, and degree requirements is given in the GRADUATE ANNOUNCEMENT OF THE DEPARTMENT OF MATHEMATICS, which is available upon request from the Graduate Secretary, Department of Mathematics.

**Courses and Seminars**

Courses and seminars are listed below. Statements of instructors commenting on their methods of teaching, emphasis in presenting material, and other characteristics of their courses are posted and are available from the Department Office, 970 Evans, at the beginning of each quarter. Detailed descriptions of seminars and names of instructors offering them are also available.

**Letters and Science List:** for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

**Lower Division Courses**

**P. Algebra and Trigonometry. (2)**

Four hours per week. Intended for students who wish to take 1A or 16A but lack the prerequisites. A screening test will be given during the first week. May not be used to satisfy the Letters and Science breadth requirement. After receiving credit for 6B, 1A, 16A or the equivalent, students will not receive credit for Math P. Review of algebra, graphs, functions, polynomials, exponential and logarithmic functions, inverse functions, trigonometric functions and their properties, mathematical induction, binomial theorem, sequences and series.

Mr. Henkin and Assistants (F, W, Sp)

**1A—1B—1C. Calculus. (4 or 5, 4 or 5, 4 or 5)**

Four or five hours per week. Prerequisite: at least three-and-one-half years of high school mathematics including algebra, geometry, trigonometry and other elementary functions, and some coordinate geometry; students lacking the prerequisites may enroll after completing course P or 6A—6B. A screening test will be given at the first class meeting. This is the usual sequence for students who plan additional study of mathematics. Students who have received credit for 16A or 190A will receive one unit of credit; students who have received credit for 16B will receive two units of credit. Students lacking a modern high school treatment of trigonometric functions or a thorough study of coordinate geometry should enroll in the course for five units instead of four for one or more quarters. Introduction to differential and integral calculus of functions of one variable with applications, transcendental functions, techniques of integration, introduction to differential equations and infinite series, vectors, introduction to differential and integral calculus of several variables.

Mr. Lawson, Mr. Stallings, Mr. Hartshorne, Mr. Seidenberg (each part offered each quarter)

**H1A—H1B—H1C. Calculus. (5—5—5)**

Five hours per week. Prerequisite: same as 1A plus A's or B's in high school mathematics and English, and the consent of instructor. No screening exam. Honors course corresponding to 1A, 1B, 1C, for able students with strong mathematical background and interest. Emphasis on theory, rigor, and hard problems. Recommended as preparation for the major, particularly for honors candidates.

Mr. Wadsworth (Sequence beginning F)

**5A. Finite Mathematics. (4)**

Four hours per week. Prerequisite: 3 years of high school mathematics, including at least 2 years of high school algebra, or Math F. A short screening test will be given at the first class meeting. Not
open to students who have completed 51A or 111. Sets, functions, logic, probability, vectors and matrices, with applications.
Mr. Gale, Mr. Berlekamp (F, Sp)

5B. Finite Mathematics. (4)
Four hours per week. Prerequisite: course 5A or a course in linear algebra. Linear programming, graph theory, combinatorics, game theory, and model theory.
Mr. Gale (W)

6A–6B. Elementary Mathematical Planning. (4–4)
Three 1-hour lectures and three hours laboratory sessions per week. Prerequisite: 2 years of high school mathematics. No credit for 6A following courses P, 1A and 16A. A problem-oriented course. Elementary concepts of algebra and trigonometry and elementary versions of advanced mathematical techniques are studied as illustrations of planning theories in selected studies drawn from life, social, and natural sciences.
Mr. Diliberto (F, W, Sp)

10. Mathematics for Liberal Arts Students. (4)
Four hours of lecture per week. Prerequisite: not open to students who have had 1A, 16A, or a more advanced course, but course 10 may be followed by one of these courses. Concepts of modern mathematics for students who have no technical background. The topics are chosen by the instructor and vary from quarter to quarter. Course 10 is not a remedial course in algebra and trigonometry.
Mr. Rhodes (W)

15. Concepts of Mathematics for Elementary School Teachers. (5)
Five hours of lecture per week. Intended for prospective elementary school credential candidates. Development and structure of the real number system and its subsystems. Elementary concepts of set theory, numeration, factoring and divisibility, nonmetric geometry, measurement. Mr. Henkin (W, Sp)

16A–16B. Analytic Geometry and Calculus. (4–4)
Four hours per week. Prerequisite: two years of high school algebra plus plane trigonometry; students lacking the prerequisites may enroll after completing course P or 6A–6B. A screening test will be given at the first class meeting. For students in the social and biological sciences. Mathematics 16A–16B is a terminal course for lower division students whose program does not require more than one year of mathematics. Students should not register in this sequence if there is any chance that they will need more than one year of mathematics. Students do not receive credit for both 16A and 190A, nor for either 16A or 190A after 1A. After receiving credit for 1B, students may receive two units for 16B. They may not receive credit for both 16B and 190C. 16A. Inequalities, absolute value; graphs of simplest functions; the derivative; extreme values; rates of change and differentials; increasing and decreasing functions (mean value theorem); integration, fundamental theorem of calculus, properties of the integral; basic properties of logarithms, exponents, and trigonometric functions (F, W, Sp). 16B. Integration by substitution and by parts; volumes of solids of revolution and arc length; vector spaces and linear algebra.
Mr. Bremermann, Mr. Hille, Mr. Goldschmidt, Mr. Addison (F, W, Sp)

41. Introduction to Linear Algebra and Vector Analysis. (4)
Four hours of lecture per week. Prerequisite: course 1C. Primarily for certain students in Mechanical Engineering. May not be taken for credit after Math 51A or Math 51B. May not replace Math 51A or Math 51B as part of the Mathematics Major. Determinants, linear equations, n-dimensional Euclidean space, matrices, linear independence, linear transformations, review of partial differentiation, application of partial differentiation to maximum and minimum problems, multiple integrals and applications, surface and line integrals, Green's theorem, divergence theorem, Stokes' theorem.
Mr. Carroll, Mr. Sarason (F, W)

51A. Introduction to Linear Algebra. (4)
Four hours of lecture per week. Prerequisite: 1C. Students may not receive credit for both 51A and 111. Matrix algebra, simultaneous linear equations, vector spaces, linear transformations, determinants.
Mr. J. Wolf, Mr. Kelley, Mr. Solovay, Mr. Hsiang (F, W, Sp)

51B. Calculus of Vector Functions. (4)
Four hours of lecture per week. Prerequisite: course 51A. Review of partial differentiation and multiple integration. Vector differential and integral calculus, including theorems of Green and Stokes. Implicit function theorem if time permits.
Mr. Bergman, Mr. J. Wolf, Mr. Solovay (F, W, Sp)

51C. Differential Equations and Related Topics. (4)
Four hours of lecture per week. Prerequisite: courses 1A–1B–1C. Ordinary differential equations of first and second order, series solutions and higher order equations. An introduction to Fourier series and separation of variables in simple partial differential equations with some applications.
Mr. Smale, Mr. Taub (F, W, Sp)

H51A–H51B–H51C. Linear Algebra, Calculus of Vector Functions, and Differential Equations. (5–5–5)
Five hours of lecture per week. Prerequisite: H1C, or 1C and consent of instructor. Honors sequence corresponding to 51A–51B–51C for able students with strong mathematical background and interest. Emphasis on theory, rigor, and hard problems. Recommended as preparation for the major, particularly for honors candidates.
(Sequence beginning F) Mr. Hochschild

Related Courses in Another Department
Philosophy 12A–12B–12C. Introduction to Logic.

Upper Division Courses
104A–104B. Introductory and Intermediate Analysis. (4–4)
Three hours of lectures per week. Prerequisite: courses 51B and 51C or consent of instructor. Mathematics 104A may not be taken for credit after H51C.
104A. Sets and functions, the topology of R^n, the Riemann integral, continuous functions, uniform convergence, the elementary transcendental functions sin x, log x, interchange of limit operations, and some discussion of metric spaces.
104B. The Frechet derivative, chain rule, implicit function theorems and existence theorems for differential equations by the method of successive approximations, integration in several variables, and further topics.
Mr. Kelley, Mr. Kato, Mr. Miller (F, W, Sp)
H104A–H104B. Introductory and Intermediate Analysis. (4–4)

Three hours of lecture per week. Prerequisite: course 51B, 51C, and consent of instructor. Not open to students who have taken 104A–104B. Honors sequence corresponding to 104A–104B for exceptional students with strong mathematical background and interest. Emphasis is on rigor, depth, and hard problems.

Mr. Graff (sequence beginning F)

105. Integration. (4)

Three hours of lecture per week. Prerequisite: course 104A. Null sets and the Riemann integral, construction and properties of Lebesgue measure, the Lebesgue integral and convergence theorems, Fubini's theorem, absolutely continuous functions and differentiation, completeness of L^1, L^2, and Fourier series. Mr. Marsden, Mr. Landorf (F, W, Sp)

111. Introduction to Linear Algebra. (4)

Three hours of lecture per week. Prerequisite: two quarter courses in calculus and upper division or graduate standing. Students may not receive credit for both 51A and 111. Same mathematical content as 51A but intended for advanced students who did not have linear algebra in their lower division calculus sequence.

Mr. Miller, Miss Hall (F, W, Sp)

112. Linear Algebra. (4)

Three hours of lecture per week. Prerequisite: course 51A or 111. Students may not receive credit for both 112 and 113C. For students in engineering or mathematical, natural, or social sciences. The course is oriented more toward a concrete knowledge of matrix theory than is 113C. Characteristic equations, values, and vectors; orthogonal and unitary vector spaces; orthogonal, unitary, and hermitian matrices; quadratic forms, hermitian forms, and diagonalization of normal matrices; introduction to infinite-dimensional spaces.

Mr. Pinney, Mr. Taub (F, W, Sp)

113A–113B. Introduction to Abstract Algebra. (4–4)

Three hours of lecture per week. Prerequisite: course 51A. Sets, groups, rings, fields, polynomials, vector spaces, linear transformations and matrices. (Each part offered each quarter) Mr. Bade, Mr. Fary, Mr. Sarason, Mr. Ogg, Mr. Wu

113C. Abstract Linear Algebra. (4)

Three hours of lecture per week. Prerequisite: course 113B. Students may not receive credit for both 113C and 112. Dual vector spaces, determinants, characteristic values, similarity, canonical forms, unitary spaces, unitary similarity, quadratic forms. Mr. Rosenthal, Mr. Bade, Mr. Fary (F, W, Sp)

H113A–H113B–H113C. Introduction to Abstract Algebra and Abstract Linear Algebra. (4–4–4)

Three hours of lecture per week. Prerequisite: course 51A and consent of instructor. Not open to students who have taken 113A–113B–113C. Honors sequence corresponding to 113A–113B–113C for exceptional students with strong mathematical background and interest. Emphasis is on rigor, depth, and hard problems.

Mr. Marsden (Sequence beginning F)

115A. Introduction to Number Theory. (4)

Three hours of lecture per week. Prerequisite: course 51A. Divisibility, congruences, numerical functions, theory of primes.

Mr. Gilkey, Mr. Lehman (F, Sp)

115B. Topics in Number Theory. (4)

Three hours of lecture per week. Prerequisite: course 115A. Topics selected from: Diophantine analysis, continued fractions, partitions, quadratic fields, asymptotic distributions, additive problems.

Mr. Gilkey (W)

117. Mathematical Problems Seminar. (4)

Three hours of lecture per week. Prerequisite: consent of the instructor. Upper division standing advisable. The student is given the opportunity to exercise his mathematical abilities on problems calling for original thought, and to discuss methods of attack on mathematical questions. Material used may include isolated problems, advanced topics developed through problems, and open research topics. Approach varies with the instructor. For the most part, only material covered in undergraduate courses will be assumed. May be repeated for credit.

Mr. Kahan (F)

120A–120B–120C. Analysis for Applied Mathematics. (4–4–4)

Three hours of lecture per week. Prerequisite: courses 51B and 51C. Primarily for students in applied mathematics and those students in the physical sciences who are likely to pursue more advanced work.


(F, W)

120B. Holomorphic functions, singularities. Contour integration and residue theory. Analytic continuation and Riemann surfaces.

(W, Sp)


(F, Sp)

Mr. Pinney, Mr. Chambré, Mr. Lehman

121A–121B. Mathematical Tools for the Physical Sciences. (4–4)

Three hours of lecture per week. Prerequisite: courses 51B and 51C. Primarily for students in the physical sciences. Students who wish to prepare for advanced work in applied mathematics should take courses 112 or 113C, and 104A, 155 or 120A–B–C. 121A. Orthogonal functions and eigenfunction representations, ordinary differential equations, special functions of mathematical physics. (F, W)

121B. Partial differential equations: Laplace equation, wave equation, diffusion equation, Green's function. Functions of a complex variable.

Mr. Rosenlicht, Mr. Cordes (W, Sp)

123. Ordinary Differential Equations. (4)

Three hours of lecture per week. Prerequisite: course 104A. Some background in linear algebra is recommended. Existence and uniqueness of solutions, linear systems. Other topics selected from: boundary value problems, analytic systems, autonomous systems, Sturm-Liouville theory.

Mr. Chern (F)

125A–125B. Mathematical Logic. (4–4)

Three hours of lecture per week. Prerequisite: course 113A or consent of instructor. Sentential and quantificational logic. Formal grammar, semantical interpretation, formal deduction, and their interrela-
tion. Applications to formalized mathematical theories. Selected topics from model theory or proof theory.  
Mr. Vaught, Mr. Mckenzie (125A; F, W, 125B, W, Sp)

*126. Introduction to Partial Differential Equations.  
(4)
Three hours of lecture per week. Prerequisite: course 104A. Classification of second order equations, boundary value problems, for elliptic and parabolic equations, initial value problems for hyperbolic equations, existence and uniqueness theorems in simple cases, maximum principles, and a priori bounds, the Fourier transform.

128A. Numerical Analysis. (5)
Three hours of lecture per week and one 4-hour laboratory. Prerequisite: courses 51B and 51C. Students do not receive credit for both 128A and 129B. Syntax and semantics of ALGOL, interpolation and approximation, discretization of operators, numerical solution of ordinary differential equations. Emphasis on methods appropriate for use with computers.  
Mr. DeVogelaere, Mr. Berman (F, W)

128B. Numerical Analysis. (5)
Three hours of lecture per week and one 4-hour laboratory. Prerequisite: courses 128A, and 112 or 113C. Students do not receive credit for both 128B and 129A. Solution of nonlinear equations. Numerical methods for solving systems of linear equations and inverting matrices. Characteristic roots and vectors of matrices. Introduction to numerical solution of partial differential equations. Emphasis on methods appropriate for use with computers.  
Mr. DeVogelaere (Sp)

129A. Computational Algebra. (4)
Three hours of lecture and one hour of problem section per week. Prerequisite: course 51A or 111 and a working knowledge of either ALGOL or FORTRAN. Round-off errors. Approximation by interpolation. Solution of nonlinear equations. Numerical methods for solving systems of linear equations and inverting matrices. Characteristic roots and vectors of matrices. Introduction to numerical solution of partial differential equations. Emphasis on methods appropriate for use with computers.  
Mr. DeVogelaere, Mr. Feldman (F, W)

129B. Computational Analysis. (4)
Three hours of lectures and one hour of problem section per week. Prerequisite: courses 51B and 51C and a working knowledge of either ALGOL or FORTRAN. Interpolation, quadrature, ordinary differential equations, difference methods for initial value and boundary value problems. Variational methods, elliptical partial differential equations. Students may not receive credit for both 129A and 128B.  
Mr. Parlett, Mr. Feldman (F, W)

130. The Classical Geometries. (4)
Three hours of lecture per week. Prerequisite: course 113B. Topics chosen from the following list: axioms for affine and projective planes, planes over a division ring, duality, the coordinatization theorem, n-dimensional projective geometry over a field, collineations and correlations, classification of hyperquadrics, the projective group and its subgroups, non-Euclidean geometry, invasive geometry.  
Mr. Rhodes, Mr. Rosenhantl, Mr. Seldenberg (F, W, Sp)

132. Topics in Geometry. (4)
Three hours of lecture per week. Prerequisite: course 113A and consent of instructor. Topics selected from such areas as classical projective geometry, invasive geometry, symplectic geometry, geometric algebra, integral geometry, convexity, and elementary topology.  
Mr. Bowen (W)

133. Algebraic Curves. (4)
Three hours of lecture per week. Prerequisite: course 113A. The complex projective plane, simple and singular points of plane algebraic curves, Bezout's theorem, branches, linear series, cubic curves.  
Mr. Green (Sp)

134. Number Systems. (4)
Three hours of lecture per week. Prerequisite: course 11C. Especially recommended for prospective teachers. Systems of natural numbers, integers, rational numbers, and real numbers developed both axiomatically and through set-theoretical construction. Proof by induction and definitions by recursion.  
Mr. Schlessinger, Mr. Simpson (F, W, Sp)

135. Introduction to the Theory of Sets. (4)
Three hours of lecture per week. Prerequisite: courses 113A and 104A. Set-theoretical paradoxes and means of avoiding them. Sets, relations, functions, order and well-order. Proof by transfinite induction and definition by transfinite recursion. Cardinal and ordinal numbers and their arithmetic. Construction of the real numbers. Axiom of choice and its consequences.  
Mr. Mckenzie, Mr. Bowen, Mr. Rosenlicht, Mr. Vaught (F, W, Sp)

140. Metric Differential Geometry. (4)
Three hours of lecture per week. Prerequisite: courses 104B or 120B; and 113B or 111. Fredet formulas and winding numbers for curves, local and its consequences.  
Mr. Lawson, Mr. Taub, Mr. Kobayashi (F, W, Sp)

*141. Second Course in Metric Differential Geometry. (4)
Three hours of lecture per week. Prerequisite: course 140. Continuation of course 140. Emphasis will be placed on three-dimensional Euclidean space, where geometry can be "seen." Global surface theory, such as rigidity theorems, integral formulas, minimal surfaces, geodesic flows, non-Euclidean geometry. Topics will vary with the instructor.

*145. Boolean Algebras. (4)
Three hours of lecture per week. Prerequisite: course 125A. Postulates, treatment as rings or lattices, relation to sentential calculus and calculus of classes; infinite operations, atoms; subalgebras, ideals, direct products; representation theorem.

151. Generalized Functions (Distributions). (4)
Mr. Wu (F)

160. History of Mathematics. (4)
Three hours of lecture per week. Prerequisite: courses 51B, 51C, and 113A. History of algebra, geometry, analytic geometry, and calculus from ancient times through the seventeenth century and selected topics from more recent mathematical history.  
Mr. Lehmer (F)
163. Tutorial in Upper Division Mathematics. (4)

Four hours per week. Prerequisite: consent of instructor. Emphasis is placed on the individual's experience in discovering and explaining mathematics. Examples of subjects which may be covered are game theory, category theory, differential topology, mathematical foundations of quantum mechanics, global theory of ordinary differential equations, and classical linear groups. Content varies; may be repeated for credit with consent of instructor.

Mr. Dubins (W, Sp)

175. Calculus of Variations. (4)

Three hours of lecture per week. Prerequisite: course 51B or equivalent knowledge of the calculus. Euler equations for variational problems; differential equations of mathematical physics derived from integral principles; solutions of variational problems by direct methods.

Mr. Kato (F)

185. Introduction to the Theory of Functions of a Complex Variable. (4)

Three hours of lecture per week. Prerequisite: course 104A. Analytic functions of a complex variable, Cauchy's integral theorem, power series, Laurent series, singularities of analytic functions, the residue theorem with application to definite integrals. Some additional topics such as conformal mapping.

Mr. Bade, Mr. Ogg, Mr. Lanford, Mr. Wagoner (F, W, Sp)

188. Mathematical Models in Physics and Engineering. (4)

Three hours of lecture per week. Prerequisite: courses 113B and 185. Designed primarily for mathematics majors with little or no background in physical sciences. Study of the relationship between mathematical concepts such as discrete and continuous spectra, resolvents of linear operators, group invariance, and physical concepts which arise in the study of dynamical systems and wave propagation.

190A–190B–190C–190D. Survey of Algebra and Analysis. (4-4-4-4)

Three hours of lecture per week. Prerequisite: upper division or graduate standing with specialization outside mathematics and physical science. Students who have studied calculus should not take 190A but may enter 190B or 190C. Students receive 2 units for 190C following 16B. Course 190D prepares students for course 104A.

190A. Analytic geometry, differential and integral calculus. (F, W)

190B. Calculus of several variables (partial differentiation, extremum problems), complex numbers and trigonometry, vectors and vector spaces. (W, Sp)

190C. Linear algebra. (F, Sp)

190D. Infinite series, differential and difference equations, multiple integration, Kuhn-Tucker theorem. (F, Sp)

Mr. Nelson, Mr. Kobayashi

191. Experimental Courses in Mathematics.

The topics to be covered and the method of instruction to be used will be announced at the beginning of each quarter that such courses are offered. See departmental bulletins.

195. Special Topics in Mathematics. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. Lectures on special topics, which will be announced at the beginning of each quarter that the course is offered. May be repeated for credit.

Mr. Berlekamp (F)

H196. Honors Thesis. (4)

Prerequisite: senior honors standing. Independent study of an advanced topic leading to an honors thesis.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.

The Staff (F, W, Sp)

Related Courses in Other Departments

Computer Science 140. Combinatorics.
Computer Science 142. Graph Theory.
Statistics 100A–100B–100C. Introduction to Theory of Probability and Statistics.
Statistics 141. Introduction to Continuous Parameter Stochastic Processes.
Statistics 142. Introduction to Discrete Parameter Stochastic Processes.

Graduate Courses

202A. General Topology. (4)

Three hours of lecture per week. Prerequisite: course 104B. Topological spaces, connectedness, separation axioms, Urysohn lemma, compactness, local compactness, paracompactness, Tychonov theorem.

Mr. Feldman, Mr. Loewe, Mr. Hsiang, Mr. Graff (F, W, Sp)

202B. Function Spaces. (4)

Three hours of lecture per week. Prerequisite: course 202A. Convergence theory, uniform spaces, spaces of functions, Arzela-Ascoli theorems, Stone-Weierstrass theorem, further topics selected by the instructor.

Mr. Feldman, Mr. Hsiang (W, Sp)

203. Measure and Integration. (4)

Three hours of lecture per week. Prerequisite: course 202A. (may be taken concurrently). General theory of measure and integration, including the Fubini theorems and the Radon-Nikodymb theorem.

Mr. Moore, Mr. Loewe (F, W, Sp)

204A–204B–204C. Ordinary and Partial Differential Equations. (4-4-4)

Three hours per week. Prerequisites: courses 105 and 185 or permission of instructor. Fundamental existence theorem for ordinary differential equations. Properties of linear systems with constant and periodic coefficients. Sturm-Liouville theory; Poincare-Bendixson Theorem, Cauchy-Kowalewski theory for systems of partial differential equations. Initial and boundary value problems for elliptic, parabolic, and hyperbolic second order equations. Nonlinear equations and systems. Mr. Hile (Sequence beginning F)

205A–205B. Theory of Functions of a Complex Variable. (4-4)

Three hours of lecture per week. Prerequisite: course 185 or 120B. Normal families, the Riemann
mapping theorem, Picard's and related theorems, and additional topics chosen by the instructor from classical complex variable theory.

Mr. Sarason (205A: F, Sp; 205B: W)

206A. Linear Spaces. (4)

Three hours of lecture per week. Prerequisite: courses 105 and 202A, or course 203. Elementary theory of Banach and Hilbert spaces, Hahn-Banach theorem, closed graph theorem, principle of uniform boundedness, linear functionals and operators, weak convergence, spaces Lp and C.

Mr. Nelson, Mr. Chernoff, Mr. Loeve (F, W, Sp)

206B. Linear Operators. (4)

Three hours of lecture per week. Prerequisite: course 206A. Spectrum and resolvent, Fredholm theory of compact operators, spectral theorem for bounded self-adjoint operators, commutative Banach algebras.

Mr. Bowen, Mr. Chernoff (W, Sp)

207. Differential Operators. (4)

Three hours of lecture per week. Prerequisite: course 206B. Differential operators, unbounded symmetric operators, perturbation theory, additional topics selected by the instructor.

Mr. Kato (F)

208. Functional Analysis. (4)

Three hours of lecture per week. Prerequisite: course 206A. Locally convex linear topological spaces, distributions, further topics selected by the instructor.

Mr. Bade (W)

212A–212B. Several Complex Variables. (4–4)

Three hours of lecture per week. Prerequisite: course 205. Power series and analytic functions of several variables, analytic sets and ideals of holomorphic functions, analytic continuation and envelopes of holomorphy, analytic spaces, global problems and sheaf theory. Further topics such as pseudoconvexity and the E. Levi problem, embedding theorem for Stein manifolds, proper mapping theorem, normalization theorem, bounded domains in Cn.

Mr. Green (Sequence beginning W)


Three hours of lecture per week. Prerequisite: courses 113B and 202A. Fundamental group, covering spaces, simplicial complexes, homology theory and applications. Homotopy groups, fibrations, relations between homotopy and homology, obstruction theory, classification theorems, spectral sequences and applications. Mr. Hirsch, Mr. Gilkey, Mr. Spanier (215A: F, W; 215B: W, Sp; 215C: F, Sp)


Three hours of lecture per week. Prerequisite: courses 112 or 113C, and 185 or 120A (which may be taken concurrently). Ordinary differential equations in the real and complex domains, existence, differentiability of solutions, linear systems with constant and periodic coefficients, analysis of singular points, Poincare-Bendixson theorem, perturbation theory, Sturm-Liouville theory, Fuchsian equations, asymptotic expansions. Mr. Diliberto (F, W)


Three hours of lecture per week. Prerequisite: course 219A. Group actions and orbits, classification, special cases of Z and R; structural stability in low dimensions, characterization of stable fields in two dimensional manifolds. Higher dimensional theory, generic properties of fields and diffeomorphisms; closing lemma, structural stability, flows and diffeomorphisms; special topics.

220A–220B–220C. Higher Mathematics for Physical Sciences and Engineering. (4–4–4)

Three hours of lecture per week. Prerequisite: courses 120A, 120B, 120C; or 104A, 185 and familiarity with the following topics: Fourier integrals, differential equations of Fuchsian type and Sturm-Liouville theory, or permission of the instructor. Primarily for students in engineering. A qualifying examination will be given during the first class meeting. Students who have passed course 210A–B–C at Berkeley with grade C will be admitted to 220A.

220A. Special functions of mathematical physics. 220B. Partial differential equations of mathematical physics. 220C. Integral equations. Variational methods. (Sequence beginning F) Mr. Cordes

221. Logarithmic and Newtonian Potential. (4)

Three hours of lecture per week. Prerequisite: courses 105 or 203; and 185. Harmonic and superharmonic functions, Dirichlet problem, capacity of sets, general potentials.

222A–222B–222C. Partial Differential Equations. (4–4–4)

Three hours of lecture per week. Prerequisite: courses 105 or 203; and 185. The theory of initial value and boundary value problems for hyperbolic, parabolic, and elliptic partial differential equations, with emphasis on nonlinear equations. More general types of equations and systems of equations.

223A–223B–223C. Modern Applied Mathematics for Physical Sciences. (4–4–4)

Three hours of lecture per week. Prerequisite: courses 112 or 113C, and 104A and 185 or 120A–B. Hilbert space theory, linear operators and spectral theory, with applications to mathematical principles of quantum theory, ordinary and partial differential equations and integral equations.


Three hours of lecture per week. Prerequisite: courses 112 or 113C; and either 104A and 185, or 121A–B, or 120A–B.

224A–224B. Introduction to the theory of distributions. Fourier and Laplace transforms, Partial differential equations, Green's function, Operator theory, with applications to one-parameter unitary groups, eigenfunction expansions, perturbation theory.

224C. Special topics chosen by students and instructor. Miss Kunofsky (Sequence beginning F)

225A–225B–225C. Metamathematics. (4–4–4)

Three hours of lecture per week. Prerequisite: courses 125B and 135. Metamathematics of predicate logic. Completeness and compactness theorems, Interpolation theorem, definability, theory of models. Metamathematics of number theory, recursive functions, applications to truth and provability. Undecidable theories. (Sequence beginning F, W) Mr. Addison, Mr. Henkin
226. Mathematical Logic and Computers. (4)
Three hours of lecture per week. Prerequisite: course 125A. Boolean functions and switching circuits, deterministic computing elements, finite automata, Turing machines, introduction to recursive functions and unsolvable combinatorial problems.
Mr. Rhodes (F)

227A–227B. Theory of Recursive Functions. (4–4)
Three hours of lecture per week. Prerequisite: course 225C. Recursive and recursively enumerable sets of natural numbers: characterizations, significance, and classification. Relativization, degree of unsolvability. The recursion theorem. Constructive ordinals, the hyperarithmetical and analytical hierarchies. Recursive objects of higher type. (Sequence beginning F) Mr. Simpson

228A–228B–228C. Advanced Numerical Analysis.
(5–5–5)
Three hours of lecture and two hours of laboratory per week. Prerequisite: courses 111 or 113B, and 128B. Discretization and optimum discretization. Iteration methods. Applications to systems of linear, differential, and integral equations. Discussion of convergence, stability, and errors. Additional topics selected by the instructor. (Sequence beginning F) Mr. Miller

229A–229B. Theory of Models. (4–4)
Three hours of lecture per week. Prerequisite: course 225C. Syntactical characterization of classes closed under algebraic operations. Ultraproducts and ultralimits, saturated models. Methods for establishing decidability and completeness. Model theory of various languages richer than first-order. (Sequence beginning F) Mr. Vaught

Three hours of lecture per week. Prerequisite: courses 125A and 135.
235C. Selected topics such as: arithmetic of relation types, generalized continuum hypothesis, inaccessible numbers, constructible sets.

236A–236B. Metamathematics of Set Theory. (4–4)
Three hours of lecture per week. Prerequisite: courses 225C and 235B. Various set theories: comparison of strength, transitive and natural models, finite axiomatizability. Independence and consistency of axiom of choice, continuum hypothesis, etc. The measure of problem and axioms of strong infinity.

240A. Differential Geometry. (4)
Three hours of lecture per week. Prerequisite: course 205A. Differential manifolds and maps, abstract vector bundles, tangent bundle, vector fields, flows, Lie derivative, exterior forms, Frobenius theorem, Stokes theorem.
Mr. Weinstein, Mr. J. Wolf (F, W)

240B–240C. Riemannian Geometry. (4–4)
Three hours of lecture per week. Prerequisite: course 240A. Riemannian manifolds, parallelism, geodesics, structure, equations, completeness, curvature, relations between curvature and topology. Further topics such as: general theory of connections, holonomy groups and de Rham decomposition, pinched manifolds, submanifolds, Riemannian geometry of Lie groups.
Mr. Weinstein, Mr. J. Wolf (240B: W, Sp; 240C: Sp)

241A. Riemann Surfaces. (4)
Three hours of lecture per week. Prerequisite: courses 205 and 240A. Compact Riemann surfaces, Riemann surface of an algebraic function, Riemann-Roch theorem, Abel's theorem, Jacobian variety and linear systems, integrals of 1st, 2nd, and 3rd kind, and period relations. (Mr. Rosenlicht (F)

241B. Complex Manifolds. (4)
Three hours of lecture per week. Prerequisite: course 241A. Transcendental methods in algebraic geometry, Kahler manifolds, Hodge and Dolbeault theorems, fiber bundles and characteristic classes in algebraic geometry, abelian varieties and analytic surfaces.

Three hours of lecture per week. Prerequisite: courses 113C and 135. General notion of an algebraic structure. Subalgebras; isomorphism; homomorphisms and congruence relations; direct products, reduced products, and ultraproducts; free algebras. Applications of general notions to groups, rings, fields, lattices, Boolean algebras, etc.
Mr. Bergman (Sequence beginning W)

250A. Groups, Rings, and Modules. (4)
Three hours of lecture per week. Prerequisite: courses 113A, 113B, and 113C or their equivalent. Group theory; direct and semidirect products, composition series, permutation groups, groups with operators. Ring theory: homomorphisms and ideals, unique factorization and principal ideal domains. Modules over rings: maximum and minimum conditions, free modules, duality, tensor product and homomorphism modules.
Mr. Rosenlicht, Mr. Wadsworth (F, W, Sp)

250B. Field Theory. (4)
Three hours of lecture per week. Prerequisite: course 250A. Extensions and composites of fields. Transcendental and algebraic extensions. Algebraic closure. Separable and purely inseparable extensions and automorphisms of fields, Galois theory. Finite fields. Isomorphisms. Mr. Satake, Mr. Schlessinger, Mr. Wadsworth (F, W, Sp)

250C. Multilinear Algebra and Commutative Algebra. (4)
Three hours of lecture per week. Prerequisite: course 250B. Tensor algebra and exterior algebra of a module, with application to linear transformations. Elementary commutative ideal theory, rings of fractions, local rings. Elementary specialization and valuation theory. Related topics in commutative algebra.
Mr. Schlessinger (W, Sp)

251. Ring Theory. (4)
Three hours of lecture per week. Prerequisite: course 250B. Topics such as: Noetherian rings, rings with descending chain condition, theory of the radical, homological methods.
Mr. Hochschild (F)

252. Representation Theory. (4)
Three hours of lecture per week. Prerequisite: course 250B. Structure of finite dimensional algebras, applications to representations of finite groups, the classical linear groups.
Mr. Goldschmidt (F)
*254. Algebraic Number Theory. (4)
Three hours of lecture per week. Prerequisite: course 250B. Field theory, integral extensions, the arithmetic of number fields, number fields and their rings of integers, ramification theory.
Mr. Goldschmidt (Sp)

Three hours of lecture per week. Prerequisite: course 250B. Historical introduction, primitive terms and axioms of Euclidean geometry. Principal consequences of axioms; introduction of Cartesian coordinates. Completeness, categoricity, decidability; independence of axioms. Alternative systems of primitive terms and axioms. Non-Euclidean geometries—parallel development to Euclidean geometry.

*260A. Topological Groups. (4)
Three hours of lecture per week. Prerequisite: courses 202A and 250A. General topological groups, Haar measure, compact groups.
Mr. Dubins (W)

*260B. Abstract Harmonic Analysis. (4)
Three hours of lecture per week. Prerequisite: courses 206A and 260A. Banach algebras, convolution algebras, group representations.

*261A--261B--261C. Lie Groups. (4—4—4)
Three hours of lecture per week. Prerequisite: course 240A. Lie groups and Lie algebras, general structure theory; compact, solvable, complex, and semi-simple groups; classification of simple groups, representation theory; further topics such as the theory of symmetric spaces. (Sequence beginning W)

*265. Differential Topology. (4)
Three hours of lecture per week. Prerequisite: course 240A. Approximation theorems, imbedding theorem, Sard's theorem, tubular neighborhoods, transversality, classifying spaces, cobordism.

*270. Mathematical Theory of Fluid Dynamics. (4)
Three hours of lecture per week. Development of the fundamental equations describing the behavior of a fluid continuum followed by the treatment of special topics selected to exhibit different physical situations, analytical techniques and approximate methods of solution.
MEDICAL PHYSICS

(Division Office, 103 Donner Laboratory)

Professors:

Hans J. Bremermann, Ph.D.
John W. Gofman, M.D., Ph.D.
Hardin B. Jones, Ph.D.
Thomas H. Jukes, Ph.D., D.Sc. (in Residence)
Robert K. Mortimer, Ph.D. (Chairman)
Alexander V. Nichols, Ph.D.
Cornelius A. Tobias, Ph.D.
John H. Lawrence, M.D. Sc.D. (Emeritus)
John H. Northrop, Ph.D., Sc.D., LL.D. (Emeritus)

Associate Professors:

Robert M. Glaeser, Ph.D.
Howard C. Mel, Ph.D.

Assistant Professor:

H. John Burki, Ph.D.

NOTE: For key to footnote symbols, see page 86.
Undergraduate Advisers: J. H. Lawrence, A. Nichols.

The courses of the division are designed to meet several objectives: (1) to prepare students for advanced work in biophysics, medical physics, and allied fields; (2) to offer for physical science and engineering students selected topics and concepts of biological sciences; and (3) to provide biomedically oriented students an introduction to some of the quantitative physical problems and approaches in biology and medicine. Courses 10, 11, and 103 are designed to provide background and perspective in their specified fields.

Individual Major in Biophysics

An individual major in biophysics (physics and biology) may be arranged in consultation with one of the major advisers. Lower division course sequences in physics, mathematics, chemistry and biology are required as preparation for the major. In addition, 45 units of upper division courses in physics, physical chemistry, and biology are required for completion of the major. Recommended courses include atomic and molecular physics, thermodynamics, physics of biological systems, cell biology, and the honors course Interdepartmental Studies H195A–H195B. This individual major program prepares the student for graduate studies in biophysics, and it is also accepted as preparation by the leading medical schools. Advisers: Mr. Nichols, Mr. Lawrence.

Graduate Study

Graduate degrees available under the supervision of faculty of the division are the Ph.D. in biophysics, the Ph.D. in medical physics and the master’s degree in bioradiology. These degrees are administered under the Graduate Group in Biophysics and Medical Physics. Further information is available from the Group Office, 363 Donner Laboratory.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

10. Atomic Radiation and Life. (4)

Three 1-hour lectures and 1-hour discussion per week. Prerequisite: a lower division course in physics, or a major in natural science. Basic aspects of atomic radiations with examples from biomedical and physical fields. To provide a framework for evaluating the complex changes associated with the atomic age. For liberal arts as well as science students.

Mr. Tobias (F), Mr. Mel (Sp)

11. Drug Use and Abuse. (3)

Three hours per week. Alternate lectures and discussions presenting practical information about the effects of mood altering drugs: nature of drug action; habituation, addiction, and sensual perversion; social dynamics of drug abuse; rehabilitation, and overcoming drug dependency.

Mr. Jones (F, Sp)

Upper Division Courses

101. Radiation and Tracer Biophysics. (4)

Three 1-hour lectures and one 1-hour demonstration per week. Prerequisite: Physics 6C or 4D, Chemistry 1B, Biology 1B, or equivalent with consent of instructor. An introductory course in calculus is recommended. Basic theory of radioactivity, interactions of radiation with matter; radiation detection, radioactive isotopes and their role in evaluation of transport, distribution and turnover of metabolites; introductory theory of tracer kinetics.

Mr. Mortimer (F, Sp)

102A–102B. Physics of Biological Systems. (4-4)

Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: Physics 4E, a course in physical chemistry or thermodynamics (may be taken concurrently); Mathematics 1C, an introductory biology course; or consent of instructor.

102A. Biological energetics. Thermodynamics of closed and open systems; physical and biological transport processes; gravity and biology; coupled and uncoupled chemical, electrical, mechanical, and osmotic phenomena, and biological work.

Mr. Mel (F)

102B. Biological kinetics. Biophysics of colloidal systems and surfaces; reaction rate theory and biological catalysts; photobiology.

Mr. McLaren, Mr. Bearden (W)

103. Human Biology. (4)

Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: Biology 1A–1B or Biology 11A–11B, or consent of instructor. A presentation of scientific concepts explaining structure, function and development of the body, the nature and origin of disease, aging, conditioning, demographic and dynamic aspects of human populations.

Mr. Jones (W)

121. Molecular Physics and Biological Structure. (5)

Five 1-hour lectures per week. Prerequisite: Biology 1B, Chemistry 109A–B and Mathematics 51C, or the equivalent with consent of instructor. Experimental and theoretical principles of contemporary
molecular physics as they are used in understanding biological structure and phenomena associated with structure. To include chemical bonds; the structure of water, molecular complexes, cell organelles, and energy transport.

Mr. Glaeser (Sp)

H195. Individual Study for Honors Candidates. (1–5)

Advanced upper division work for students majoring in biophysics (physics and biology). Credit determined by faculty sponsor.

The Staff (Mr. Mortimer in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87. Additional limitation; overall grade-point average of at least 2.5. Must be taken on a passed or not passed basis.

The Staff (Mr. Mortimer in charge) (F, W, Sp)

Graduate Courses

Cellular Biophysics

201. Lipoproteins and Membrane Structure. (3)

Three 1-hour lectures per week. Lipid-protein interactions; analysis and characterization of lipoproteins; models of lipoprotein structure; organization and function of lipoproteins in membranes, mitochondria, and other subcellular structures.

Mr. Nichols, Mr. Glaeser (F)

202. Electrical and Transport Properties of Membrane. (3)

Two 1½-hour lectures per week. Analysis of membrane properties and function; capacitance and conductance; electro-diffusion and ion movement; propagation of nerve impulses; models and theories.

Mr. Tobias (W)

203A–203B. Nucleic Acids and Information Transfer. (2–2)

Two 1-hour lectures per week.

203A. Physical and chemical properties of nucleic acids, X-ray structure, molecular weight, hydrodynamic and optical properties of DNA and RNA. Primary, secondary and tertiary structures of nucleic acid in vivo and in vitro.

203B. Transfer RNA, ribosomes, protein synthesis, evolutionary relationships of proteins and nucleic acids.

Mr. Jukes (Sp)

204A–204B–204C. Advanced Laboratory in Biophysical Research. (4–4–4)

Two hours of lecture and six hours of laboratory per week. Physical properties of biological systems at the atomic, molecular, cellular, and organisinal level. Enrollment limited. 204A is not prerequisite for 204B. 204B is not prerequisite for 204C.

The Staff (F, W, Sp)

Radiation Biophysics

211. Molecular Radiation Biology. (3)

Two 1½ hour lectures per week. Analysis of the action of ionizing, ultraviolet and visible radiation on cells and viruses in relation to their effects on molecules of biological interest, radionuclide chemicals, intracellular repair of radiation damage in nucleic acids.

Mr. Burki (F)

212. Mutagenesis and Radiation Genetics. (3)

Two 1½-hour lectures per week. Genetic effects of radiation and chemical mutagens. Mutagenic mechanisms, induced genetic recombination, chromosome breakage and rearrangement.

Mr. Mortimer, Mr. Wolff (Sp)

213. Mammalian Radiation Biology. (3)

Two 1½-hour lectures per week. Prerequisite: course 211 or permission of instructor. Analysis of the actions of ionizing, ultraviolet, and visible radiation on mammalian cells and mammalian organ systems. Cell life cycles, normal and abnormal cell kinetics; recovery phenomena; internally incorporated radioisotopes; long term effects; environmental and public health aspects.

Mr. Burki (W)

214. Radiological Physics. (3)

Two 1½-hour lectures per week. Prerequisite: course 101 and Physics 124. Interaction of electromagnetic and particulate radiation with matter, dosimetry, health physics, shielding, measurement of environmental radiation.

Mr. Wallace (Sp)

Theoretical Biophysics

221. Mathematical Models and Methods in Biology. (4)

Three 1-hour lectures per week. Prerequisite: Mathematics 104A or 121A or 129A or equivalent; Biology 1A–1B or consent of instructor. Mathematical models of metabolic and ecological systems. Reductionism and the problem of complexity. Evolution and optimization. Nerve nets and function. Survey of useful mathematical methods.

Mr. Bremermann (W)

222. Self-Organizing Systems. (4)

Three 1-hour lectures per week. Prerequisite: course 221 or consent of instructor. Information theory; physical theory of nerve action; biological servomechanisms; self-organizing systems; memory; learning and logic in neural nets. Mr. Bremermann (Sp)

223. Non-Equilibrium Thermodynamics. (3)

Two 1½-hour lectures per week. Prerequisite: course 102A or equivalent or consent of instructor. Theoretical foundations of irreversible thermodynamics with application to problems of biological interest.

Mr. Bremermann (Sp)

Medical Physics

231A–231B. Nuclear Medicine. (5–5)

One 3-hour lecture and one 5-hour laboratory period each week. Prerequisite: courses in differential and integral calculus. Advanced theory and techniques of nuclear medicine, application of radioactive isotopes to the study of disease processes.

Mr. Winchell, Mr. McRae (F, W)

232A–232B. Medical Physics of Pathologic Processes. (2–2)

232A. Carcinogenesis. Evaluation of current status of evidence concerning the process of carcinogenesis and an attempt to integrate such evidence into a consistent picture. Leading concepts concerning development of malignancy will be considered in detail.

Mr. Gofman (F)

232B. Atherogenesis. Evaluation of atherogenic
21A-21B. Introduction to the Theory of Warfare. (2-2)
Two hours of lecture per week. Survey and analysis of the causes and nature of war. Discussion of the principles of war as propounded by major theoreticians. Elements of national power—economic, psychological-sociological, political, military, and scientific, and technological—as pertains to the roles of the armed forces.

The Staff (sequence beginning F)

11C. United States Defense Establishment. (2)

The Staff (Sp)

Two hours of lecture per week. Prerequisite: courses 11A–11B or consent of instructor. Study and analysis of American military theory and evolution of warfare from colonial time to Vietnam. Selected battles and campaigns are examined to trace the development of military thought and practice of warfare. Emphasis will be placed on military strategy and tactics relating to those aspects that have modern application; historical relationship between the military and the American society in the development of the nation.

The Staff (Sp)

MILITARY SCIENCE

(Department Office, 74 Harmon Gymnasium)

Professor:
Carl F. Bernard, M.A., Colonel, IN

Associate Professors:
Monte R. Bullard, M.A., Major, MI
John L. Pope, M.A., Major, MP

For further information concerning the scholarship opportunities, consult page 55 or contact the Professor of Military Science in Room 74, Harmon Gymnasium.

Lower Division Courses

11A–11B. Introduction to the Theory of Warfare. (2–2)
Two hours of lecture per week. Survey and analysis of the causes and nature of war. Discussion of the principles of war as propounded by major theoreticians. Elements of national power—economic, psychological-sociological, political, military, and scientific, and technological—as pertains to the roles of the armed forces.

The Staff (sequence beginning F)

11C. United States Defense Establishment. (2)

The Staff (Sp)

Two hours of lecture per week. Prerequisite: courses 11A–11B or consent of instructor. Study and analysis of American military theory and evolution of warfare from colonial time to Vietnam. Selected battles and campaigns are examined to trace the development of military thought and practice of warfare. Emphasis will be placed on military strategy and tactics relating to those aspects that have modern application; historical relationship between the military and the American society in the development of the nation.

The Staff (Sp)

299. Individual Research: Medical Physics and Biophysics. (1–16)

The Staff (Mr. Tobias in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser. Intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Mr. Tobias in charge) (F, W, Sp)

NOTE: For key to footnote symbols, see page 86.
stafﬁng, directing and controlling; live staff relationships, authority and responsibility, study of advanced planning and control techniques, time event networks, cost effectiveness and planning, programming, budgeting cycle; decision making and organizational communication. The Staff (sequence beginning F)

144. Fundamentals of Military Law. (2)
Two hours of lecture per week. Analysis and discussion of the military legal system as an element of United States Criminal Law; Constitutional guarantees; the Uniform Code of Military Justice; rules of evidence; pretrial, trial, and appellate processes. Summary, Special and General Courts-Martial, Non-Judicial Punishment. The Staff (Sp)

**MOLECULAR BIOLOGY**

(Deartment Office, 229 Stanley Hall)

Professors:
Melvin Calvin, Ph.D., Sc.D.
Alvin J. Clark, Ph.D.
Michael Doudoroff, Ph.D.
Harrison Echols, Ph.D.
Heinz L. Fraenkel-Conrat, M.D., Ph.D.
Donald A. Glaser, Ph.D.
C. Arthur Knight, Ph.D.
Harry Rubin, D.V.M.
Howard K. Schachman, Ph.D. (Chairman)

Gunther S. Stent, Ph.D.
Robley C. Williams,† Ph.D.

Associate Professors:
Richard Calendar, Ph.D.
Peter H. Duesberg, Ph.D.
John C. Gerhart, Ph.D.
John R. Roth,† Ph.D.

Assistant Professor:
Theodore Gurney, Ph.D.

The Department of Molecular Biology offers a program of instruction and research at the graduate level, with emphasis on the description of biological phenomena at the molecular level.

**Preparation for Graduate Study** Students interested in pursuing graduate work in molecular biology are advised to obtain a strong background in chemistry, physics, and mathematics, and to be familiar with the basic concepts of biology. Biochemistry and genetics form the specific foundation for much of the instructional work in the department. Common preparation required of all students, as exempliﬁed by course offerings at Berkeley:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Quarter Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td>General (4A–4B–4C)</td>
<td>15</td>
</tr>
<tr>
<td>Organic (12A–12B–112)</td>
<td>8</td>
</tr>
<tr>
<td>Physical (110A–110B)</td>
<td>6</td>
</tr>
<tr>
<td>Biochemistry (102, 102L or 100A–100B–100C)</td>
<td>9</td>
</tr>
<tr>
<td>Physics</td>
<td></td>
</tr>
<tr>
<td>General (Physics 4A–4B–4C–4D)</td>
<td>15</td>
</tr>
</tbody>
</table>

Those students who are deﬁcient in their preparation when they enter the graduate program in molecular biology will be expected to remedy their deﬁciencies as soon as possible.

**The Graduate Major for the Ph.D. Degree** Training and performance in laboratory research are emphasized in the graduate program of this department. Current areas

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**NOTE:** For key to footnote symbols, see page 86.
of research activity include: structure, function and metabolism of nucleic acids and proteins; chemical events in mutation and recombination; control mechanisms in the growth of viruses, bacteria, and animal cells; and biological ultrastructure.

In addition to the basic preparatory courses (listed above), the student is expected to take Molecular Biology 200A and 200B. Other courses are chosen in consultation with the graduate adviser during the first two quarters of residence and thereafter with the student's research adviser.

Each student serves as a teaching assistant for one quarter as a requirement for the Ph.D. degree. Demonstration of a reading knowledge of one foreign language chosen from French, German, Japanese, and Russian is required before the qualifying examination can be taken. In the qualifying examination the student must demonstrate proficiency in research as well as general knowledge of different areas of Molecular Biology. Incoming students with adequate undergraduate preparation should plan on finishing their Ph.D. requirements, including the dissertation, within four years. Those with deficiencies may require a longer time; such deficiencies, however, should be made up during the first year of graduate work.

**Letters and Science List:** For regulations governing this list, see the **ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE**.

**Lower Division Courses**

1. **Molecules of Life. (4)**
   
   Three lecture hours plus one discussion per week. Prerequisite: Chemistry 1A and 1B. Recommended: Biology 1A and 1B, and Chemistry 8 or 12. For students intending to major in the biological or physical sciences. Introduction to the molecular basis of metabolism and inheritance. Cell chemistry and division; biochemical pathways; enzyme function; gene structure, replication, mutation, recombination, and expression; protein synthesis.
   
   Mr. Stent, Mr. Gerhart (Sp)

10. **Introduction to Molecular Biology. (3)**
   
   Three 1-hour lectures per week. Open without prerequisite for all students and designed for those not specializing in science. The molecular basis of life. Contemporary description of genetics, mutations, evolution, growth, and reproduction, with emphasis on viruses and simple organisms. Extension to higher organisms and medical and social implications.
   
   Mr. Glaser (F), Mr. Fraenkel-Conrat (Sp)

**Upper Division Courses**

110A. **Molecular Basis of Heredity. (5)**
   
   Three 1-hour lectures and two discussion sections per week. Prerequisite: Chemistry 8A-8B; Biology 1A-1B. An introduction to the molecular basis of the structure and function of the hereditary substance of living forms. Emphasis on prokaryotic organisms and their viruses.
   
   Mr. Roth (W)

110B. **Molecular Basis of Heredity. (4)**
   
   Three 1-hour lectures and one discussion section per week. Prerequisite: Chemistry 8A-8B; Biology 1A-1B. Course 110A may be taken without course 110A with the consent of instructor. An introduction to the molecular basis of the structure and function of the hereditary substance of living forms. Emphasis on eukaryotic organisms with examples drawn from recent studies of genetic disease, cytoplasmic inheritance, the nervous system, behavior and evolution.
   
   Mr. Clark (Sp)

120. **Introduction to Molecular Virology. (4)**
   
   Four 1-hour lectures per week. Prerequisite: organic chemistry and an elementary course in biology. Consideration of viruses as infectious particles having chemical, physical, and hereditary characteristics. To be offered on a pass/not pass basis.
   
   Mr. Knight (F)

199. **Supervised Independent Study and Research. (1-5)**
   
   Enrollment is restricted by regulations listed on page 87. Additional limitation: overall grade-point average of at least 3.0. Must be taken on a passed or not passed basis.
   
   The Staff (Mr. Gerhart in charge) (F, W, Sp)

**Graduate Courses**

200A-200B-200C. **Introduction to Molecular Biology. (5-5-5)**
   
   Three 1½-hour lectures and one discussion section per week. Prerequisite: Biology 1A-1B or equivalent, or Bacteriology 100A; Biochemistry 100A or 102, and a course in physical chemistry (these courses may be taken concurrently); or consent of instructor. Three-quarter sequence beginning in the fall.
   
   200A. Genetic and functional characteristics of prokaryotic cells and of viruses; biosynthesis of nucleic acids and proteins, metabolic regulation.
   
   Mr. Calendar, Mr. Echols (F)
   
   200B. Fine structure and organization of eukaryotic cells. Molecular and cellular processes involved in the formation and function of differentiated multicellular systems.
   
   Mr. Duesberg, Mr. Gunney, Mr. Williams (W)
   
   200C. Integrated behavior of cell populations in metazoa. Molecular mechanisms of cellular interactions in the growth of tissues, in organ morphogenesis, and in the transmission and storage of information in the nervous system.
   
   Mr. Stent, Mr. Gerhart, Mr. Rubin (Sp)

201. **Molecular Biology Laboratory. (5)**
   
   One hour of lecture and eight hours of laboratory per week. Prerequisite: consent of instructor. Experimental techniques used in the isolation, characterization, and study of the structure, synthesis, and interactions of macromolecules of biological interest. (Sp)
210. Special Topics in Molecular Biology. (1–3)
One hour lecture per week per 1 unit of credit. Prerequisite: consent of instructor. A course dealing with the areas of current interest in molecular biology. May be repeated for credit.
The Staff (Mr. Schachman in charge) (F, W, Sp)

211. Introduction to Research in Molecular Biology. (4–8)
Closely supervised experimental work under the direction of individual staff members; an introduction to experimental methods and research approaches in particular areas of molecular biology. Limited to students in this department.
The Staff (Mr. Schachman in charge) (F, W, Sp)

220A–220B. Molecular Biology of Viruses. (3–3)
Three hours of lecture per week. Prerequisite: Biology 1A–1B or equivalent, or Bacteriology 100A; Biochemistry 100A or 102 (may be taken concurrently); one year of college mathematics. Structure, reproduction, mutation, and host-cell interactions of viruses.
*220A. Plant and bacterial viruses.
Mr. Fraenkel-Conrat (W)
220B. Animal cytocidal and tumor viruses.
Mr. Duesberg (Sp)

*221. General Virology Laboratory. (5)
One lecture period and 9 hours of laboratory work per week. Prerequisite: course 200A or 220A or 120, or consent of the instructor. Techniques used in research on bacterial, animal, and plant viruses.

*230. Microbial Genetics, (3)
Three hours of lecture per week. Prerequisite: course 200A or 220A, or consent of instructor. A graduate level course on current topics in microbial genetics. Emphasis will be on recent advances in the genetics of bacteria, eukaryotic microbes, and cultured cells.
Mr. Roth, Mr. Clark (F)

231. Microbial Genetics Laboratory. (5)
Two hours of lecture and nine hours of laboratory per week. Prerequisite: course 230 or consent of instructor. Experimental techniques used in research on the genetics of bacteria. Mr. Clark, Mr. Roth (W)

241. Techniques in Animal Cell Culture. (4)
One hour of lecture and seven hours of laboratory per week. Prerequisite: 200B or consent of instructor. Techniques used in research on the growth and function of animal cells in culture.
Mr. Gurney (F)

270. Research Seminar. (1)
Prerequisite: 211 or 280 taken concurrently or consent of instructor. Seminar on presentation and evaluation of results in area of student's individual research interests.
The Staff (F, W, Sp)

280. Research. (1–12)
Individual research under the supervision of a staff member.
The Staff (F, W, Sp)

290. Seminar. (1)
Recent topics in molecular biology. Topics will be announced in advance of each quarter. Enrollment in more than one section is permitted.
The Staff (F, W, Sp)

299. Special Study for Graduate Students. (1–5)
Meetings to be arranged. Reading and conferences under the direction of a staff member.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Roth in charge) (F, W, Sp)

MUSIC

(Department Office, 104 Morrison Hall)

Professors:
David D. Boyden,† M.A., Mus. D. (h.c.)
Richard L. Crocker, Ph.D.
Alan Curtis, Ph.D.
William D. Denny, M.A. (Chairman)
Vincent H. Duckles, Ph.D.
Daniel Heartz,† Ph.D.
Andrew W. Imrie, M.A.
Joseph Kerman,† Ph.D.
Lawrence Moe, Ph.D.
(University Organist)
Joaquin Nin-Culmell
Edgar H. Sparks, Ph.D.
Charles C. Cushing, M.A. (Emeritus)

Associate Professors:
Philip Brett, Ph.D.
James E. Cunningham, M.M.
Richard Felciano, Ph.D.
Michael Senturia, A.B.

Olly Wilson, Ph.D.
Assistant Professors:
Edwin Dugger,† M.F.A.
Anthony Newcomb, Ph.D.

Lecturers:
Bernhard Abramowitsch (Piano)
James Berdahl, M.A. (Director of Bands)
John Burke, M.M. (Organ)
Richard Burke, M.M. (Clarinet)
Jacqueline R. Clark, A.B.
Elizabeth Davidson, M.A.
Ronald Erickson, M.A. (Violin)
Deno Gianopoulos (Piano)
Laurette Goldberg, B.Mus. (Harpischord)
Merrill Jordan (Flute)
Felix Knuner
Daniel Livesay, A.B. (Trombone)
Michael Lorimer (Classical Guitar)
Margaret Lucchesi, M.A. (Percussion)

NOTE: For key to footnote symbols, see page 86.
James Matheson, A.B. (Oboe)
Detlev Olshausen, A.B. (Viola)
José Rey de la Torre (Classical Guitar)
Margaret A. Rowell, A.B. (Violoncello)
James R. Russell, A.B. (Clarinet)
Earl Saxton, M.A. (French Horn)

David Schneider (Violin)
Verne M. Sellin, B.S.
Philip Shoptaugh (Trumpet)
John M. Swackhamer, A.B.
Corinne Swall, M.A.

Departmental Major Advisers: Mr. Cunningham, Mr. Moe, Mr. Wilson.

Graduate Advisers: Composition, Mr. Nin-Culmell (M.A. and Ph.D.); History and Literature, Mr. Crocker (Ph.D.), Mr. Brett (M.A.).

Music Education Adviser: Mr. Sparks.

The Department of Music at Berkeley is concerned with the cultivation of music in the University by means of concerts, lectures, and courses offered for general students as well as for music majors in the three principal branches of musical endeavor. The Theory courses provide an introduction to the materials of musical composition through ear training, harmony, counterpoint, and analysis. The History and Literature courses present a comprehensive survey of the evolution of music and detailed study of the chief periods of its development. The Performance courses offer, through solo, ensemble, and group performance, the study of standard, little-known, and new works representative of the repertoire for individual performers, diverse chamber ensembles, band, chorus, and orchestra.

The department will consider recommending to the Dean a reduction of the minimum unit load for those students who wish to pursue intensive vocal or instrumental study and to take longer than the usual four years to obtain the A.B. degree.

Students interested in graduate study are advised to become acquainted with the regulations of the Graduate Division. A background in foreign languages is essential: for the M.A. degree one foreign language, normally French or German; for the Ph.D. degree, option in research, French, German, and liturgical Latin; option in composition French or German and one other language. Graduate study is offered in the theory, history, and composition of music; the value of a thorough undergraduate preparation cannot be overemphasized.

A qualifying examination in keyboard skills, musicianship, and harmony will be given during the advance enrollment period. Results of this examination will determine assignment to sections in elementary and intermediate courses. Students should consult the Circular for New Undergraduates for more detailed information. Entering undergraduates, including those transferring from other institutions, must take this examination, and should consult with the appropriate adviser before enrolling in any music course.

All students who wish either to audit or to enroll in performance courses are requested to make appointments for auditions during the advance enrollment period.

The Major

First Year Courses A–B–C; 1A–1B–1C.
Third and Fourth Years (a) Performance—Three courses from the group 141–149, preferably in sequence. (b) Additional courses to complete the minimum of 36 units in the series for majors 100–199 (including performance courses 141–149 but not courses in the 127 and 128 series). Interdepartmental Studies courses 104, 115, and 137 are acceptable for the major.

Honors Program Adviser: Mr. Crocker. Suitably qualified honor students majoring
in music are invited to consult the adviser concerning studies which they may propose to undertake. Appropriate general fields include music history, analysis, musical composition, and performance. The Honors Seminar (H198) is required of seniors who wish to obtain departmental honors at graduation.

**Teacher Training** Consult Mr. Sparks. Attention is called to the following recommended courses: Orchestration, Conducting, both of which may be used as elective courses for the major in the series 100–199; Vocal Technique, Stringed Instruments, Wind Instruments. See also the ANNOUNCEMENT OF THE SCHOOL OF EDUCATION.

**Higher Degrees**

All graduate students should consult a graduate adviser during the advance enrollment period and take the advisory and language examinations scheduled at that time. Graduate students should consult the Graduate Division section of this catalogue and the special announcements issued by this department concerning the M.A. and Ph.D. degrees.

**Medieval Studies** Students who are interested in specializing in medieval studies should consult the Graduate Division of this catalogue.

**Letters and Science List:** for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

**Group I**

Courses open to all students in the University.

**THEORY**

**Lower Division Courses**

10A–10B. Basic Musicianship. (2–2)
Three 1-hour meetings per week. Fundamentals of music, including notation, sight singing, ear training, and beginning linear analysis. For general students. The Staff (Mr. Swackhamer in charge) (F, W, Sp)

Three 1-hour meetings per week. A writing course, based on traditional harmony. Beginning linear and vertical analysis. For general students. Mr. Levine (W, Sp)

**HISTORY AND LITERATURE**

**Lower Division Course**

27. Introduction to Music. (4)
Two 1-hour lectures, one 1-hour listening section, and one 1-hour discussion section per week. Lectures, demonstrations, and supervised listening dealing with the rudiments of music. Mr. Brett (F); Mr. Moe (W)

**Upper Division Courses**

127A. History of Music. (4)
Two 1-hour lectures, one 1-hour listening section, and one 1-hour discussion section per week. **Prerequisite:** course 27. The evolution of musical style from early times to Beethoven. Mr. Brett (W)

127B. History of Music. (4)
Two 1-hour lectures, one 1-hour listening section, and one 1-hour discussion section per week. **Prerequisite:** course 27. The evolution of musical style from Beethoven to the present day. Mr. Brett (Sp)

128A. Opera. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27. A study of operas selected from the repertoire of the San Francisco Opera Association, fall season, 1973. Mr. Crocker (F)

128B. The Symphonies of Beethoven. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27.

*128C. Contemporary Music. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27.

128D. J. S. Bach. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27.

*128E. Mozart. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27.

128F. Symphonic Literature of the Nineteenth Century. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27.

*128G. Choral Literature of the Nineteenth Century. (4)
Three 1-hour lectures per week. **Prerequisite:** course 27.

*128H. G. F. Handel. (4)
Three hours of lecture per week. **Prerequisite:** course 27.

128I. Ibero-American Music. (4)
Three 1-hour lectures per week. Pre-Columbian, colonial, folk, and art music of Ibero-America. Enrollment limited to 100 students. Mr. Nin-Culmell (Sp)
128K. Afro-American Music. (4)
Three hours of lecture per week. Black-American music from its African origins to the various forms in which it exists in America today. The origins and development of contemporary American Black music in popular music as well as jazz and contributions to their white counterparts. Enrollment limited to 100 students.
Mr. Wilson (F)

128L. The Music of Black Africa. (4)
Three hours of lecture per week. An introductory study of the stylistic characteristics and social function of music in traditional Sub-Saharan cultures. Enrollment limited to 100 students. Mr. Nkedia (W)

*128N. Music on the Grand Tour. (4)
Three hours of lecture per week. Prerequisite: course 27. A survey of French and Italian music of the 18th century based on the writings of Charles Burney and other travelers. Mr. Duckles

PERFORMANCE

Admission to all performance courses is determined by audition during the period of advance enrollment. All courses in this group may be repeated for credit.

Upper Division Courses

141. University Symphony Orchestra. (2)
Two 2-hour rehearsals per week. This course should be taken in a three-quarter sequence.
Mr. Senturia (F, W, Sp)

142. University Chamber Band. (2)
Two 2-hour rehearsals and one section hour per week.
Mr. Berdahl (F)

143. University Concert Band. (2)
Two 1½-hour rehearsals and one section hour per week. This course should be taken in a two-quarter sequence.
Mr. Berdahl (W, Sp)

144. University Chorus. (2)
Two 1½-hour rehearsals and one section hour per week. Primarily concerned with major works for chorus and orchestra. This course should be taken in a three-quarter sequence.
Mr. Cunningham (F, W, Sp)

145. Repertory Chorus. (2)
Two 2-hour rehearsals per week. A smaller mixed chorus that aims at a high standard of ensemble singing and explores the lesser-known choral repertory. This course should be taken in a three-quarter sequence.
Mr. Brett (F, W, Sp)

146. Chamber Music Ensemble. (2)
Chamber music for strings, winds, piano, and voice.
Mr. Berdahl, Miss Davidson, Mr. Khuner (F, W, Sp)

147. Contemporary Chamber Music Ensemble. (2)
Four hours per week.
The Staff (Mr. Felciano in charge) (F, W, Sp)

149. Collegium Musicum. (2)
Two 2-hour rehearsals per week. Performance of Renaissance and Baroque music for voices and instruments. This course should be taken in a three-quarter sequence.
Mr. Curtis (F, W, Sp)

Group II

Courses primarily for students whose major subject is music.

Lower Division Courses

A-B-C. Musicianship. (2-2-2)
Three 1-hour classes per week for ear training, sight singing, and dictation. Sequence beginning (F).
The Staff (Mrs. Clark in charge)

D-E-F. Musicianship. (2-2-2)
A continuation of course A-B-C, which is prerequisite.
Sequence beginning (F).
The Staff (Mrs. Clark in charge)

1A-1B-1C. Harmony. (4-4-4)
Three 1-hour classes per week. Diatonic harmony, chorale harmonization, and analytical studies. Emphasis will be on written work.
Sequence beginning (F).
The Staff (Mr. Moe in charge)

2A-2B-2C. Harmony. (4-4-4)
Three 1-hour classes per week. A continuation of course 1A-1B-1C, which is prerequisite. Chromatic harmony, analytical and compositional projects.
Sequence beginning (F).
The Staff (Mr. Imbrie in charge)

21A-21B-21C. Development of Musical Style. (4-4-4)
Three 1-hour lectures and one section meeting per week. Prerequisite: course 1C or consent of instructor. A study of the development of music from antiquity to the present; listening, technical analysis, and written reports.
Sequence beginning (F)
Mr. Newcomb

Upper Division Courses

THEORY

100A. Advanced Musicianship. (2)
Three class hours per week. Prerequisites: courses F, 2C, and consent of instructor.
Mr. Swackhammer (F)

100B. Keyboard Harmony. (2)
Three class hours per week. Prerequisite: course 2C and consent of instructor.
Miss Davidson (W)

100C. Score Reading. (2)
Three class hours per week. Prerequisite: course 2C and consent of instructor.
Miss Davidson (Sp)

101A–101B. Tonal Counterpoint. (4-4)
Three 1-hour classes per week. Prerequisite: course 2C.
Sequence beginning (W)
Mr. Levine, Mr. Nin-Culmell

105A–105B–105C. Composition. (4-4-4)
Three class hours per week. Prerequisite: course 2C and consent of instructor.
Sequence beginning (F)
Mr. Imbrie

106A–106B. Canon and Fugue. (4-4)
Two 2-hour classes per week. Prerequisite: course 101B.
Sequence beginning (W), Mr. Denny

107A–107B. Studies in Musical Analysis. (4-4)
Two 1½-hour classes per week. Prerequisite: course 2C.
Sequence beginning (F)
Mr. Felciano, Mr. Senturia
HISTORY AND LITERATURE

The following courses will be given in rotation. **Prerequisite: courses 2C and 21C or consent of instructor.**

*114. Music in the Fourteenth Century. (4)
A study of sacred and secular polyphony from the motets of Philippe de Vitry through the song forms of Guillaume de Machaut, his contemporaries and successors, up to 1400. Mr. Crocker

115. The Performance of Medieval and Renaissance Music. (4)
**Prerequisite: Experience in playing an instrument or in singing.** Three class hours per week.
Mr. Crocker (W)

116E. The Performance of Baroque Music. (4)
**Prerequisite: experience in playing an instrument or in singing.** Three class hours per week.
Mr. Curtis (Sp)

*116F. The Organ Music of J. S. Bach. (4)
Three class hours per week.
Mr. Moe

116G. J. S. Bach. (4)
Three hours of lecture per week.
Mr. Curtis (F)

*116H. Purcell. (4)
Three hours of lecture per week.
Mr. Brett

117A. The Symphonies of Mozart. (4)
Three class hours per week.
Mr. Duckles (F)

117B. The Operas of Mozart. (4)
Mr. Heartz (W)

*117C. The String Quartets of Beethoven. (4)
Three class hours per week.
Mr. Sparks

*117D. The Symphonies of Beethoven. (4)
Three class hours per week.
Mr. Boyden

118B. Piano Music of the Romantic Period. (4)
Three class hours per week.
Mr. Sparks (W)

*118D. Wagner’s Ring of the Nibelung. (4)
Three class hours per week.
Mr. Dugger

*119D. Chamber Music of the Twentieth Century.
(4)
Mr. Imbrie

119E. Contemporary Music. (4)
Three class hours per week.
Mr. Crocker (Sp)

119F. Studies in Afro-American Music. (4)
Three class hours per week. **Prerequisite: course 2C, 128K, or consent of instructor.** Detailed analysis of specific musical forms and study of their historical development. Unique aspects of the musical organization, improvisational techniques, and value system will be explored.
Mr. Wilson (Sp)

119G. Studies in African Music. (4)
Three class hours per week. **Prerequisite: course 128K or consent of instructor.** Analytical studies of selected topics in the music of black Africa. Emphasis on the development of sound research methods.
Mr. Nketia (W)

120A–120B. The History of Musical Instruments. (4–4)
Three hours of lecture per week. **Prerequisite: courses 2C, 21C or consent of instructor.** The history and musical usage of the main families of musical instruments including special attention to rare or unique instruments in the holdings of the department. A final grade will be assigned upon completion of both quarters. Sequence beginning (W) Mr. Boyden

122. The History of the Organ. (4)
Three class hours per week. The history of the organ with emphasis on the development of national styles. The unique instruments in the Music Department’s collection will be studied in detail.
Mr. Moe (F)

150. Instrumental and Vocal Instruction. (1)
Open only to majors in music. Advanced private instruction in keyboard, stringed, woodwind, brass, and percussion instruments and in voice. May be repeated for credit if an average grade of B is maintained.

The Staff (Mr. Moe in charge) (F, W, Sp)

*160A–160B. Proseminar in Music History and Criticism. (4–4)
Three hours of lecture per week. **Prerequisite: courses 2C and 21C and one course in the series 114-119 or consent of instructor.** An introduction to advanced work in music history and criticism, building on the students’ previous experience of musical literature, history, theory, and analysis. A limited number of selected topics will be studied by means of lectures, discussions, and reports.

Honors and Special Studies Courses

H198. Honors Seminar. (4)
Two 2½-hour meetings per week. Open to senior honor students who have at least a 3.2 average in the major.
Mr. Crocker (Sp)

198. Group Special Study for Advanced Undergraduates. (2 or 4)
Restricted to senior honor students. Not to serve in lieu of regular courses of instruction.
The Staff (Mr. Imbrie in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Additional limitation: overall grade-point average of at least 3.0. Must be taken on a passed or not passed basis.
The Staff (Mr. Imbrie in charge) (F, W, Sp)
Graduate Courses

Consent of the instructor must be obtained before enrollment in any graduate course. For further conditions concerning admission to graduate courses, see page 27.

200A-200B. Introduction to Musical Scholarship. (4-4)
Bibliography, research methods, and individual projects typically drawing on manuscripts and early prints in the University of California Music Library. Sequence beginning (F), Mr. Duckles

201. Workshop in Electronic Music. (4)
One 1½-hour meeting per week, supplemented by four hours of laboratory work. A consideration of compositional machine skills necessary to operate the analog equipment in the electronic music studio; practical application of musical acoustics to the available equipment.
Mr. Wilson (F, W)

One 3-hour meeting per week. Mr. Wilson (Sp)

203. Seminar in Composition. (4)
One 3-hour meeting per week.
Mr. Felciano (F, W, Sp)

204. Studies in Musical Analysis. (4)
One 3-hour meeting per week.
Mr. Wilson (Sp)

*205A-205B. The History of Theory. (4-4)
Sequence beginning (F), Mr. Crocker

208. Proseminar in Music History. (4)
Two 1½-hour meetings per week. Studies in the history and literature of Western music, dealing with representative composers, music, and topics. The following courses will be given in rotation.

- 208X. Chant and Related Forms.
  Mr. Crocker (Sp)
- 208A-208B. Medieval Polyphony and its Notation.
  Sequence beginning (F), Mr. Sparks
- 208C. The Sixteenth Century.
  Mr. Heartz (Sp)
- 208D. The Seventeenth Century.
  Mr. Curtis
- 208E. The Eighteenth Century.
  Mr. Boyden
- 208F. The Nineteenth Century.
  Mr. Sparks
- 208G. The Twentieth Century.
  Mr. Imbie

*210. The History of Musical Instruments. (4)
One 3-hour meeting per week. A continuation of course 120A-120B which will involve cataloging instruments in the Department's collections.
Mr. Boyden

*212A-212B. Seminar: Medieval Studies. (4-4)
One 3-hour meeting per week. A final grade will be assigned upon completion of both quarters.
Sequence beginning (W), Mr. Crocker

*213A-213B. Seminar: Studies in the Sixteenth Century. (4-4)
One 3-hour meeting per week.
Mr. Sparks

215A-215B. Seminar: Research in Music History. (4-4)
One 3-hour meeting per week. The topic will be the Italian Madrigal from Marenzio to Monteverdi. A final grade will be assigned upon the completion of both quarters.
Sequence beginning (F), Mr. Newcomb

218A-218B. Seminar: Studies in Classic and Romantic Music. (4-4)
One 3-hour meeting per week. The topic will be the origins and evolution of the "classic" and "romantic" styles during the 18th century. A final grade will be assigned upon the completion of both quarters. Sequence beginning (W), Mr. Heartz

*220. Seminar: Problems in Criticism. (4)
Mr. Kerman

298. Group Special Studies. (2-8)
The Staff (Mr. Brett in charge) (F, W, Sp)

299. Special Study. (2-8)
Open to properly qualified graduate students for research or creative work. Such work shall not serve in lieu of regular courses of instruction.
The Staff (Mr. Crocker in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Preparation for the comprehensive or language requirements in consultation with the field adviser. May not be used for unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Newcomb in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Curtis in charge) (F, W, Sp)

Professional Courses

405A-405B-405C. Elementary Piano. (½-½-½)
Open only to majors in music. Required of music majors who do not pass the entrance examination in piano. Graded on a pass/not pass basis only.
Sequence beginning (F)

405D-405E-405F. Elementary Piano. (½-½-½)
Open only to majors in music. Required of music majors who do not pass the entrance examination in piano. Graded on a pass/not pass basis only.
Sequence beginning (F)

428A-428B-428C. Vocal Technique. (2-2-2)
Two 1½-hour meetings per week. Prerequisite: some ability at the piano. Auditions required. May be repeated once without duplication of credit. Principles of vocal and choral technique; voice-testing; care of adolescent voices; transposition; evaluation of teaching materials.
Sequence beginning (F), Miss Swall

429A. Stringed Instruments. (2)
One 2-hour meeting per week. Open only to majors and teaching minors in music. May be repeated twice without duplication of credit.
Mr. Sellin (F, W, Sp)

*429B. Wind Instruments. (2)
One 2-hour meeting per week. Open only to majors and teaching minors in music. May be repeated twice without duplication of credit.
Interdepartmental Studies

*IDS 104. Storm and Stress in Opera and Drama. (4)
See Interdepartmental Studies for the complete description of this course.

*IDS 115. Music and Poetry of the English Renaissance. (4)
See Interdepartmental Studies for the complete description of this course.

**NATIVE AMERICAN STUDIES PROGRAM**

See Ethnic Studies.

**NAVAL SCIENCE**

(Department Office, 25 Callaghan Hall)

The professors in this department are commissioned officers of the United States Navy and Marine Corps especially selected by the Navy and the University of California for teaching the Naval Science curriculum.

Professor:
Richard D. Van Antwerp, M.S., Commander, U.S. Navy (Chairman)

Associate Professor:
James H. Holds, M.S., Lieutenant Commander, U.S. Navy

Assistant Professors:
Thomas F. Jessen, B.A., Major, U.S. Marine Corps
Lawrence C. Deartth, B.S., Lieutenant, U.S. Navy
Jeffrey L. Richard, A.B., Lieutenant, U.S. Navy
George C. Cooley, A.B., Lieutenant, U.S. Navy

The Department of Naval Science and the Naval Reserve Officers Training Corps (NROTC) offer several programs of instruction leading to Regular or Reserve commissions in the U.S. Navy or the U.S. Marine Corps as elected by the student. In addition to the NROTC programs described in the information section of this catalogue, special scholarships will be offered to eligible students interested in nuclear propulsion. Also, beginning in academic year 1973–1974 women students will be eligible to participate in all programs leading to commissions in the U.S. Navy or Naval Reserve.

For further details contact the Professor of Naval Science in Callaghan Hall.

**Lower Division Courses**

1A–1B–1C. Naval Ships Systems. (4–4–4)
Three hours of lecture per week. Principles of ship design as related to functional ship missions and operations through study of inter-related internal systems. Theory of thermodynamic cycles in marine propulsion systems, and the study of ship stability and damage control. Theory of electrical, ship control, and weapons systems. Mr. Richard (F, W, Sp)

2A–2B. American Military Affairs. (3–3)
Three hours of lecture per week. A study of U. S. military affairs from the American Revolution to the present with emphasis on the period since the Civil War. It analyzes the transformation from the limited wars of the eighteenth century to the total wars of this century and the brushfire wars of the last two decades. Mr. Cooley (W, Sp)

**Upper Division Courses**

111. Naval Operations Analysis. (3)
Three hours of lecture and one hour of laboratory per week. Prerequisite: Math 1A–1B–1C or 11A–11B–11C or 16A–16B or Statistics 1A–1B or 2 or 20 or 100A, 100B, 100C. An introduction to the quantitative methods of decision making under uncertainty. Fundamentals of game theory, planning, and communicating of decisions; students exposed to relevancy of operations analysis to Naval Operations. Mr. Deartth (F)

112A–112B. Navigation. (4–4)
Three hours of lecture and one hour of laboratory per week. Prerequisite: 112A is prerequisite to 112B.

112A. The principles and practice of terrestrial navigation and the application of electronic navigation and piloting. Laboratory work includes...
application of principles covered in the readings and lectures. Nautical rules of the road; meteorology Mr. Dearth (W)
112B. Nautical Astronomy. The principles of celestial navigation. The laboratory work includes the various methods of solution of celestial problems and sight reduction. Mr. Dearth (Sp)

*151–152. Evolution of Land Warfare. (3–3)
Three hours of lecture per week. A study of the forms of warfare practiced by great peoples in history in order to formulate the senses of historical flow or continuity and of change in the evolution of warfare; to develop a basic sense of strategy by historical example; and to explore the impact of historical precedent on military thought and action. Offered in alternate years beginning in academic year 72/73. Mr. Jessen

151. Ancient Times to Mid 19th Century. (F)
152. American Civil War to Present. (W)

154. History of Amphibious Warfare. (3)
Three hours of lecture per week. Major amphibious operations from Gallipoli through the campaigns in the Pacific are examined in sufficient detail to trace the development of modern concepts of doctrines and techniques of amphibious warfare. Offered in alternate years, next in academic year 1973–74. Mr. Jessen (Sp)

NEAR EASTERN STUDIES

(Department Office, 1229 Dwinelle Hall)

Professors:
Robert B. Alter, Ph.D.
William M. Brinner,† Ph.D.
George F. Dales, Jr., Ph.D.
Mounah A. Khouri, Ph.D. (Chairman)
Anne D. Kilmer, Ph.D.
Walter J. Fischel, Ph.D. (Emeritus)
Henry L. F. Lutz, Ph.D., D.D., LL.D. (Emeritus)

Associate Professors:
Hamid Algar, Ph.D.
Ariel A. Bloch, Ph.D.
Leonard H. Lesko, Ph.D.
Jacob Milgrom, D.H.L.
James T. Monroe, Ph.D.
Ruggero Stefanini, Dottore in Lettere.

Assistant Professors:
Mordechai A. Friedman,† Ph.D.
Wolfgang J. Heimpel, Ph.D.

Martin Schwartz, Ph.D.
Gideon Shunami, Ph.D.
Professor:
Victor R. Gold, Ph.D. (Visiting)
Assistant Professors:
William J. Fulco, Ph.D. (Visiting)
William C. Hickman, Ph.D. (Acting)

Lecturers:
Guitty Azarpay, Ph.D.
Charlotte Grosman

Instructors:
Daniel A. Foxvog, Cand. Phil. (Acting)
Roger S. Monroe, Cand. Phil. (Acting)
George A. Saliba, Cand. Phil.
Grace M. Smith, Cand. Phil. (Acting)

Associate:
Aharon Barnea, M.A.

Departmental Major Adviser: Martin Schwartz.
Graduate Adviser: Hamid Algar.

Instruction in the Department of Near Eastern Studies is concerned with the languages and civilizations of the ancient, medieval, and modern Near East. The department officers specialized training in Archaeology, Assyriology, Egyptology, Hittitology, Iranian Studies, Judaic and Islamic Studies and Turkish. For students from other disciplines, the department provides a wide variety of courses to supplement such related fields as linguistics, history, political science, comparative literature, and anthropology. The department strongly recommends that graduate students take advantage of courses offered in these fields, provided that they are relevant to the student's field of study. Credit for such courses will be recognized by the department, subject to approval of the graduate adviser. Many of the department’s courses are restricted to a small number of students, thus affording an opportunity for close contact with the instructing staff. To those not studying the languages, the lecture courses offer a comprehensive body of information on past and present Near Eastern civilizations. The depart-

NOTE: For key to footnote symbols, see page 86.
ment is one of several participating in the recently formed Graduate Program in Ancient History and Mediterranean Archaeology (see page 93 for a full description of the program). The department is also participating with the Graduate Theological Union in a joint doctoral degree program in Near Eastern Religions. For further information consult the departmental office.

Cooperative arrangements between the University and the nearby Graduate Theological Union enable students in the Department to use the extensive library holdings of the Union and to supplement their programs with selected courses in Palestinian archaeology, Biblical studies, Semitic epigraphy and philology.

The Majors

A. The Major in Near Eastern Studies

I. In Arabic, Hebrew, Persian and Turkish: Prerequisite: the elementary courses in the language, or their equivalents. It is recommended that these be taken in the freshman year.

The major requires 37 upper division language units plus 8 upper division lecture units, for a complete total of 45 units. The distribution of courses should be determined in consultation with the major adviser. Further details on requirements are available in the departmental office. With the consent of the department, portions of the requirement may be fulfilled by related courses in other departments.

II. In Assyriology, Hittitology, Old Iranian Studies, and Egyptology: A basic reading knowledge of German is recommended. The major requires 36 upper division language units plus 8 upper division lecture units.

B. The Major in Ancient Near Eastern History and Archaeology

The major requires at least 60 quarter units. The required courses for the major shall include:

1) Anthropology 1, 2, 3, or 4 or the equivalent, NES 10 or History 4A or the equivalent, and NES 20ABC for a total of 21 or 22 lower division units.

2) At least 12 upper division units in one of the Near Eastern languages, and at least 24 upper division units should be selected from the lecture courses and seminars offered by the department in the fields of history, archaeology, art, and culture.

Honors Program

In addition to completing the regular requirements for the major, a candidate for graduation with honors must (a) have a 3.0 grade-point average overall and within the department and (b) complete the Honors Course H198, in which he will prepare an honors thesis in his senior year.

Graduate Study

Graduate programs leading to the M.A. and Ph.D. degrees are offered in the following languages and literatures: Arabic, Hebrew, Persian, and Turkish; and in the following special fields of the Near East: Altaic studies, Assyriology, Biblical and Judaic studies, Old Iranian studies, comparative Semitics, Egyptology, Hittitology, and Islamic studies.

Degrees

Applicants for graduate study should have fulfilled the equivalent of the departmental requirements for the A.B. or be prepared to satisfy these requirements before advancement to candidacy. Both M.A. and Ph.D. degrees require the study of one major and at least one minor language offered in the department. If deemed relevant to the major, the minor language may be taken outside the department with the consent of the graduate adviser.

The M.A. degree is obtained according to Plan II (see page 36). In addition to the plan's requirements, the student must pass a reading examination in French or
German or another language deemed pertinent by the graduate adviser. A written final examination is required of each student to test (a) his working knowledge of the pertinent languages—one major language and at least one minor language in the department—according to his field of concentration; (b) his general knowledge of the relevant history and civilization of his area; and (c) his knowledge of other subjects specified in the program. Scholarly papers written independently or in connection with course work will also be required. Students must satisfactorily complete the requirements for the M.A. before proceeding to the Ph.D.

Admission to candidacy in the Ph.D. program depends on successful completion of the following requirements: (1) a reading examination in one of the three above-mentioned languages that was not taken for the M.A. degree, or in any other European language (i.e., Italian, Spanish, etc.) germane to the student's main field of interest; (2) both the written and oral sections of the qualifying examination; and (3) submission of research or seminar reports written in the course of graduate work.

After admission to candidacy, the student completes his dissertation according to Plan A (see page 42).

For further details, consult the regulations of the Graduate Division and the Graduate Adviser in 1229 Dwinnell Hall.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Near Eastern Studies

Undergraduate Courses Not Requiring Knowledge of Area Languages

Lower Division Courses

10. Languages and Cultures of the Near East, (4)

Three 1-hour lectures per week. The growth, structure, and differentiation of ethnic, religious and language groups in the Arab states, Israel, Turkey, and Iran.

Mr. Brinner (Sp)

15A-15B. Introduction to Near Eastern Art and Archaeology, (4-4)

Three hours of lecture per week. A: Ancient Art of Western and Central Asia from the Neolithic through the Iron Age. B: Medieval Art of Western and Central Asia.

Miss Azarpay (F, W)

20A-20B-20C. History and Culture of Ancient Western Asia and Egypt, (4-4-4)

Three hours of lecture per week. A survey of the civilizations of the Near East with special emphasis on ancient Egypt, Mesopotamia, Iran, Anatolia, from their origins until Hellenistic times.

Mr. Heimpel in charge (F, W, Sp)

Upper Division Courses

150A-150B-150C. The History of Ancient Israel, (4-4-4)

Three 1-hour meetings per week. 150A, the Priestly period from the beginning of the age of Solomon; 150B, the Divided Kingdom through the Persian period; 150C, the Hellenistic and Talmudic periods. Sequence beginning in the fall, but one quarter is not a prerequisite for another.

Mr. Milgrom, (F, W, Sp)

151. Jewish Civilization, (4)

Three hours of lecture per week. The social, religious, and cultural aspects of Jewish life in the main centers of Asia, Africa, and Europe from the time of the coming of Islam to the eighteenth century, as reflected in Gaonic and medieval literature.

Mr. Milgrom (W)

152A-152B-152C. Aspects of Biblical Religion, (4-4-4)

Three hours of lecture per week. The teachings of ancient Israel's intellectual leaders (priests, prophets, and sages) on the following issues: individual versus collective responsibility, sin versus self-redeemption, national versus universal aspirations, etc. Sequence beginning fall, but A is not prerequisite for B, nor B for C.

Mr. Milgrom (F, W, Sp)

153A-153B. Hebrew Literature in Translation, (4-4)

Three 1-hour meetings per week. A chronological survey of major works of Hebrew literature from the early postbiblical period to the present day.

153A. Apocrypha, Dead Sea Scrolls, Talmudic literature, The Midrash.

153B. Medieval Hebrew poetry and fiction; religious literature; beginnings of modern Hebrew literature; modern Hebrew poetry and prose; contemporary Israeli writing.

No knowledge of Hebrew is required. Credit and grade will be awarded upon completion of the full sequence.

Mr. Alter (F, W)

154C. The Bible in Translation, (4)

Three 1-hour lectures per week. Intended for students not majoring in Near Eastern Languages as an introduction to the Books of the Bible, their historical development, and their place within the broader context of Ancient Near Eastern society.

160A-160B. Culture of Iran in Islamic Times, (4-4)

Three 1-hour meetings per week. A general survey of Iranian cultural history from the beginning of the Islamic era, with special emphasis on religious and philosophical currents. 160A, from the downfall of the Sassanid empire to the establishment of the Samanid dynasty; 160B, from the Ghaznavids to the nineteenth century.

Mr. Algar (F, W)
161A—161B. The Religions of Ancient Iran. (4-4)
Two 1-hour lectures per week. Principally devoted to the study of Zoroastrianism and Manichaeanism.
Sequence beginning (F)
Mr. Schwartz (F, W)

162A—162B. Introduction to the Comparative Study of the Iranian Languages. (3–3)
Two 1-hour lectures per week. Prerequisite: consent of instructor and familiarity with at least one classical Indo-European language or with the processes of comparative philology. Survey of the languages of the Iranian branch of the Indo-European family of languages.
Sequence beginning (W), Mr. Schwartz (W, Sp)

*163A—163B. History of Persian Literature. (4–4)
Three 1-hour lectures per week.
163A. Classical Persian literature from Firdawsi to the fifteenth century.
163B. Persian literature from the fifteenth century to the contemporary period.
(F, W)

*164A—164B. Civilization of Ancient Iran. (4–4)
Three hours of lectures per week. The civilization of the Iranian nations from the beginning to the rise of Islam.
Sequence beginning (F)
Mr. Schwartz (W, Sp)

*168A—168B. Turkish Literature in Translation. (4–4)
Three 1-hour lectures per week. Prerequisite: no knowledge of Turkish is required. A study, primarily, of Turkish literature in translation from the 8th century Inner Asian inscriptions down to contemporary writings from the Turkish Republic. Works will be discussed in relation to history of the Turks with attention given to pertinent political, social, and religious themes.
Mr. Hickman (F, W)

169A—169B. Ottoman Civilization. (4–4)
Three hours of lecture per week. Religious, social, economic, and political institutions of the Ottoman period will be treated.
Mr. Hickman (F, W)

*170A—170B. Ancient Mesopotamian Society and Religion. (4–4)
Two 1½-hours lectures per week. Discussion of original sources bearing on the society and the religious beliefs and practices of the ancient Mesopotamians.
Mr. Heimpel (F, W)

*172A—172B. Ancient Mesopotamian Documents and Literature. (4–4)
Three 1-hour lectures per week. A survey of the writings on clay tablets (in translation). A study of a selection of literary, legal, economic, epistolary, educational, scientific, historiographic, divinatory, and religious texts.
Mrs. Kilmer (F, W)

*173A—173B—173C. Ancient Egyptian Civilization. (4–4–4)
Three 1-hour lectures per week. The history and institutions of ancient Egypt from its earliest period to the Hellenistic period.
Mr. Lesko (F, W, Sp)

174A—174B—174C. Ancient Egyptian Documents, Literature, and Religion. (4–4–4)
(Formerly numbered 174)
Three hours of lecture per week. A survey of translated writings of the ancient Egyptians.
174A. The writings in general with some description of the methods and importance of paleography and epigraphy.
174B. Wisdom Literature, Stories and Poetry.
174C. A study of the mythological and mortuary literature of the ancient Egyptians.
Mr. Lesko (F, W, Sp)

180A—180B. Islamic Civilization. (4–4)
Three 1-hour lectures per week. The political, legal, and social institutions of Islam will be critically studied in an historical framework.
Mr. Brinner (F, W)

182A—182B—182C. Arabic Literature in Translation. (4–4–4)
(Formerly 182A–182B)
Three 1-hour lectures per week. Survey of Arabic literature from its origins in pre-Islamic poetry through its historical development during the Umayyad, Abbasid, and post-Abbasid periods to contemporary Arabic literature. No knowledge of Arabic is required.
Mr. Khouri (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
Tutorial instruction in areas not covered by regularly scheduled courses.
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations shown on page 87. Must be taken on a passed/not passed basis.
The Staff (Su, F, W, Sp)

290A—290B—290C—290D—290E—290F—290G—290H. Special Studies. (1–5)
Hours variable. Prerequisite: consent of instructor.
A, Near Eastern Studies; B, Arabic; C, Cuneiform; D, Egyptian; E, Hebrew; F, Iranian; G, Semitics; H, Turkish. Students may enroll in more than one section of 290, but the total number of units of Special Study in any one quarter may not exceed 12.
The Staff (F, W, Sp)

298. Seminar. (3)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor.
The Staff (F, W, Sp)

601. Individual Studies for Master Students. (1–8)
Individual study for the comprehensive or language requirements in consultation with the graduate adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

Art and Archaeology of the Near East
*190A—190B—190C. Seminar in Near Eastern Art. (4–4–4)
Three hours per week. The artistic traditions of Western Asia from the Neolithic to Medieval times:
A) the arts of the Near East during the Neolithic period and the Bronze Age. B) The art and architecture of the Near East from the Iron Age to the Seleucid period. C) The art and architecture of the Near East from Parthian times through the Islamic Middle Ages.

292. Seminar in Mesopotamian Archaeology. (4)

Three hours per week. Prerequisite: open to graduate students and Ancient Near East majors. Admission by consent of instructor. Discussions of and research into a major aspect or problem of Mesopotamian archaeology. Subject to be selected through consultation of students and instructor.

Mr. Dales (W)

293. Seminar in Near Eastern Art. (4)

Three hours of lecture per week. Prerequisite: graduate standing or consent of instructor. Graduate seminar on specific aspects of the arts of Western and Central Asia. Topic to be announced at the first meeting of the Seminar.

Mrs. Azarpay (Sp)

*294. Field Methods in Near Eastern Archaeology. (5)

Four hours per week. The basic techniques used in exploration, excavation of different types of sites, recording of finds, analysis and interpretation of archaeological data.

Mr. Dales (Sp)

*295. Supervised Field Research in Near Eastern Archaeology. (10–15)

Full time participation in an archaeological excavation or exploratory survey. Students will participate in all aspects of the operation and will be responsible for preparing a written report on some specific part of the work. Geographical areas and sites to be determined each year.

Mr. Dales (F)

Arabic

Lower Division Course

1A–1B–1C. Elementary Arabic. (4–4–5)

Five 1-hour recitation sessions and one 1-hour laboratory per week. Sequence beginning (F).

Mr. Saliba (F, W, Sp)

Upper Division Courses

100A–100B–100C. Intermediate Arabic. (5–4–4)

Five 1-hour recitation sessions and two 1-hour drill sessions per week. Prerequisite: course 1A–1B–1G, or equivalent. Sequence beginning (F).

Mr. R. Monroe (F, W, Sp)


Five 1-hour recitation sessions and two 1-hour drill sessions per week. Prerequisite: course 1A–1B–1G or equivalent or consent of instructor.

Mr. R. Monroe (F, W, Sp)

103A–103B–103C. Rapid Reading of Selected Texts with Review of Grammar and Composition. (4–4–4)

Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C, or equivalent.

Mr. Bloch (F, W, Sp)

104A–104B–104C. Classical Arabic Poetry and Prose. (4–4–4)

(Formerly 103A–103B–103C)

Three 1-hour lectures per week. Prerequisite: course 103A–103B–103C or equivalent. May be repeated for additional credit when subject matter differs and with consent of instructor.

Mr. J. Monroe (F, W, Sp)


Three 1-hour lectures per week. Prerequisite: course 103A–103B–103C or equivalent. May be repeated for additional credit when subject matter differs and with consent of instructor.

Mr. Khouri (F, W, Sp)


Three 1-hour meetings per week. Prerequisite: three years of Arabic or consent of instructor. Selected readings in Arabic from the Qur'an viewed as a religious document, with consideration of traditional Islamic exegesis and other secondary reading.

Mr. Algar (F, W, Sp)

*109A–109B–109C. Primary Sources in Arabic Studies. (4–4–4)

Three 1-hour lectures per week. Prerequisite: course 103A–103B–103C or equivalent or consent of instructor. May be repeated for credit when subject matter differs and with consent of instructor.

Mr. Algar (F, W, Sp)

A. General works, language and literature.

Mr. Bloch, Mr. Khouri B. Religion, Philosophy, and the Sciences.

Mr. Algar C. History and Institutions.

Mr. Brinner

H198. Senior Honors. (2)

Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis.

The Staff (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Prerequisite: enrollment is restricted by regulations on page 87. Must be taken on a passed/not passed basis.

The Staff (F, W, Sp)

Graduate Courses

*200A–200B–200C. Advanced Grammar and Syntax. (4–4–4)

Three 1-hour meetings per week. Prerequisite: 106A–106B–106C.

Mr. Bloch (F, W, Sp)

201A–201B–201C. Arabic Dialectology. (4–4–4)

Three 1-hour meetings per week. Prerequisite: at least two years of Arabic and one year of another Semitic language or equivalent. A comparative approach to the Arabic dialects, their relationship to literary Arabic and other Semitic languages.

Mr. Bloch (F, W, Sp)
*202A–202B–202C. Advanced Spoken Arabic. (4–4–4)
Three 1-hour meetings per week. Prerequisite: at least two years of spoken Arabic or consent of instructor. Intensive study of a particular dialect. May be repeated for additional credit when applied to a different dialect. Mr. Bloch (F, W, Sp)

Three 1-hour meetings per week. Prerequisite: 104A–104B–104C or equivalent. Intensive study of major writers from the pre-Islamic to the end of the Abbasid periods. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

205A–205B–205C. Contemporary Arabic Literature. (4–4–4)
Three 1-hour lectures per week. Prerequisite: 105A–105B–105C or equivalent. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

*206. Judaeo-Arabic. (4)
Three hours of lecture per week. Prerequisite: course 102A–102B–102C and Hebrew 102A–102B–102C or consent of instructor. Emphasis on legal and documentary texts with readings from Geniza Manuscripts. Mr. Friedman (F)

*207A–207B–207C. Hispano-Arabic Literature. (4–4–4)
(formerly numbered 107A–107B–107C)
Three hours of lecture per week. Prerequisite: course 103A–103B–103C or equivalent. Significant writers of poetry and prose from the 10th and 11th centuries will be read and discussed. Mr. J. Monroe (F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of the instructor.
The Staff (F, W, Sp)

Cuneiform

Upper Division Courses

*100A–100B–100C. Elementary Akkadian. (4–4–4)
Three 1-hour meetings per week. Introduction to Akkadian grammar; reading of selected Cuneiform texts. Sequence beginning (F). The Staff (F, W, Sp)

Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit. Reading of texts selected on an individual basis. Sequence beginning (F). Mrs. Kilmer (F, W, Sp)

*102A–102B–102C. Elementary Sumerian. (4–4–4)
(formerly numbered 210A–210B–210C)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or consent of instructor. Introduction to Sumerian grammar. Mr. Heimpel (F, W, Sp)

*103A–103B–103C. Intermediate Sumerian. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 102A–102B–102C or equivalent. May be repeated for additional credit. (F, W, Sp)

Three 1-hour meetings per week. Introduction to Cuneiform Hittite language and grammar with reading of selected historical and religious texts. Sequence beginning (F). Mr. Stefanini (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
The Staff (F, W, Sp)

H198. Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

200A–200B–200C. Advanced Akkadian. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or consent of instructor. May be repeated for additional credit. Major literary compositions. Credit and grade will be awarded upon completion of the full sequence. (F, W, Sp)

*206A–206B–206C. Advanced Hittite. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 106A–106B–106C or consent of instructor. May be repeated for additional credit. Mr. Stefanini (F, W, Sp)

210A–210B–210C. Advanced Sumerian. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 102A–102B–102C or consent of instructor. Selected Cuneiform texts. May be repeated for additional credit. Sequence beginning (F). The Staff (F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor.
The Staff (F, W, Sp)

Upper Division Courses

Egyptian

100A–100B–100C. Elementary Egyptian. (4–4–4)
Three 1-hour meetings per week. Middle Egyptian grammar and texts. Sequence beginning (F). Mr. Lesko (F, W, Sp)

Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C, or equivalent. Readings in Middle Egyptian hieroglyphic and hieratic texts. Introduction to Old Egyptian. May be repeated for additional credit. Sequence beginning (F). Mr. Lesko (F, W, Sp)

*102A–102B–102C. Elementary Coptic. (4–4–4)
Three 1-hour meetings per week. Mr. Lesko (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
The Staff (F, W, Sp)
H198. Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations shown on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

*200A–200B–200C. Readings in Coptic. (4-4-4)
Three 1-hour meetings per week. Prerequisite: Egyptian 102A–102B–102C or consent of instructor. May be repeated for additional credit. (F, W, Sp)

201A–201B–201C. Elementary Hebrew. (4-4-5)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C and 102A–102B–102C or equivalent. Introduction to late Egyptian and Demotic. Sequence beginning (F). Mr. Lesko (F, W, Sp)

202A–202B–202C. Intermediate Hebrew. (5-4-4)
Three 1-hour meetings per week. Prerequisite: concurrent or previous enrollment in course 201A–201B–201C or consent of instructor. May be repeated for additional credit. Philological analysis of texts of a single genre and period. Mr. Lesko (F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor. The Staff (F, W, Sp)

Hebrew

Lower Division Courses

1A–1B–1C. Elementary Hebrew. (4-4-5)
Five 1-hour recitation sessions and one 1-hour laboratory per week. Sequence beginning (F). Mr. Barnea, Mrs. Grosman (F, W, Sp)

15A–15B–15C. Hebrew Conversation. (1–1–1)
Two 1-hour recitation sessions per week. Prerequisite: two quarters of Hebrew or equivalent. Sequence beginning (F). Mrs. Israeli (F, W, Sp)

20A–20B–20C. Intermediate Hebrew. (5-4-4)
Five 1-hour recitation sessions per week. Prerequisite: course 1A–1B–1C, or equivalent. Sequence beginning (F). Mrs. Israeli (F, W, Sp)

Upper Division Courses

100A–100B–100C. Advanced Hebrew. (4-4-4)
Four 1-hour meetings per week. Prerequisite: course 20A–20B–20C or equivalent. Mrs. Israeli (F, W, Sp)

101A–101B–101C. Biblical Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 20A–20B–20C or equivalent. May be repeated for additional credit with consent of instructor. (F, W, Sp)

*102A–102B–102C. Early Postbiblical Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 20A–20B–20C or equivalent. May be repeated for additional credit with consent of instructor. (F, W, Sp)

*103A–103B–103C. Medieval Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or equivalent. May be repeated for additional credit with consent of instructor. Mr. Shunami (F, W, Sp)

104A–104B–104C. Modern Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit with consent of instructor. (F, W, Sp)

198. Directed Group Study for Upper Division. Students. (1–4)
The Staff (F, W, Sp)

H198. Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

201A–201B–201C. Advanced Biblical Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: courses 101A–101B–101C and 105A–105B–105C or equivalents. May be repeated for additional credit. Mr. Migrom (F, W, Sp)

202A–202B–202C. Advanced Rabbinic Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: courses 102A–102B–102C and 105A–105B–105C or equivalents. Mr. Friedman (F, W, Sp)

*203A–203B–203C. Advanced Medieval Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: courses 103A–103B–103C and 105A–105B–105C or equivalents. May be repeated for additional credit. Mr. Alter. (F, W)

204A–204B–204C. Advanced Modern Hebrew Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 105A–105B–105C and one of the following: 101A–101B–101C, 102A–102B–102C or 103A–103B–103C, or equivalent. Mr. Alter (F, W, Sp)
**205. Studies in Hebrew Linguistics. (4)**
Three 1-hour meetings per week. Prerequisite: consent of instructor. (Sp)

**298. Seminar. (2)**
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of the instructor. The Staff (F, W, Sp)

**Iranian and Persian**

**Lower Division Course**

1A–1B–1C. Elementary Modern Persian. (4–4–5)
Five 1-hour recitation sessions per week. Sequence beginning (F).
(F, W, Sp)

Upper Division Courses

100A–100B–100C. Intermediate Modern Persian. (5–4–4)
Five 1-hour recitation sessions per week. Prerequisite: course 1A–1B–1C, or equivalent. Sequence beginning (F).
(F, W, Sp)

Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit with consent of instructor. (F, W, Sp)

102A–102B–102C. Readings in Classical Persian Prose. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or consent of instructor. (F, W, Sp)

103A–103B–103C. Classical Persian Poetry. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or consent of instructor. (F, W, Sp)

110A–110B–110C. Middle Persian. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit. Manichean Middle Persian texts, with an introduction to Pahlavi. Mr. Schwartz (F, W, Sp)

111A–111B–111C. Old Iranian. (4–4–4)
Three 1-hour meetings per week. Prerequisite: consent of the instructor. May be repeated for additional credit. Readings of texts in Avestan, Western Middle Iranian, and Sogdian taken from Zoroastrian, Manichean and Buddhist texts. Mr. Schwartz (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
The Staff (F, W, Sp)

**Semitics**

Upper Division Courses

100A–100B–100C. Aramaic. (4–4–4)
Three 1-hour meetings per week. Prerequisite: Hebrew 100A–100B–100C or consent of instructor. Biblical and Ancient Aramaic, including study of the Aramaic parts of Daniel and Ezra and the inscriptions and papyri from Syria, Egypt, Mesopotamia, and the Persian Empire. Sequence beginning (F).
Mr. Gold (F, W, Sp)

Three 1-hour meetings per week. Prerequisite: Biblical Aramaic or consent of instructor. Morphology and syntax of the Syriac language. Readings in the Syriac translation of the Bible and in Syriac literature. Sequence beginning (F).
Mr. Bloch, Mr. Gold (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
The Staff (F, W, Sp)

H198. Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

200A–200B–200C. Advanced Persian. (4–4–4)
Three 1-hour recitation sessions per week. Prerequisite: 28 units of upper division work. Different sections offering a variety of texts from all periods of the literature. May be repeated for additional credit. Mr. Algar (F, W, Sp)

201A–201B–201C. Iranian Philology. (4–4–4)
Two 1-hour meetings per week. Prerequisite: course 110A–110B–110C or 111A–111B–111C, or consent of instructor. May be repeated for additional credit. Reading of texts in Avestan, Western Middle Iranian, and Sogdian taken from Zoroastrian, Manichean and Buddhist texts. Mr. Schwartz (F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of the instructor. The Staff (F, W, Sp)

**Semitics**

Upper Division Courses

100A–100B–100C. Aramaic. (4–4–4)
Three 1-hour meetings per week. Prerequisite: Hebrew 100A–100B–100C or consent of instructor. Biblical and Ancient Aramaic, including study of the Aramaic parts of Daniel and Ezra and the inscriptions and papyri from Syria, Egypt, Mesopotamia, and the Persian Empire. Sequence beginning (F).
Mr. Gold (F, W, Sp)

Three 1-hour meetings per week. Prerequisite: Biblical Aramaic or consent of instructor. Morphology and syntax of the Syriac language. Readings in the Syriac translation of the Bible and in Syriac literature. Sequence beginning (F).
Mr. Bloch, Mr. Gold (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
The Staff (F, W, Sp)

H198. Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

200A–200B–200C. Advanced Persian. (4–4–4)
Three 1-hour recitation sessions per week. Prerequisite: 28 units of upper division work. Different sections offering a variety of texts from all periods of the literature. May be repeated for additional credit. Mr. Algar (F, W, Sp)

201A–201B–201C. Iranian Philology. (4–4–4)
Two 1-hour meetings per week. Prerequisite: course 110A–110B–110C or 111A–111B–111C, or consent of instructor. May be repeated for additional credit. Reading of texts in Avestan, Western Middle Iranian, and Sogdian taken from Zoroastrian, Manichean and Buddhist texts. Mr. Schwartz (F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of the instructor. The Staff (F, W, Sp)
the Ugaritic languages and literature (found at Resha-Shamra in Syria) with special reference to the development of early Hebrew literature. Sequence beginning (F).
Mr. Fuks (F, W, Sp)

102A–102B–102C. The Canaanite Dialects. (4–4–4)
Three 1-hour meetings per week. Prerequisite: advanced status in Hebrew. Study of the Hebrew, Moabite, Phoenician, and Punic inscriptions with reference to epigraphy, language, style, and literary relations. Sequence beginning (F).
(F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor.
The Staff (F, W, Sp)

Turkish

Lower Division Courses

1A–1B–1C. Elementary Modern Turkish. (4–4–5)
Five 1-hour recitation sessions per week. Sequence beginning (F).
Mrs. Smith (F, W, Sp)

15A–15B–15C. Conversational Turkish. (1–1–1)
Three hours per week. Prerequisite: concurrent enrollment in Elementary Turkish or the equivalent of one year of Turkish or consent of instructor.
The Staff (F, W, Sp)

Upper Division Courses

100A–100B–100C. Intermediate Modern Turkish. (5–4–4)
Five 1-hour recitation sessions per week. Prerequisite: course 1A–1B–1C, or equivalent. Sequence beginning (F).
Mrs. Smith (F, W, Sp)

101A–101B–101C. Readings in Modern Turkish. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit with consent of instructor.
Mr. Hickman (F, W, Sp)

102A–102B–102C. Ottoman Turkish Texts. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 1A–1B–1C or consent of instructor. Study of Turkish texts in Arabic script of the pre-Atatürk Period.
Mr. Hickman (F, W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
The Staff (F, W, Sp)

H198. Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis.
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.
The Staff (F, W, Sp)

Graduate Courses

*200A–200B–200C. Advanced Turkish. (4–4–4)
Three 1-hour recitation sessions per week. Prerequisite: 28 units of upper division work in Turkish. Different sections offering a variety of texts from all periods of the literature. May be repeated for additional credit.
Mr. Hickman (F, W, Sp)

*201A–201B. Old Turkish. (4–4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit. Orkhon and Yenisei inscriptions, Irk Bitig.
(F, W)

*202A–202B–202C. Comparative Turkic. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 201A–201B or equivalent and Oriental Languages 176.
202A–202B. The Turkic peoples, their languages and geographic distribution; classification of the Turkic languages; historical phonology and morphology of the Turkic languages.
202C. A Turkic language, either Uzbek, Tatar, Kirghiz, or Kazakh in various years. (F, W, Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for credit with consent of the instructor.
The Staff (F, W, Sp)

NEUROBIOLOGY

Group Major in Neurobiology

Advisers: Mr. Gerald Westheimer, Mr. C. H. Fraser Rowell, Mr. Arnold L. Leiman.

The neurobiology group major is offered in the College of Letters and Science and is intended for students seriously committed to the study of the nervous system. In order to understand what is known about the function of the nervous system, and to prepare for future advances in this area, a sound background is required in basic sciences (physics, chemistry, mathematics) together with more selective knowledge in anatomy, biochemistry, physiology, psychology, molecular biology, and zoology. Since problems related to or analogous to those encountered in studying the nervous system are handled in electrical engineering, computer sciences, and linguistics, courses in these subjects may also be desirable.

NOTE: For key to footnote symbols, see page 86.
The group major requires a basic background in physics, chemistry, and mathematics, and gives guidance on course work in the very large field of relevant subjects. It may lead to graduate study in neurobiology, and might also be appropriate for those entering the health sciences who are already strongly biased towards later specialization in neurology, neuropathology, psychiatry, pharmacology, or mental health. It must be understood that the departmental majors in physiology, zoology, electrical engineering, and psychology also provide a starting point for graduate work in neurobiology, and lead to a greater range of career choices.

Graduate courses in neurobiology are listed under Interdepartmental Studies in this catalogue.

LOWER DIVISION COURSES

Students are strongly advised to pursue physics, chemistry, and mathematics to the most advanced level they can achieve in their freshman and sophomore years.

The following, or equivalent courses at other institutions, are minimum requirements: Physics 6A–6B–6C, Introductory Physics (4–4–4); Chemistry 1A–1B, General Chemistry (4–4); Chemistry 8A–8B, Survey of Organic Chemistry (4.5–4.5); Mathematics 1A, Calculus (4 or 5), or 16A, Analytic Geometry and Calculus (4); Biology 1A–1B, General Biology (6–6).

Additional recommended courses: Molecular Biology 10, Introduction to Molecular Biology (3); Psychology 1, General Psychology (5); Linguistics 20, Language and Linguistics (5); Zoology 1, Animal Diversity (4); Mathematics 1B, 1C, Calculus (4 or 5, 4 or 5) or 16B, Analytic Geometry and Calculus (4).

UPPER DIVISION COURSES

A minimum of 45 units from the following list is required, including two laboratory courses. Students should aim to take at least one course under each subject subheading, except physiology. The physiology sequence includes cell biology, endocrinology, neuroanatomy, and neurophysiology, and if taken satisfies requirements in all these areas.

Behavior  Zoology 135, Animal Behavior (4); Zoology 135L, Laboratory Studies of Animal Behavior (3); Psychology 115, Introduction to Comparative Psychology (4); Psychology 116, Advanced Comparative Psychology (4).

Biochemistry  Biochemistry 100A–100B–100C, General Biochemistry (3–3–3); or Biochemistry 102, A Survey of the Principles of Biochemistry (4); and Biochemistry 102L, Biochemistry Laboratory (5).


Endocrine  Zoology 120, Biology of Chemical Mediation (5); and 121, Advanced Comparative Endocrinology (5).

Neuroanatomy  Zoology 180, Comparative Histology (4); and 180L, Laboratory in Comparative Histology (4).

Neurophysiology  Physiology 110, Introduction to Neurobiology (3); Psychology 110, Introduction to Biological Psychology (4); Psychology 111A–111B, Advanced Biological Psychology (5–5); Psychology 112, Advanced Laboratory Studies in Biological Psychology (5); Zoology 136, The Neurophysiological Basis of Animal Behavior (3).

Sensory Mechanisms  Psychology 123, Sensory and Perceptual Processes (5); Psychology 124, Laboratory in Sensory and Perceptual Processes (3).

Physiology  (These five courses must be taken as a sequence.) Physiology 101, Introductory Cell Physiology (5); Physiology 102A, 102B, Mammalian Physiology (5–5); Physiology 103A, 103B, Physiology Laboratory (3–3).
The following courses are recommended electives: Physiology 123, Comparative Physiology (4); Physiology 152, Physiology of Human Development (4); Anatomy 151, Developmental Anatomy (5); Psychology 131, Introductory Psychology of Language (4); Psychology 131L, Laboratory in the Psychology of Language (1); Zoology 124, Invertebrate Physiology (4); Zoology 124L, 124M, Invertebrate Physiology Laboratory (5–5); EECS 100A, 100B, Electrical Circuits, Electronics and Instrumentation (3–3); EECS 104A, 104B, Electric Circuits (4–4); EECS 181A, 181B, Animal Control Systems (3–3); EECS 183A, 183B, Bioelectronics Laboratory (2–2); Linguistics 106, Transformational Grammar (4); Linguistics 114, The Biological Basis of Language (4); Linguistics 186, Mathematical Linguistics (4); Molecular Biology 110A, 110B, Molecular Basis of Heredity (5–4).

NUTRITIONAL SCIENCES

(Department Office, 119 Morgan Hall)

Professors:
George M. Briggs, Ph.D.
Doris H. Calloway, Ph.D.
Richard L. Lyman, Ph.D.
Sheldon Margen, M.D. (Chairman)
E. L. Robert Stokstad, Ph.D.
Jessie V. Coles, Ph.D. (Emeritus)
Bessie B. Cook (Bessie Cook Jeffer), Ph.D. (Emeritus)
Helen L. Gillum, Ph.D. (Emeritus)
Maynard A. Joslyn, Ph.D. (Emeritus)
Judson T. Landis, Ph.D. (Emeritus)
Gordon Mackinney, Ph.D. (Emeritus)
Ruth Okey, Ph.D. (Emeritus)

Associate Professors:
Barbara M. Kennedy (Barbara Kennedy Johnson), Ph.D.
Rosemarie Ostwald, Ph.D.
Mary Ann Williams, Ph.D.

Assistant Professors:
Leonard F. Bjeldanes, Ph.D.
George W. Chang, Ph.D.
Janet C. King, Ph.D.
Susan M. Oace, Ph.D.

Professors:
Malcolm A. Holliday, M.D. (San Francisco)
Ruth L. Huenemann, D.Sc.
Arthur I. Morgan, Jr., Ph.D. (Adjunct)
Reinhard S. Speck, M.D. (San Francisco)
Samuel Lepkovsky, Ph.D. (Emeritus)

Associate Professors:
Robert B. Bradfield, Ph.D.
Horace K. Burr, Ph.D. (Adjunct)
Daniel F. Farkas, Ph.D. (Adjunct)

Lecturers:
Samuel Abrahams, Ph.D.
Dale Gross, Ph.D.
Angela G. Little, Ph.D.
E. Sigurd Nasset, Ph.D.
Robert L. Olson, M.B.A.
Jonas E. Richmond, Ph.D.
Gaylord P. Whiltlock, Ph.D.

Undergraduate Major Adviser in Food and Nutritional Sciences: Miss Kennedy.
Undergraduate Major Adviser in Dietetics: Mrs. King.
Graduate Advisers for Nutrition: Mr. Briggs, Mr. Lyman.
Graduate Adviser for Food Science: Mr. Chang.

Undergraduate Programs

The Department of Nutritional Sciences in the College of Agricultural Sciences offers two majors—dietetics, and food and nutritional sciences—under the agricultural sciences curriculum (see page 67), as follows:

DIETETICS

This field of study prepares students for membership in the American Dietetic Association, leading to a career as a therapeutic and clinical dietitian. The program

NOTE: For key to footnote symbols, see page 86.
of study is divided into two parts. The first two years constitute a preprofessional curriculum that includes a core of basic sciences. To be eligible for consideration for admission to the professional program, applicants must have completed 90 units with a grade-point average of 2.0 (A = 4.0) and have achieved a grade-point of 2.5 in the restricted areas stipulated below.

**Minimum Requirements**

The following minimum requirements must be met before a student will be considered for admission to the professional major or to upper division standing:

*Humanities and Social Sciences*, 20 units as follows: economics (4); English, rhetoric, or comparative literature (8); psychology (4); sociology or cultural anthropology (4).

*Physical Sciences and Mathematics*, 20 units as follows: chemistry—inorganic with laboratory (8) and organic with laboratory (8); statistics (4).

*Biological and Agricultural Sciences*, 20 units as follows: bacteriology with laboratory (5); physiology with laboratory (5); additional courses (10).

The professional curriculum is an intensive two-year program of academic and clinical study that meets the requirements of the American Dietetic Association. Continuing students and new applicants will be considered only for fall quarter enrollment in the first year of the professional two-year program. Enrollment is limited to 40 spaces. A few students will be admitted with minor deficiencies under special opportunities criteria. Students must complete University admissions procedures and also submit a letter of application and unofficial transcript of credits to the Department of Nutritional Sciences not later than May 1.

Inquiries concerning the professional curriculum should be directed to Dietetics Coordinator, Department of Nutritional Sciences.

**Major Requirements**

*Humanities and Social Sciences*, 23 units as follows: economics (4); English, rhetoric, or comparative literature (8); psychology (4); sociology or cultural anthropology (4); additional course in psychology, sociology, or anthropology (upper division) (3).

*Physical Sciences and Mathematics*, 24 units as follows: chemistry—inorganic with laboratory (8) and organic with laboratory (8); computer science (4); statistics (4).

*Biological and Agricultural Sciences*, 27 units as follows: bacteriology with laboratory (5); biochemistry (4); physiology with laboratory (5); upper division course in physiology, anatomy, or genetics (3); additional courses (10).

*Major Field*, 65 units as follows: introduction to nutritional sciences (with laboratory) (8); food science (4); human nutrition with laboratory (8); therapeutic nutrition with laboratory (8); introduction to research (2); quantity food service (5); introduction to public health nutrition (4); principles of education (2); psychosocial aspects of organization and management (4); specified additional courses (20).

*Additional courses*, 41 units.

*Total units*, 180.

Certain courses may be required in satisfaction of the above. The undergraduate adviser will provide this information and any other details about the major.

**FOOD AND NUTRITIONAL SCIENCES**

This major provides basic preparation in the natural and physical sciences for various types of research and technical positions in government, industry, or institutions, or for
graduate study in food science, nutrition, or other related fields with special emphasis leading to teaching and research in academic institutions. Major requirements:

**Humanities and Social Sciences,** 32 units as follows: English, rhetoric, or comparative literature (8); additional courses (24).

**Physical Sciences and Mathematics,** 48 units as follows: chemistry—inorganic with laboratory (12), organic with laboratory (8), and quantitative (4); calculus, and statistics or computer science (12); physics with laboratory (12).

**Biological and Agricultural Sciences,** 36 units as follows: bacteriology with laboratory (5); biochemistry with laboratory (8); biology (5); physiology (5); additional courses (13).

**Major Field,** 30 units as follows: introduction to nutrition (3); introduction to food science (3); food science (6); nutrition (6); additional upper division courses (12).

**Additional courses,** 34 units.

**Total units,** 180.

Certain courses may be required in satisfaction of the above. The undergraduate adviser will provide this information and any other details about the major.

Transfer students may be excused from taking certain required courses if similar material may have been covered at another institution. Competence in subject matter must be demonstrated by successfully passing an examination before waiver can be considered. See course instructor for further information.

To graduate in one of the above majors, the students must have at least a C average in all required nutritional sciences courses. Those who do not maintain such an average may be required to withdraw from the major.

**Graduate Programs**

Since primary emphasis in the graduate program is placed on a biochemical and physiological approach to problems in experimental and human nutrition and food science, it is essential that the prospective graduate student present an adequate background in such fields as chemistry (including introductory, quantitative, and organic, with laboratories), mathematics (calculus and/or statistics), one year of physics with laboratory, at least one quarter of physiology with laboratory, bacteriology with laboratory, and a course in biochemistry with laboratory. An otherwise qualified student may be admitted with one or two deficiencies, but he will be expected to make these up as early as possible in his graduate study.

The M.S. degree is given usually in nutrition or food science. Most students take their Ph.D. degree in nutrition; however, other majors available include comparative biochemistry, agricultural chemistry, microbiology, or other group programs to which individual faculty members belong. Within the general framework of the requirements of the Graduate Division and those of the particular graduate group in which the student will work, his program is based on his own individual needs and interests. Emphasis is placed on individual research, course 299, and each student is expected to write a thesis based on the results of this research.

All beginning graduate students take course 201 in order to gain experience in critically evaluating scientific and technical literature, and presenting oral reports. Each graduate student is expected to attend the weekly staff seminar, and to take additional units in seminars as agreed upon with his guidance committee. He also must fulfill a requirement of two quarters as a Teaching Assistant if he is working for his Ph.D. or one quarter if working for the M.S. Training is oriented to laboratory sciences and is aimed particularly at preparing the student for a career in teaching and independent research. For further details, consult the graduate adviser.
Nutritional Sciences

Lower Division Courses

1. Introduction to Nutrition. (3)
Lectures, 3 hours per week. Prerequisite: Chemistry 1A. Intended primarily for majors. Introduction to nutrition, with emphasis on metabolism and the nutritional requirements of man. Mr. Stokstad (Sp)

2. Introduction to Food Science. (3)
Lecture, 3 hours per week. Prerequisite: course 1, or Chemistry 1C and 8A (may be taken concurrently). Primarily for majors. Foods: their composition, post-harvest changes, storage deterioration. Food supplies and changes in food habits in relation to increasing urbanization and population growth. Mr. Stokstad (Sp)

10. Survey of Nutritional Sciences. (5)
Lectures, 5 hours per week. Primarily for non-majors. Broad aspects of nutritional science and food components and their importance to life and mankind. Not open to students who have had course 1. Mr. Briggs (W)

30. Introductory Food Microbiology. (3)
Three hours of lecture per week. Prerequisite: one course in biology or equivalent, and Chemistry 8A or equivalent. Source, type, and activity of microorganisms in fresh and processed foods; changes produced by their growth and activity during food preparation, storage, and service; microbial metabolism as it affects production of fermented foods; and food-borne infection and contamination.
Mr. Chang (W)

30L. Introductory Food Microbiology Laboratory. (2)
Laboratory, 6 hours per week. Prerequisite: one course in biology or equivalent; Chemistry 8A or equivalent; and course 30 or equivalent, which may be taken concurrently. Laboratory experiments to acquaint the student with microorganisms and their role in food preparation, preservation, and contamination. Planned to accompany lectures in Nutritional Sciences 30.
Mr. Chang (W)

Upper Division Courses

100. Economics of Food and Nutrients. (3)
Lectures, 3 hours per week. Prerequisite: one course in economics or agricultural economics (may be taken concurrently), or consent of instructor. Availability and utilization of food as affected by economic and other relevant factors in relation to current and projected world and local nutritional problems.
Mr. Olson (Sp)

101. Food Analysis. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: Chemistry 1C and 8B. Principles of quantitative analysis applied to food materials; chemical analysis of typical carbohydrate, fat, and protein foods. Miss Kennedy (F)

103. Introduction to Nutritional Sciences. (5)
Five hours of lecture per week. Prerequisite: Chemistry 8B; Physiology 1; Biochemistry 102 (may be taken concurrently). Students with credit for courses 1 or 2 will receive only 3 units of credit. Fundamentals of comparative and human nutrition; food as a carrier of nutrients, food availability.
Miss Oace, Mrs. Ostwald (F)

103L. Introductory Nutritional Sciences Laboratory. (3)
One hour of lecture and six hours of laboratory per week. Prerequisite: courses 1 and 2 or course 103 (to be taken concurrently); Chemistry 8B. Primarily for majors. Laboratory experiments to acquaint students with quantitative chemical procedures used in nutrient and food analysis, and with principles of biological assay procedures.
Miss Williams (F)

106. Food Chemistry. (3)
Lectures, 3 hours per week. Prerequisite: course 2 and Chemistry 8B. Chemistry of food proteins, carbohydrates, fats, and other constituents of foods.
Miss Kennedy (F)

106L. Food Chemistry Laboratory. (4)
Lecture, 1 hour per week; laboratory, 9 hours per week. Prerequisite: course 106 (to be taken concurrently) and Biochemistry 102L. Experiments on the chemical characteristics of various components of foods such as lipids, carbohydrates and proteins, and on the reactions which they undergo during processing and storage.
Mr. Stokstad (F)

107. Principles of Food Preservation and Processing. (4)
Lectures, 3 hours per week; one field trip. Prerequisite: course 30, or Bacteriology 102 and 102L, and course 106. Recommended: Biochemistry 102 or its equivalent. Control and utilization of microorganisms and enzymes in commercial preparation and preservation of food products. Nature and control of nonenzymic chemical deterioration in processed foods. Development and present status of various refining, manufacturing and processing operations.
Mr. Burr (W)

108. Introduction to Food Research. (2)
Two hours of lecture per week. Prerequisite: course 101 or Chemistry 5; an upper division course in food science, or consent of instructor. Proseminar on current research in the chemistry of food composition, preparation, and control.
Mrs. Little (Sp)

110. Food Toxicology. (3)
Three hours of lecture per week. Prerequisite: course 100 and a course in physiology. Principles and problems in evaluating the wholesomeness and safety of foods, food components, additives, and contaminants. Selective toxicity, detoxication mechanisms, basic concepts and techniques of safety evaluation, and interpretation of biological data.
Mr. Margen (Sp)

111. Experimental Study of Food Properties. (4)
Two hours of lecture and six hours of laboratory per week. Prerequisite: courses 103 and 103L, and course 30L or Bacteriology 102L (or equivalent). Study of selected chemical and physical properties of class-representative foods in relation to preparative procedures; effects of preparation and storage on sensory and nutritive attributes of foods.
Miss Kennedy, Mrs. Little (W)

121. Institutional Food Service Organization and Management. (5)
Lecture, 3 hours per week; laboratory, 6 hours per week (three 2-hour periods). Prerequisite: course 14B. Administration of quantity food service units; menu planning; purchasing practices. — (F)
122. Quantity Food Production and Service Systems. (2)
Two hours of lecture per week. Prerequisite: course 121. Concepts and alternate strategies in the management of food production and service systems in institutions. — (W)

122L. Quantity Food Production and Service Laboratory. (3)
One hour of discussion and seven hours of laboratory per week. Prerequisite: course 122 (may be taken concurrently). Practical experience in dealing with typical problems in quantity food production and service including production scheduling, quality control, sanitation, and personnel interactions. — (W, Sp)

123. Problems of Quantity Food Service. (5)
Five hours of lecture or recitation per week. Prerequisite: course 122. The systems approach in solving food service management problems, including kitchen layout and design, planning for and controlling resources, computer applications. — (Sp)

135. Institutional Food Production, Service Organization. (5)
Four hours of lecture and four hours of laboratory per week. Prerequisite: course 111, Business Administration 150, Computer Science 10 (may be taken concurrently); or equivalent. Primarily for majors. Management principles as applied to institutional food systems; quantity food purchasing, production and service; menu planning; survey of equipment. Laboratory and outside assignments covering practical applications of theoretical content.

Mrs. King, Miss Kennedy (Sp)

140. Nutrition. (5)
Lectures, 5 hours per week. Prerequisite: Chemistry 1A or high school chemistry; Physiology 1. Primarily for students not majoring in nutritional science. Not open for credit to students who have taken course 160. Essential nutrients and their functions in human nutrition. Miss Williams (F)

150. Experimental Nutrition. (5)
Lecture, 5 hours per week. Prerequisite: course 1 or equivalent; Biochemistry 102; and a course in physiology. Biochemical and physiological interactions among the vitamins, carbohydrates, proteins and fats and their relation to mammalian nutrition. Mr. Lyman (F)

160. Human Nutrition. (3)
Three hours of lecture per week. Prerequisite: course 103 or consent of instructor. Scientific principles of meeting the metabolic and nutritional needs of normal individuals throughout the life span.

Mrs. King, Mr. Margen (W)

160L. Human Nutrition Laboratory. (5)
Two hours of lecture and nine hours of laboratory per week. Prerequisite: course 103L; course 160 (may be taken concurrently). Primarily for majors. Laboratory experiences selected to illustrate the scientific basis of nutrient allowances during the life cycle, methods of assessment, consequences of deficiencies, and application to field problems.

Mrs. King, Mr. Margen (W)

161. Therapeutic Nutrition. (3)
Lectures, 3 hours per week. Prerequisite: course 160. Biochemical, physiological, and nutritional basis for therapeutic treatment of various conditions and diseases in man by dietary means. Mrs. Calloway (Sp)

161L. Therapeutic Nutrition Laboratory. (2)
One hour discussion per week; laboratory, 3 hours per week. Prerequisite: course 161 (may be taken concurrently). Mrs. Calloway (Sp)

170. Experimental Nutrition Laboratory. (5)
Two hours of lecture and nine hours of laboratory per week. Prerequisite: course 150 or 160 (may be taken concurrently); Biochemistry 102L. Basic principles and techniques used in research in human and animal nutrition. Mr. Lyman, Mrs. Ostwald (W)

197. Field Study in Foods and Nutritional Sciences. (1–5)
May be repeated for credit. Supervised experience in off-campus organizations relevant to specific aspects of foods and nutritional sciences. Regular individual meetings with faculty sponsor and written reports required.

The Staff (Mr. Margen in charge) (F, W, Sp)

198. Directed Group Study. (1–5)
Prerequisite: consent of instructor.

The Staff (Mr. Margen in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (Mr. Margen in charge) (F, W, Sp)

Graduate Courses

201A–201B–201C. Seminar in Nutrition. (1–1–1)
Discussion group, 1 hour per week. Prerequisite: intended primarily for first-year graduate students. Introduction to literature research in food and nutritional sciences. The Staff (Mr. Margen in charge) 201A (F); 201B (W); 201C (Sp)

204. Nutritional Aspects of the Metabolism of Carbohydrates and Lipids. (2)
Lecture, 1 hour per week; 1-hour discussion per week. Prerequisite: Biochemistry 102 and a course in nutrition or consent of instructor. Nutrition of carbohydrates and lipids emphasizing dietary and hormonal controls of metabolic pathways.

Mr. Abraham (Sp)

205. Biochemical Aspects of Protein Nutrition. (2)
Lectures, 2 hours per week. Prerequisite: Biochemistry 100A–100B–100C, or 102, or consent of instructor. Nutrition of proteins relative to their structure and chemical properties. Mr. Margen (F)

206. Innovations in Food Processing. (2)
Lectures, 2 hours per week. Prerequisite: courses 106 and 107. Current and new methods for efficiently resolving requirements for improved nutrition, non-polluted, more convenient and freshen­
tasting foods, pressures of competitive cost reduction and increasing sanitary and wholesomeness regulations.

Mr. Morgan (Sp)
211. Research Methods in Nutritional Sciences, Instrumentation. (5)

Lecture, 1 hour per week; laboratory, 12 hours per week. Prerequisite: graduate standing and consent of instructor. Advanced physical and chemical techniques in food science and nutrition; application of chromatography, radioisotopes, ultracentrifugation, electrophoresis to individual problems in nutritional science research. Students may select special problems of their interest. Mr. Gross (Sp)

212. Research Methods in Nutritional Sciences, Biological. (5)

Lecture, 1 hour per week; laboratory, 12 hours per week. Prerequisite: graduate standing and consent of instructor. Effects of nutrition on biochemical and physiological responses of various biological systems. Advanced techniques for metabolic experiments and their application to individual problems of nutritional research. Miss Williams, Mr. Lyman (Sp)

290. Advanced Seminars in Nutritional Sciences. (1–2)

One 1-hour meeting per week. Prerequisite: open to qualified graduate students. May be repeated for credit. More than one section may be taken simultaneously. Advanced study in various aspects of nutritional sciences. The following sections will be offered, but not necessarily every quarter: 290C, Comparative Nutrition; 290F, Food Science; 290G, Nutritional Sciences, General; 290H, Human Nutrition; 290J, Journal Club; 290L, Lipids; 290M, Metabolism, General. The Staff (F, W, Sp)

298. Directed Group Studies. (1–6)

Prerequisite: graduate standing and consent of instructor. Special study in various fields of nutritional sciences. Topics will vary depending on interests of qualified graduate students and availability of staff. The Staff (Mr. Margen in charge) (F, W, Sp)

299. Research in Food and Nutrition. (1–12)

The Staff (Mr. Margen in charge) (F, W, Sp)

400. The Profession of Dietetics. (1)

One week orientation and four meetings during the quarter relating to roles of dietetic specialists, professional goals, field trips to health care facilities. Prerequisite: open only to juniors in the dietetics curriculum. To be taken on a passed/not passed basis. The Staff (Mrs. Calloway in charge) (F)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Mr. Margen in charge) (F, W, Sp)

Staff Seminar in Nutritional Sciences. (No credit)

The Staff (F, W, Sp)

IDS 10A–10B–10C, Man and His Environment—Crises and Conflicts. (5–5–5)

See Interdepartmental Studies for the complete description of this course.

IDS 240. Nutrition of Population Groups. (3)

See Interdepartmental Studies for the complete description of this course.

OPTOMETRY

(Department Office, 107 Minor Hall)

Professors:
Irving Fatt, Ph.D.
Merton C. Flom, Ph.D.
Monroe J. Hirsch, Ph.D.
Elwin Marg, Ph.D.
Meredith W. Morgan, Ph.D.
Lawrence Stark, Ph.D.

Clinical Professors:
Darrell B. Carter, Ph.D.
Morton D. Sarver, M.S.

Associate Professor:
Robert B. Mandell, Ph.D.

Associate Clinical Professor:
Elizabeth Caloroso, M. Opt.

Assistant Professors:
Anthony J. Adams, Ph.D.
Theodore Cohn, Ph.D.
Daphne Freeman, Ph.D.
Kenton E. Kerr, Ph.D.
Jack R. Hobson, B.S., (Emeritus)

NOTE: For key to footnote symbols, see page 86.
The Department of Optometry prepares students for professional practice. The curriculum requires four years based on two years of preprofessional education and terminates in the degree, Doctor of Optometry. For details, consult the ANNOUNCEMENT OF THE SCHOOL OF OPTOMETRY, available at 107 Minor Hall.

Physiological Optics

Physiological optics is a field of study leading to the M.S. and Ph.D. degrees. The program is administered by the Group in Physiological Optics, representing faculty from the School of Optometry.

Those interested in this graduate program should familiarize themselves with the regulations of the Graduate Division and, in addition, should contact the adviser of the Group in Physiological Optics as early as possible. Admission to this program requires a bachelor's degree in physics, physiology, physiological optics, psychology or optometry, or a doctor's degree in medicine or optometry.

For further details on the requirements for the M.S. and Ph.D., please consult the adviser of the Group in Physiological Optics, School of Optometry.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Optometry

Upper Division Courses

100. History of Optometry. (2)

Two 1-hour lectures per week. Prerequisite: junior standing. The profession of optometry, its history and present status. Mr. Hirsch (F)

104. Ophthalmic Optics. (3)

Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Physics 106A. History of the development of lenses and spectacles; optical properties of lens materials; the theory and design of spectacle lenses. Laboratory exercises in lens-cutting, edging, beveling, drilling, mounting, neutralization, and frame-fitting and adjusting. Mr. Kors (Sp)

105. Ophthalmic Optics. (3)

Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 104. Continuation of Optometry 104. Mr. Kors (F)

John Grisham, O.D.
Ronald Harris, O.D.
Dennis K. Kelleher, Ed.D.
Willie G. Kelley, B.S.
Robert Kleinstein, O.D.
Leslie Kratz, O.D.
Milton Levin, O.D.
John Nelson, O.D.
Dennis Ratnoff, M. Opt.
James Ronan, M. Opt.
Albert L. Scalef, O.D., M.S.
Eugene Y. Tsujimoto, O.D.
Robert A. Turcios, B.S.
Thomas M. Wiley, O.D., M.S.

127. Refraction of the Eye. (5)

Three 1-hour lectures, two 3-hour laboratories per week. Prerequisite: Physiological Optics 102. Optical and biological variables determining the refractive state of the eye. Lectures and laboratory assignments on subjective and objective techniques of measurement and methods of correcting refractive anomalies: skiametry, keratometry, versions, vergences, relative accommodation, and the various techniques for the analysis of optometric data. Mr. Carter (F)

128. Introduction to Pathology. (3)

Two 1½-hour lectures per week. Prerequisite: Physiology 112–113. Basic pathological processes in human development, senescence and disease. A correlated survey of disturbed function in disorders of visceral systems, including disturbances of electrolyte and fluid balance and of metabolism. Mr. Shantinath (W)

130. Optometric Analysis. (5)

Three 1-hour lectures and two 2-hour laboratories per week. Prerequisite: course 127. Routine examination and case analysis; interrogation and case history, motility, phorometry, versions, vergences, relative accommodation and the various techniques for the analysis of optometric data. Introduction to clinical observations. Mr. Carter (W)
131. Clinical Manifestations of Disease and Pharmacological Influences on Disease and Function. (3)

Two 1½-hour lectures per week. Prerequisite: course 128. A survey of disease processes and systemic disorders with special reference to ocular implications and manifestations. The role of modern drugs on therapy and side effects of drug use, especially as they relate to the eye and vision.

Mr. Shantinath (Sp)

133. Anomalies of Binocular Vision. (5)

Four 1-hour lectures and one 2-hour laboratory. Prerequisite: course 127. Detection, measurement, classification, etiology, symptomatology, signs and prognosis of the latent and manifest disorders of binocular fixation, both constant and nonconstant; orthoptics and visual training. Clinical observations.

Mr. Flom (Sp)

150A-150B-150C. Ocular Disease. (3-4-4)

Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: courses 128 and 131. Introduction to ocular disease and their optometric detection; symptomatology and signs of ocular disease. External examination of the eye, pupillary reactions. Internal examination of the eye, ophthalmoscopy, biomicroscopy, tonometry, visual fields.

Sequence beginning (F), Mr. Tamler, Mr. Carter (F, W, Sp)

152. Advanced Geometric Optics. (5)

One 2-hour and two 1½-hour lectures. Prerequisite: Physics 106A. Gaussian optics. Aberration and dispersion, oblique astigmatism, "corrective curve" lenses, design and characteristics of ophthalmic instruments.

Mr. Mandell (F)

158A-158B. Vision Rehabilitation. (4-4)

Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: courses 127 and 453. Aniseikonia, low vision and geriatric optometry. Orthoptics, pleoptics and pediatric optometry.

Sequence beginning (W), Mr. Mandell (W); Mrs. Caloro (Sp)

161. Contact Lenses. (5)

Three 1-hour lectures and two 3-hour laboratories per week. Prerequisite: courses 105 and 454. Historical development, physical and optical properties of contact lenses and their adaptation to the human eye, with emphasis on the anatomical and physiological implications.

Mr. Sarver (Sp)

177. Public Health Optometry. (4)

Two 1½-hour lectures and field trips. Prerequisite: consent of instructor. Vision performance: screening methods, establishment and evaluation of standards, importance in industry, schools and vehicle operation; eye safety programs; methods of supplying vision care by means of government assistance, in the armed forces, in health clinics and hospitals, group practices and prepaid and insurance programs.

Mr. Neumayer (W)

178. Applied Psychology for Optometrists. (2)

Two 1-hour lectures per week. Prerequisite: senior standing in Optometry. Patient management and communication, oral and written; suggestion and hypnosis.

Mr. Hirsch (Sp)

185. Practice Management. (4)

Three 1-hour lectures per week and two field trips per quarter. Prerequisite: senior standing in Optometry. Laws governing the practice of optometry. The establishment and management of an optometric practice; economics, taxes, insurance, accounting methods, office design, mode of practice, practice administration, and patient relations; professional organizations and societies.

Mr. Sarver (F)

198. Group Studies for Advanced Undergraduates. (1-5)

One to five hours of lecture per week. Prerequisite: varies with topic, to be specified by the instructor for each group. Group studies of selected topics.

Mr. Freeman (Sp)

Professional Courses

410. Introduction to Clinical Optometry. (2-6)

One 1-hour lecture and 6 to 30 hours of laboratory per week (depending on number of units). Prerequisite: consent of instructor. Lectures and clinical practice in the technique and interpretation of clinical data.

Mr. Neumayer and Staff

412. Contact Lens Clinic. (2)

Two 3-hour clinics per week. Prerequisite: consent of the instructor. Clinical practice and the techniques of fitting contact lenses.

Mr. Lester

453. Optometry Clinic. (3)

One 1-hour lecture, one 4-hour clinic, and one 2-hour dispensary per week. Prerequisite: junior standing in optometry. Optometry clinic. Examination and prescribing for clinic patients. Dispensing of eye wear.

Mr. Hirsch and Staff (F)

454. Optometry Clinic. (4)

Two 1-hour lectures, one 4-hour clinic, and one 2-hour dispensary per week. Prerequisite: course 453. Examination and prescribing of lenses to clinic patients, special problems in ophthalmic optics.

Mr. Hirsch and Staff (W)

455. Optometry Clinic. (4)

Two 1-hour lectures, one 4-hour clinic, and one 2-hour dispensary per week. Prerequisite: course 454. Continuation of Optometry 454.

Mr. Hirsch and Staff (Sp)

480A-480B-480C. Clinical Internship (Advanced Optometry Clinic). (2-5; 2-5; 2-5)

Eight to twenty hours of laboratory per week. Prerequisite: course 455. Optometric examination, dispensing, consultation, and subsequent follow-up vision care of patients performed independently by student clinicians (interns) under supervision of the clinic staff. Offered only on a passed/not passed basis.

Sequence beginning (F), Mr. Hirsch and Staff (F, W, Sp)

483A-483B-483C. Clinical Internship (Special Clinical Practice). (5-5-5)

Fifteen to twenty hours of laboratory per week. Prerequisite: courses 455 and 161. Clinical practice in contact lenses, aniseikonia, low vision, strabismus, orthoptics, detection of ocular disease, vision screening and color vision testing and consultation. Offered only on a passed/not passed basis.

Sequence beginning (F), Mr. Hirsch and Staff (F, W, Sp)
486A-486B. Clinical Colloquia. (2-2)

One 2-hour seminar per week. Prerequisite: senior standing. Analysis and discussion of representative cases encompassing diagnosis, etiology, prognosis, treatment, referral, consultation and professional communication. Sequence, beginning (W), Mr. Morgan, Mr. Hirsch (W, Sp)

489. Advanced Summer Clinic. (2-5)

One hour of lecture and eight to twenty hours of laboratory. Prerequisite: content of instructor and completion of course 455. Optometric examinations of patients in the clinic performed independently by student clinicians under the supervision of the clinic staff. Refraction and dispensing. (Up to 5 units of 489 may be substituted for Optometry 480 toward the O.D. degree.) Mr. Neumaier and Staff

§'491A. Modern Opto-Electronic Methods in Clinical Optometry. (2)

Six hours of laboratory per week. Prerequisite: third year standing in the School of Optometry and Physiological Optics 403 or its equivalent (may be taken concurrently). Limited to eight students. The use of visual-evoked potentials in clinical optometry as well as other modern opto-electronic methods in visual diagnosis and prognosis. Mr. Freeman (Sp)

498. Group Studies, Seminars or Group Research. (1-8)

One to eight hours of work per week. Prerequisite: varies with topic, to be specified by the instructor for each group. Group studies of selected topics. Mr. Freeman (F, W, Sp)

499. Special Study. (1-5)

One 1-hour class per week. Prerequisite: senior standing in Optometry. Independent study in Optometry. Mr. Freeman (in charge) (F, W, Sp)

Physiological Optics

Upper Division Courses

101. Anatomy of Eye and Orbit. (5)

Three 1.5-hour lectures and one 2-hour laboratory per week. Prerequisite: Anatomy 102. The macroscopic and microscopic anatomy of the orbit, its content and adjacent structures. The cranial nerves associated with vision and their cortical connections. The blood supply to the eye and orbit. The embryology of the eye.

Mr. Cohn (W)

102. Dioptrics of the Eye. (5)

Four 1-hour lectures and one 2-hour laboratory per week. Prerequisite: Physics 106A. The eye as an optical instrument; image forming properties, optical defects, and image quality; dimensions; optical constants, schematic eyes, cardinal points, ametropia, accommodation, retinal image size, blur circles, defraction, aberrations, scatter, and absorption.

Mr. Freeman (Sp)

125. Vegetative Functions of the Eye. (3)

Three 1-hour lectures per week. Prerequisite: course 102. Consideration of the physiology of the cornea and lids; formation and function of lacrimal fluid; formation, function, and drainage of the aqueous humor; intraocular pressure; metabolism and circulation in the eye; physiology and biochemistry of the lens; iris and pupil; accommodation; photometry.

Mr. Fatt (F)

125L. Laboratory in Vegetative Functions of the Eye. (2)

One hour of lecture and one 3-hour laboratory per week. Prerequisite: course 102 and 125 (may be concurrent). Laboratory experiments in vegetative functions of the eye.

Mr. Fatt (F)

129. Motility of the Eye. (5)

Three 1.5-hour lectures and one 2-hour laboratory per week. Prerequisite: course 102. Detailed consideration of ocular movements; specification of direction of regard, line of sight, visual axes, center of rotation, primary position; kinematics of the eye. Listing's Law; action of the extracocular muscles; types of movements, reflex, saccadic, pursuit, versions, vergences; accommodation; accommodative-convergence; convergence accommodation.

Mr. Adams, Mr. Stark (W)

132. Visual Stimuli. (5)

Three 1.5-hour lectures and one 2-hour laboratory per week. Prerequisite: consent of instructor. Study of visual stimuli, their nature and specification; radiometry; photometry; colorimetry; illumination; light sources; atmospheric scatter; effects of radiation; color vision.

Mr. Adams (Sp)

151. Monocular Sensory Processes of Vision. (5)

Three 1.5-hour lectures and one 2-hour laboratory per week. Prerequisite: consent of instructor. Action of visible light on the retina, visual pigments and electrical phenomena. Light sense: sensitivity, threshold, differential thresholds, luminosity curves. Effects of stimulation: single and periodic, critical frequency of flicker, light and dark adaptation, after-images, spatial and temporal induction. Form sense: visual acuity. Perception of motion.

Mr. Marg (F)

160. Binocular Vision and Space Perception. (5)

Three 1.5-hour lectures and one 2-hour laboratory per week. Prerequisite: consent of instructor. Binocular integration; horopter, correspondence, figure-ground relations, perception of size, shape, direction, motion, time, and complex patterns; information theory.

Mr. Flom (W)

175. Recent Advances in Physiological Optics. (1)

One 1-hour class per week. Prerequisite: consent of instructor. Recent advances in physiological optics and optometry.

Mr. Marg (Sp)

198. Group Studies for Advanced Undergraduates. (1-5)

Group studies of selected topics.

Mr. Cohn (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted by regulations listed on page 87. Additional limitation: Optometry students with a grade-point average of at least 3.0, a study or research interest in the basic science of physiological optics, and intentions of graduate study in physiological optics should take this course instead of Optometry 499. Must be taken on a passed/not passed basis. (Mr. Freeman in charge) (F, W, Sp)

Graduate Courses

201A. Seminar in Physiological Optics. (2)

One 2-hour seminar per week. Prerequisite: consent of instructor. Can be repeated for credit. Graduate seminar in physiological optics.

Mr. Flom (F)
201B. Seminar in Physiological Optics. (2)
One 2-hour seminar per week. Prerequisite: consent of instructor. Can be repeated for credit. Graduate seminar in physiological optics. Mr. Marg (W)

201C. Seminar in Physiological Optics. (2)
One 2-hour seminar per week. Prerequisite: consent of instructor. Can be repeated for credit. Graduate seminar in physiological optics. Mr. Cohn (Sp)

202. Applied Human Physiological Optics. (4)
Four hours of lecture or recitation per week. Prerequisite: graduate standing in physiological optics, third or fourth year standing in optometry and Physiological Optics 491, or consent of he instructor. Basic and technical problems and limitations of applications of human physiological optics, including electro-retinography, electro-oculography, TV pupillometry and ophthalmoscopy, ultrasonic echography, visual evoked potentials computer interactive visual testing, and phosphene visual prosthesis.
Mr. Marg (W)

204. Optical Image Formation in the Eye. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: graduate standing in physiological optics. Lectures and laboratory demonstrations. Measurement of optical properties of simple and compound eyes. Image quality and resolution. Optometric instrumentation. Mr. Kapash (F)

206. The Oculomotor System. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: consent of instructor. Lectures and laboratory demonstrations on mechanical, physiological, servoanalytical and behavioral aspects of pupil, accommodation and monocular and binocular eye movement responses.
Mr. Stark (Sp)

207. Simulation of Visual Systems. (4)
Two hours of lecture and six hours of laboratory per week. Prerequisite: permission of instructor. Analysis of eye movement and sensory visual systems from a control and systems approach is made available to non-engineers using computer simulation techniques, and biologist-oriented display programs.
Mr. Stark (Sp)

208. Neurosensory Physiology of Vision. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: consent of instructor. Lecture and laboratory demonstrations on the neural mechanisms underlying the sensory and central processes of visual perception.
Mr. Marg (Sp)

260. Physiology of the Cornea and Sclera. (4)
Two 2-hour lectures per week. Prerequisite: graduate standing and a course in calculus. Detailed analysis of the cornea and sclera including histology, permeability, diffusion, metabolism, and mechanical properties. The optical properties of the cornea.
Mr. Fatt (Sp)

298. Group Studies, Seminars or Group Research. (1–8)
One to eight hours of lecture per week. Group studies of selected topics. Advanced studies in various subjects through special seminars on topics to be selected each year, informal groups of studies of special problems, group participation in experimental problems and analysis. Mr. Fatt (F, W, Sp)

299. Research in Physiological Optics. (2–8)
Varied. Prerequisite: consent of instructor. Research.
Mr. Marg in charge (F, W, Sp)

300A–300B–300C. Teaching Methods in Physiological Optics and Optometry. (2–2–2)
Two hours of class per week. Prerequisite: graduate standing in Physiological Optics. Instruction in teaching methods and materials, in physiological optics and optometry, observation of classes in session, practice teaching in classroom and laboratory. Can be taken more than once for credit.
Mr. Flom, Mr. Adams (F, W, Sp)

401. Applications of Electronics and Computers in Physiological Optics and Optometry. (3)
(Formerly numbered 491)
Two hours of lecture and two hours of laboratory per week. Prerequisite: graduate standing in physiological optics, optometry student, or consent of instructor. The study of vision requires the application of electronic and computer techniques. Topics will cover the recording of bio-electric phenomena, transducers, signal averaging and other computer processing and displays, and computer interactive systems used in physiological optics and optometry.
Mr. Cohn (F, Sp)

601. Individual Study for Master’s Students. (1–8)
Prerequisite: consent of instructor. Individual study for the comprehensive requirements in consultation with the adviser in physiological optics. Units may not be used to meet either unit or residence requirements for the master’s degree. Must be taken on a satisfactory/unsatisfactory basis.
Mr. Marg (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the adviser in physiological optics, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required for the Ph.D. May not be used for unit or residence requirements. Must be taken on a satisfactory/unsatisfactory basis.
Mr. Marg (F, W, Sp)

ORIENTAL LANGUAGES

(Department Office, 104 Durant Hall)

Professors:
Haruo Aoki, Ph.D.
Cyril Birch, Ph.D.
Kun Chang, Ph.D.
William H. McCullough, Ph.D. (Chairman)

Michael C. Rogers, Ph.D.
Edward H. Schafer, Ph.D. (Agassiz Professor)
Denzel Carr, Ph.D. (Emeritus)
Yuen Ren Chao, Ph.D., Litt.D., LL.D.
( Agassiz Professor, Emeritus)
Seiichi Ando, Ph.D. (Visiting)

NOTE: For key to footnote symbols, see page 86.
The Department of Oriental Languages at Berkeley offers a thorough training in the classical and modern languages and literatures of Eastern Asia. The East Asiatic Library, which houses one of the largest American collections of materials related to China, Japan, Korea, and Tibet, is located on the Berkeley campus. The three undergraduate major programs emphasize respectively Chinese, Japanese, and Altaic languages. In all cases the student proceeds from initial acquisition of a facility in the spoken language to a reading knowledge of both modern and classical forms. Individual upper division courses stress the philological, linguistic, or literary study of Oriental cultures, and the student is encouraged to select courses that will provide him an insight into each of these disciplines. The department also emphasizes the study of a particular Oriental culture in its broader geographical context.

**The Major**

**Emphasis on Chinese**

**Lower Division:** Oriental Languages—Chinese 1A–1B–1C (5–5–5); Chinese 10A–10B–10C (5–5–5); Chinese 11A–11B (5–5); Linguistics 20 (5) (may be taken on a passed/not passed basis).

**Upper Division:** Oriental Languages—Chinese 100A–100B–100C (4–4–4); Chinese 103 (4) or Chinese 113 (4); Chinese 104A (4) or Chinese 104B (4) or Chinese 104C (4); Chinese 133 (4) (for students expecting to proceed to the M.A. or Ph.D. degree in Oriental Languages with emphasis on Chinese); Chinese 145 (4). In consultation with the adviser, a program of courses in addition to those prescribed to make a total of 36 upper division units (either one or two lecture courses may be counted among these).

**Emphasis on Japanese**

**Lower Division:** Oriental Languages—Japanese 1A–1B–1C (5–5–5); Japanese 10A–10B–10C (5–5–5); Japanese 12 (4); Linguistics 20 (5) (may be taken on a passed/not passed basis).

**Upper Division:** Oriental Languages—Japanese 100A–100B–100C (4–4–4); Japanese 129A (4) or Japanese 129B (4) or Japanese 129C (4); Japanese 139A (4); Japanese 132 (4).

**Lower and Upper Division:** In consultation with the adviser, a program of courses in addition to those prescribed to make a total of 45 lower division units and 36 upper division units.

**Emphasis on Altaic Languages**

**Lower Division:** Oriental Languages—Korean 1A–1B–1C (5–5–5) or Near Eastern Studies—Turkish 1A–1B–1C (4–4–5); Linguistics 20 (5).
Upper Division: Oriental Languages—Altaic and Tibetan 144A—144B—144C (5—5—5). Altaic and Tibetan 154A—154B—154C (4—4—4) and other relevant courses as designated by the adviser (e.g., Oriental Languages 143, 177A—177B [4—4]; Near Eastern Studies—Turkish 100A—100B—100C [5—4—4] and 168A—168B [4—4]) to make a total of 36 upper division units.

Honors Program

An undergraduate student who has completed 21 units of language courses in the department, and who has an overall grade-point average of 3.0, may apply to the departmental chairman for admission to the honors program. If he is accepted, his curriculum will then differ from that of other candidates for the A.B. degree in that he will be permitted to take from 1 to 6 units of H195 (honors course) which will count toward the major in lieu of other language courses that he might offer for the degree. While enrolled in this course, he will do independent and advanced work under the guidance of appropriate members of the staff. At the same time, he will prepare himself to take a comprehensive examination in the last quarter of his senior year.

Graduate Programs

M.A. and Ph.D. programs are offered in Chinese Language and Literature and in Japanese Language and Literature. The M.A. degree is offered in Altaic Language and Literature, with emphasis on Mongolian. Information concerning graduate degree requirements may be obtained from the departmental office.

The prospective graduate student is urged to acquire an active command of his language of emphasis as early as possible. Toward this end, a period of study at the Inter-University Program for Chinese Language Study in Taipei, Taiwan, or the Inter-University Center for Japanese Language Study in Tokyo, Japan, both institutions co-sponsored by the University of California at Berkeley, is strongly recommended.

Oriental Languages—General

(Courses in which knowledge of an Oriental language is not required.)

*38A—*38B—*38C. Great Books of Eastern Asia. (1—1—1)

One 1-hour meeting per week. *38A is not prerequisite to *38B; *38A and *38B are not prerequisite to *38C. Lectures and reading on the great classics of Eastern Asia, in English translation. (F, W, Sp)

Upper Division Courses

112A—112B. Chinese Literature in Translation. (4—4)

Three hours of lecture per week. Prerequisite: junior standing; sophomores admitted with consent of instructor. Lectures on principal genres, authors, and individual works of Chinese literature from the beginning to the present day, with section discussions (to follow each lecture) based on lectures and on students’ reading of selected works in English translation. Mr. Miller (W); Mr. Birch (Sp)

*132. History of Japanese Literature. (4)

Three 1-hour meetings per week. From the beginning to modern times, with emphasis on Chinese, Buddhist, and Western influences, Mr. Motofuji (W)

140—143. Civilizations of Eastern Asia. (4)

Three 1-hour meetings per week.

*140. China. (Formerly numbered 142C) Prerequisite: junior standing. Mr. Schaefer (Sp)

*141. Japan. (Formerly numbered 142J.) Major themes in the development of traditional Japanese civilization. Mr. McCullough (W)

142. Korea. (Formerly numbered 142K.) The development of Korean civilization, with emphasis on Chinese influence. Mr. Rogers (F)

*143. Mongolia. (Formerly numbered 142M.) A survey of the historical, cultural, and linguistic development of the Mongols. Mr. Bosson (F)

*152. Modern Japanese Literature in Translation. (4)

Three 1-hour meetings per week. Reading in English translation of representative works of Japanese writers from the end of the nineteenth century to the present. Mr. Motofuji (Sp)

*155. Traditional Japanese Historical Writing. (4)

Three 1-hour meetings per week. A survey of historians, histories, and historical sources in the premodern period. No knowledge of Japanese required. Mr. McCullough (F)

171A—171B. Development of Buddhism in the Far East. (4—4)

Three 1-hour meetings per week. The introduction of Buddhism from India into Central Asia and China, and its subsequent spread to Korea and Japan. The separate tradition of Tibetan Buddhism is included. A two quarter sequence beginning (Sp).
Chinese

Lower Division Courses

1A-1B-1C. Elementary Chinese. (5-5-5)
(Formerly numbered 1C-2C-3C)
Five 1-hour meetings plus two additional hours in the language laboratory required per week. Sequence beginning (F). Mr. Chang (F, W, Sp)

10A-10B-10C. Intermediate Chinese. (5-5-5)
(Formerly numbered 4C-5C)
Five 1-hour meetings plus one additional hour in the language laboratory required per week. Prerequisite: course 1C. Sequence beginning (F). The Staff (F, W, Sp)

11A-11B. Introduction to Classical Chinese. (5-5)
(Formerly 6C)
Five 1-hour meetings per week. Prerequisite: course 1C or Japanese 10B. 11A is prerequisite to 11B. Mr. Schaefer (F, W)

Upper Division Courses

100A-100B-100C. Advanced Chinese. (4-4-4)
(Formerly numbered 106 and 124A-B)
Three hours of reading and discussion per week. Prerequisite: course 10C.

100A. Belleslettish writings in pai-hua and literary styles. The Staff (F)

100B, 100C. Expository writings in pai-hua and literary styles. The Staff (W, Sp)

103. Classical Chinese: Medieval Texts (Cultural and Literary). (4)
Three 1-hour meetings per week. Prerequisite: course 11B. Mr. Schaefer (Sp)

104A-104B-104C. Studies in Ancient Chinese Literature. Philological Analysis of Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: courses 103 or 113 and 8 additional units of upper division Chinese or Japanese. Topics and texts will vary from year to year, normally in the following sequence: Prose (F), Poetry (W), Philosophy (Sp).

*105. Advanced Mandarin. (4)
Three 1-hour meetings per week. Prerequisite: course 10B. Reading and discussion in Chinese of contemporary materials. Designed to increase competence in handling the modern language.
Mr. Jamieson (Sp)

*110A-110B-110C, Readings in Chinese Buddhist Texts. (4-4-4)
Two 1 1/2-hour meetings per week. Prerequisite: one upper division course in Classical Chinese. 110A is not prerequisite to 110B; 110A and 110B are not prerequisite to 110C.
Mr. Lancaster (F, W, Sp)

113. Classical Chinese: Medieval Texts (Narrative and Historical). (4)
Three 1-hour meetings per week. Prerequisite: course 11B. Mr. Schaefer (F)

118. Documents on the Chinese World Order. (4)
Two 1 1/2-hour meetings per week. Prerequisite: three quarters of Classical Chinese, including course

125. Chinese Dialectology. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 100B and Linguistics 20. Mr. Chang (Sp)

*133. Chinese Bibliography. (4)
Three 1-hour meetings per week. Prerequisite: two upper division courses in classical Chinese. Open to seniors or by consent of instructor.
Mr. Jamieson (W)

*134A-134B-134C. Cantonese. (4-4-4)
Two 1 1/2-hour meetings per week. Prerequisite: course 100B. Mr. Chang (F, W, Sp)

*135. Phonology of Ancient Chinese. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 103 or 113. Mr. Chang (W)

*136A-136B. Chinese Neoclassical Literature Since 1400. (4-4)
Two 1 1/2-hour meetings per week. Prerequisite: one upper division course in classical Chinese, or consent of instructor. 136A is not prerequisite to 136B. Readings of representative Ming authors with emphasis on Neoclassicism and its aftermath.
Mr. Cheng (W, Sp)

145. Chinese Grammar. (4)
Two 1 1/2-hour meetings per week. Prerequisite: course 100B and Linguistics 20. Mr. Chang (W)

156. Readings in Chinese Vernacular Literature. (4)
Three 1-hour meetings per week. Prerequisite: course 100B. May be repeated for credit.
Mr. Birch (F, W)

*165. Readings in Chinese Linguistics. (4)
Two 1 1/2-hour reading sessions per week. Prerequisite: course 100A, 100B or 100C, or equivalent, and Linguistics 20. A course designed to develop the student's ability to use Chinese source materials on linguistics.
Mr. Chang (F)

175. Sino-Tibetan Linguistics. (4)
Two 1 1/2-hour meetings per week. Prerequisite: Linguistics 20. An exploration into the genetic relations among Chinese, Thai, Tibetan, Burmese, and other Asian languages.
Mr. Chang (Sp)

*183A-183B-183C. Masterpieces of Chinese Literature and Literary Criticism. (4-4-4)
Two 1 1/2-hour meetings per week. Prerequisite: course 103 or 113. 183A: Pre-Han literature. 183B: Han through Sung (poetry). 183C: Han through Sung (essays and literary criticism). 183A is not prerequisite to 183C. Mr. Cheng (F); Mr. Miller (W, Sp)

*185. History of Chinese Linguistics. (4)
Two 1 1/2-hour meetings per week. Prerequisite: Linguistics 20. A historical survey of the development of Chinese linguistics from the Han Dynasty to the present.
Mr. Chang (Sp)

*194. Sino-Altaica. (4)
Three 1-hour meetings per week. Prerequisite: 24 units of Chinese language courses. Problems in texts
pertaining to the history of the Chinese frontier, with special reference to China's early relations with Altaic-speaking people.

Japanese

Lower Division Courses

1A-1B-1C. Elementary Japanese. (5-5-5)
(Formerly 1J-2J-3J)
Five 1-hour meetings per week. Registration for two additional hours per week in the language Laboratory is required. Sequence beginning (F)
Mr. Aoki (F, W, Sp)

10A-10B-10C. Intermediate Japanese. (5-5-5)
(Formerly 4J-5J-6J)
10A. Five 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 1C.
10B-10C. Five 1-hour meetings per week. 10A is prerequisite to 10B; 10B is prerequisite to 10C.
Mr. Motofuji (F, W, Sp)

12. Introduction to Literary Japanese. (4)
Three 1-hour meetings per week. Prerequisite: course 10B.
Mrs. McCullough (Sp)

19A-19B-19C. Japanese Composition. (3-3-3)
Three 1-hour meetings per week. Practice in speaking and writing modern Japanese. Prerequisite: course 1C. Sequence beginning (F)
Mr. Nakamura (F, W, Sp)

Upper Division Courses

100A-100B-100C. Advanced Japanese. (4-4-4)
(Formerly numbered 109, 119)
Three 1-hour meetings per week. Readings in modern Japanese. 100A-100B: Expository writings. Prerequisite: 10C. 100A is not prerequisite to 100B. 100C: Belles lettres. Prerequisite: 100A or 100B.
Mr. McCullough (F, W), Mr. Nakamura (Sp)

Two 1½-hour meetings per week. Prerequisite: course 10A.
Mr. Cheng (Sp)

129A-129B-129C. Readings in Classical Japanese Literature. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 12. 129A is not prerequisite to 129B; 129A and 129B are not prerequisite to 129C.
Mrs. McCullough (F, W), Mr. McCullough (Sp)

139A-139B. Japanese Grammar. (4-4)
Mr. Aoki (W, Sp)

149A-149B-149C. Advanced Colloquial Japanese. (4-4-4)
Four 1-hour meetings per week. Prerequisite: course 10C. 149A is not prerequisite to 149B; 149A and 149B are not prerequisite to 149C. Training in the active use of colloquial Japanese. 149B and 149C will include lectures in Japanese on elements of Japanese culture.
Mr. Nakamura (F, W, Sp)

159. Contemporary Japanese Literature. (4)
Three 1-hour meetings per week. Prerequisite: course 100C.
Mr. Motofuji (F)

160. Japanese Drama. (4)
Three 1-hour meetings per week. Prerequisite: course 129C. No. kyōgen, jōruri and kabuki.
Mr. Motofuji (F)

189. Japanese Documents. (4)
Three 1-hour meetings per week. Prerequisite: course 129A or 129B or 129C; advanced knowledge of spoken Japanese. An introduction to printed and manuscript documents of the Edo period. Instruction is in Japanese.
Mr. Andō (F)

Korean

Lower Division Course

*1A-1B-1C. Elementary Korean. (5-5-5)
(Formerly numbered 1K-2K-3K)
1A. Five 1-hour meetings and two 1-hour laboratories per week.
1B-1C. Five 1-hour meetings and one 1-hour laboratory per week. Sequence beginning (F).
Mr. M. Rogers (F, W, Sp)

Upper Division Courses

100A-100B-100C. Intermediate Korean. (4-4-4)
Three hours of lecture per week. Prerequisite: course 1C.
Mr. Rogers (F, W, Sp)

Altaic and Tibetan

144A-144B-144C. Introduction to Mongolian. (5-5-5)
Four 1-hour meetings per week. An introduction to the official language of the Mongolian People's Republic (Khalkha). Graded readings in literary and expository texts.
Mr. Bosson (F, W, Sp)

*154A-154B-154C. Intermediate Mongolian. (4-4-4)
Three 1½-hour meetings per week. Continued reading and exercises in Khalkha, together with an introduction to the orthography and grammar of literary Mongolian in vertical script. Selected prose texts from the 17th century to the present in both Cyrillic script and vertical script.
Mr. Bosson (F, W, Sp)

164A-164B-164C. Elementary Tibetan. (4-4-3)
164A-164B. Two 1½-hour meetings per week. Prerequisite: consent of instructor. Introduction to the grammar of standard literary Tibetan; graded readings in Tibetan prose from literary and historical sources.
164C. One 2-hour meeting per week. Prerequisite: courses 164A-164B.
Mr. Bosson (F, W, Sp)

*174A-174B-174C. Intermediate Tibetan. (3-3-3)
Two 1½-hour meetings per week. Prerequisite: 164A, 164B, 164C. Emphasis on doctrinal Buddhist texts.
Mr. Lancaster (F, W, Sp)

177A-177B. Manchu. (4-4)
Three 1½-hour meetings per week. Prerequisite: junior standing; consent of instructor. An introduction to literary Manchu; reading of selected prose texts.
Mr. Bosson (W, Sp)

*178A-178B. Survey of Mongolian Languages. (4-4)
Three 1-hour meetings per week. Prerequisite: courses 144A, 144B, 144C. The linguistic classifica-
tion of the Mongolian languages will be discussed in connection with a detailed study and comparison of their phonological and morphological peculiarities.  
Mr. Bosson (W, Sp)

179. Buriat. (4)  
Three 1-hour meetings per week. Prerequisite: courses 178A, 178B. An introduction to the standard modern Buriat literary language; reading of selected prose texts.  
Mr. Bosson (Sp)

*184. Advanced Tibetan. (2)  
Two 1-hour meetings per week. Prerequisite: courses 174A, 174B, 174C. Extensive reading in historical and literary texts. May be repeated for credit.  
Mr. Bosson [F, W, Sp]

Special Upper Division Courses

H195. Honor Course. (1-6)  
Hours to be arranged. Limited to senior honor candidates in Oriental Languages.  
The Staff (F, W, Sp)

198. Preceptorial and Reading Course. (1-4)  
Hours to be arranged. Prerequisite: junior standing.  
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)  
Enrollment is restricted by regulations listed on page 87. Additional limitations: restricted to senior honor students in Oriental Languages. Must be taken on a passed/not passed basis. The Staff (F, W, Sp)

Graduate Courses

201. Japanese Bibliography. (3)  
(Formerly numbered 131)  
Three 1-hour meetings per week. Prerequisite: Japanese 100A-100B-100C. Japanese reference works for literature and history. Mr. McCullough (F)

(Formerly 137)  
Two 1½-hour meetings per week. Prerequisite: Korean 1C; Chinese 103, 113, or consent of instructor. Survey and analysis of major source works from the Three Kingdoms period through the Yi Dynasty. Mr. Jamieson (F)

206. Chinese Vernacular Literature. (4)  
One 2-hour seminar per week. Detailed study of a text with its literary and historical background. May be repeated once for credit with consent of instructor. Mr. Birch (Sp)

212. Seminar in Chinese Literary History. (4)  
One 2-hour seminar per week. Textual and aesthetic criticism. Mr. Miller (F, Sp)

*213. Seminar in Philological Analysis of Ancient Chinese Texts. (4)  
One 2-hour seminar per week.  
(F, W)

216. Texts on the Civilization of Medieval China. (4)  
Two 1-hour seminars per week. May be repeated for credit with consent of instructor.  
Mr. Schafer (W, Sp)

*217. Seminar in Philological Analysis of Koryo and Yi Dynasty Sources. (4)  
One 2-hour seminar per week. May be repeated for credit with consent of instructor. Mr. Rogers (W)

218. Seminar on the Sources for the Traditional Chinese World Order. (4)  
Two 1-hour lectures per week. Prerequisite: advanced knowledge of literary Chinese. Cultural, strategic, and economic factors in the operation of the tributary system of the Chinese empire. Historiographical effects of the tension between orthodox ideology and political realities. Emphasis on textual analysis of primary sources. Mr. Rogers (W)

224. Reading in Altaic Texts. (4)  
One 2-hour seminar per week. May be repeated for credit with consent of instructor.  
Mr. Bosson (W, Sp)

*229. Seminar in the Classical Civilization of Japan. (4)  
One 2-hour seminar per week. May be repeated for credit. Mr. McCullough (W)

*236. Seminar in Chinese Linguistics. (4)  
One 2-hour seminar per week. Prerequisite: one or more of the following: 125, 135, 145, 155, 185. Mr. Chang (Sp)

239. Seminar in Japanese Linguistics. (4)  
One 2-hour seminar per week. Prerequisite: 139B. May be repeated for credit. Mr. Aoki (F)

*244. Seminar in Altaic Comparative Phonology. (4)  
One 2-hour session per week. A laboratory in comparative phonology of the Altaic languages. Each student will concentrate on one specific aspect of the problem. Mr. Bosson (F, W)

*249. Seminar in Modern Japanese Literature. (4)  
One 2-hour seminar per week. Prerequisite: 159. May be repeated for credit with consent of instructor. Mr. Motofuji (W)

*275. Historical Documents. (4)  
Two 1-hour seminars per week. Prerequisite: advanced level of competence in literary Chinese or consent of instructor. Mr. Jamieson (Sp)

276. Old Turkish: Uighur. (4)  
Two 1½-hour meetings per week. Prerequisite: Near Eastern Studies 201A-201B.  
Mr. Bosson (Sp)

299. Thesis Preparation and Related Research. (1-8)  
Hours to be arranged. Prerequisite: consent of thesis supervisor and graduate adviser.  
The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1-8)  
Prerequisite: consent of graduate adviser. Individual study for the comprehensive or language requirements in consultation with the graduate adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.  
The Staff (F, W, Sp)
602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare for various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the Ph.D. degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

PALEONTOLOGY

(Department Office, 3 Earth Sciences Building)

Professors:
Zach M. Arnold, Ph.D.
William B. N. Berry, Ph.D.
William A. Clemens, Jr., Ph.D.
J. Wyatt Durham, Ph.D.
Joseph T. Gregory, Ph.D.
Robert M. Kleinpell, Ph.D.
Donald E. Savage, Ph.D.
Charles L. Camp, Ph.D. (Emeritus)

Associate Professor:
Wayne L. Fry, Ph.D.

Departmental Major Adviser: Mr. Durham.
Graduate Adviser: Mr. Berry.

The department offers instruction in invertebrate and vertebrate paleontology, micropaleontology, paleobotany, and stratigraphic paleontology. Professional opportunities are few in the field without an advanced degree, hence the undergraduate program is designed to prepare students for graduate study. Either the biology of fossil organisms or the geological aspects of their occurrence may be emphasized.

The Major

A core of fundamental courses is followed by advanced study of either geology and biostratigraphy or the biology and paleobiology of either plants or invertebrates or vertebrates. Study of a modern foreign language is strongly recommended.

All programs must include Chemistry 1A–1B and 8A, Biology 1A–1B, Geology 5A–5B, and Paleontology 1. Students intending to prepare for graduate study are strongly advised to include basic courses in physics and mathematics through calculus.

Programs emphasizing biostratigraphy and the geological aspects of paleontology must include Geology 102, 150, 118, Paleontology 111, 112, 113, 114, Biology 150, and two additional courses in geology, zoology, or paleontology (Genetics 100, Zoology 109, 157, Physiology 123–123L, and Geology 105, 107 are recommended).

Major with paleobiological emphasis must include Biology 150, Genetics 100, Geology 107, Paleontology 112, one course sequence from each of the following three groups: (a) Paleontology 111 and 114 or 115, or 120–121, or 125–126; (b) Botany 105, 110; or Zoology 155, or 108 or 157; or 106–106L; (c) Botany 144 or Physiology 123–123L, or Zoology 131–131L. Geology 150, Zoology 109 and 107A are also recommended.

Honors Program Honor students may apply to the advisor at the beginning of the senior year for admission to the honors program. Students accepted for this program may substitute the research and Honors Thesis course for up to 8 units of the major requirements, and must complete a thesis (course H195).

Students who wish to arrange an individual major should confer with the departmental adviser.

The Museum of Paleontology, the research institute and archive for the staff and students and for qualified visiting scholars, has large collections of fossil vertebrates, invertebrates, and plants from every continent, principally from the western United States. Requests for utilization of the collections or facilities should be addressed to the Director, Room 3, Earth Sciences Building.

NOTE: For key to footnote symbols, see page 86.
Preparation for Graduate Study  Graduate study, with programs leading to both the M.A. and Ph.D. degrees, is a principal activity of the department. Students may emphasize either the biological or the geological aspects of paleontology. Facilities are extensive and education in most paleontological fields is offered. Candidates are expected to acquire a broad familiarity with several fields in paleontology as well as with related subjects outside the department, such as geology, anthropology, zoology, and botany. Ph.D. candidates are required to pass reading examinations in two foreign languages (usually French and German) before taking the oral qualifying examination.

For further details on the requirements for the M.A. and Ph.D. degrees, please contact the graduate adviser for the department.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT of the COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

1. Introduction to Paleontology. (5)
   Three 1-hour lectures, two 2-hour laboratories per week; field trip. Fossils: their significance in the study of evolution, their meaning to earth history. Ancient floras and faunas of the world. Genealogies of prominent groups of plants and animals, including the ancestry of man.
   The Staff (Mr. Savage in charge) (F, Sp)

2. Directed Studies in Paleontology. (2)
   Two 3-hour laboratories per week. Prerequisite: course 1 or 10 (may be taken concurrently). Field, museum, and laboratory investigations of diverse problems in paleontology under direct faculty guidance. Supervised field trips, readings, and discussions.
   The Staff (Mr. Durham in charge) (F, W, Sp)

10. Elements of Paleontology. (4)
   Two 1-hour lectures, one discussion-demonstration section per week and one or more field excursions. Not open to students who have taken course 1. The fossil record as evidence of earth history and organic evolution with emphasis on biological and geological principles.
   Mr. Arnold (W)

Upper Division Courses

101. Phylogeny and Evolution. (4)
   Two 1-hour lectures and one 2-hour demonstration section per week; one or more field trips. Prerequisite: a course in paleontology or in a related science. Paleontology 101 is designed for science-oriented students not majoring in paleontology. Examination and discussion of selected examples from the fossil record of plant and animal groups.
   The Staff (Mr. Clemens, coordinator) (Sp)

111. Invertebrate Paleontology. (4)
   Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 1 or 10 or Biology 1A–1B, or 11A–11B, or Geology 5A–5B. Paleobiology, morphology and systematics of the invertebrates.
   Mr. Berry (F)

112. Stratigraphic Paleontology. (4)
   Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 111. Elements of biostratigraphy and the stratigraphic sequence of fossils.
   Mr. Berry (W)

113. Stratigraphic Chorology of the Cenozoic. (4)
   Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 112. Emphasis on the distribution and interrelationships of diverse marine Cenozoic faunas. To be given alternate years with course 239.
   (Sp)

114. Micropaleontology. (4)
   Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 112 or 113 or consent of the instructor. Principles of advanced stratigraphic paleontology with emphasis on the Foraminifera.
   (F)

115. Paleobiology of Microorganisms. (4)
   Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 114 or consent of instructor. Biological and paleontological principles in the study of microfossils, with emphasis on the Foraminifera.
   Mr. Arnold (Sp)

120. Paleobotany. (4)
   Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: consent of instructor. Advanced study of plants represented in the fossil record. Primarily for students with comprehensive knowledge of earth sciences.
   Mr. Fry (F)

121. Floras of the Past. (4)
   Two 1-hour lectures, one 3-hour laboratory per week and term report. Prerequisite: course 120, 220, or consent of instructor.
   Mr. Fry (W)

122. Field Investigations in Paleobotany. (4)
   Lectures, demonstrations and special investigations in the field, preparation of acceptable research paper, examinations.
   Mr. Fry (Sp)

125. Vertebrate Paleontology. (4)
   Three hours of lecture per week and one 3-hour laboratory per week. Prerequisite: Paleontology 1 or Anthropology 1, and Biology 1A–1B or 11A–11B or equivalent. Geologic history and evolution of backboned animals.
   Mr. Gregory (Sp)

126. Morphology of the Vertebrate Skeleton. (2)
   One hour of lecture and one 3-hour laboratory. Prerequisite: Paleontology 1 or Anthropology 1, and Biology 1A–1B or Biology 11A–11B. Development and morphology of skeleton and dentition.
   Mr. Gregory (W)

*136. Paleozoic and Early Mesozoic Stratigraphy of North America. (4)
   Three 1-hour lectures and term report. Prerequisite: course 115. To be given alternate years with course 210. Emphasis on Paleozoic stratigraphy of western North America.
   Mr. Berry (W)

*170. History of Paleontology. (4)
   Three 1-hour lectures per week, assigned reading and written report. Prerequisite: senior or graduate
H195. Honors Thesis. (8)
Restricted to candidates for honors with the bachelor's degree. Preparation of a satisfactory report on original research. In evaluating the report emphasis will be placed on composition and style as well as scientific content. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (F, W, Sp)

Graduate Courses

"210. Principles of Phylogeny and Systematics. (4)
To be given in alternate years with 236. Four hours lecture and seminar per week. Mr. Berry (Sp)

217. Morphology and Systematics of Invertebrates. (4)
Two hours lecture and two 3-hour laboratories per week (alternate years, in same years as 237). Advanced studies in mollusks, echinoids, corals, and other invertebrates. Mr. Durham (W)

"220. Advanced Paleobotany. (4)
Two hours lecture and two 3-hour laboratories per week. Prerequisite: advanced training in plant anatomy and systematics. Advanced study of plants represented in the geologic record. Mr. Fry (W)

224. Paleontology and Evolution of Fish. (4)
Two hours of lecture and two 3-hour laboratory sessions per week. Prerequisite: courses 125 and 126 or Zoology 106 or equivalent. To be offered in alternate years with Paleontology 225. Mr. Gregory (F)

225. Paleontology and Evolution of Amphibians and Reptiles. (4)
Two hours of lecture and two 3-hour laboratory sessions per week. Prerequisite: courses 125 and 126 or Zoology 106 or equivalent. Mr. Gregory (W)

226A-226B. Evolution and Systematics of Mammals. (6-6)
Two 1-hour lectures, one 2-hour discussion section, and two 3-hour laboratories per week. Prerequisite: courses 125 and 126 or comparative anatomy of vertebrates. Study of fossil record of Mammalia and comparative research on modern animals contributing to determination of mammalian phylogenetic relationships. One weekend field trip will provide experience with collecting techniques. Mr. Clemens (F, W)

227. History and Paleoecology of Higher Vertebrates. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 226A-226B. Mr. Savage (Sp)

229. Field Studies in Vertebrate Paleontology. (1-4)
Prerequisite: course 224, 225, or 227. Demonstrations in the field and written reports on problems in occurrence, taphonomy, stratigraphic rela-

236. Paleozoic and Early Mesozoic History of North America. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: consent of instructor. Emphasis on paleoecologic, zoogeographic and tectonic interpretations of North American Paleozoic faunal and stratigraphic record. Mr. Berry (W)

237. Cenozoic of the Pacific Coast. (5)
Three 1-hour lectures and two 3-hour laboratories per week; week field trip. To be given alternate years. Prerequisite: course 111, 112, and consent of instructor. Studies of original literature and materials on invertebrate paleontology and stratigraphy. Mr. Durham (F)

238. Later Mesozoic of the Pacific Coast. (4)
Three 1-hour lectures and one 3-hour laboratory per week. To be given alternate years. Studies of original literature and materials of Mesozoic invertebrates. Mr. Durham (Sp)

239. Cenozoic History of the West Coast of North America. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 114 or consent of instructor. To be given in alternate years with course 113. Emphasis on correlation, sequence, and relationships of foraminiferal faunas. ——— (Sp)

250. Seminars in Paleontology. (2)
Advanced study and current literature in various fields of paleontology. Topics vary from year to year. (a) Mr. Arnold (F, Sp); (b) Mr. Berry (F); (c) Mr. Clemens (F); (d) Mr. Durham (W, Sp); (g) Mr. Gregory (F); (h) Mr. Savage (F, Sp).

299. Research in Paleontology. (1-9)
The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

Courses in Other Departments

IDS 215A-215B. Faunal Analysis in Archaeology. (4-4)
See Interdepartmental Studies for the complete description of this course.

Biology 160A-160B. Marine Geobiology. (3-3)
See Biology for the complete description of this course.
PARASITOLOGY

For courses in Parasitology, see Entomological Sciences.

PEST MANAGEMENT CURRICULUM

Offered jointly by the Departments of Entomological Sciences and Plant Pathology, in the College of Agricultural Sciences.

(Office, 137 Giannini Hall)

The Departments of Entomological Sciences and Plant Pathology jointly administer this curriculum. A complex of organisms, both plant and animal, affect the welfare of humans. Some of the more serious of these directly compete for the food and fiber that is basic to our economic and social system. The curriculum is designed to train students to recognize and identify pest problems, and to recommend corrective procedures that are ecologically and economically sound. Employment opportunities for the graduate should exist in both the private and public sectors of our economy that are concerned with pest control, crop protection, as well as environmental protection.

Courses designed for the curriculum are listed under Entomological Sciences (page 257).

Curriculum Requirements

*Humanities and Social Sciences*, 30 units as follows: economics (5); English, rhetoric, or communications (10); interdepartmental studies (5); additional courses (10).

*Physical Sciences and Mathematics*, 29 units as follows: chemistry—inorganic, with laboratory (8), organic, with laboratory (9); biochemistry (4); mathematics (4); physics (4).

*Biological and Agricultural Sciences*, 64 units, other than in pest management, as follows: biology (12); interdepartmental studies (5); animal physiology (7); plant physiology (4); insect anatomy (2); insect identification (4); general entomology (5); ecology (4); genetics (5); data collection and assessment (4); pathobiology (12).

*Major Field*, 37 units as follows: pest management methods (9); systems approach to pest management (8); pest management practices (12); summer field course (8).

*Additional courses*, 20 units.

*Total units*, 180.

Certain courses may be required in satisfaction of the above. The undergraduate advisers will provide this information and any other details about the curriculum.

(Advisers: L. A. Falcon, 330 Hilgard Hall; A. R. Weinhold, 147 Hilgard Hall)

For additional information, see the Announcement of the College of Agricultural Sciences, available without charge in the Dean's Office, 101 Giannini Hall.

PHILOSOPHY

(Department Office, 314 Moses Hall)

Professors:
Ernest W. Adams, Ph.D.
Karl Aschenbrenner, Ph.D.
William Craig, Ph.D.
Hubert L. Dreyfus,† Ph.D.
Paul K. Feyerabend, Ph.D., L.H.D.
H. Paul Grice, M.A.
Benson Mates, Ph.D.
Wallace T. Matson,‡ Ph.D.
David Rynn, Ph.D.
John R. Searle, D.Phil.
Michael Scriven,‡ D.Phil.

NOTE: For key to footnote symbols, see page 86.
The Major

Lower Division 12A–12B or 91A–91B; 25A–25C–25D.

Upper Division 100; 102 or 104; 134A.

A total of 60 units is required in the major program. Twenty-four units are required in the upper division in addition to the three required upper division courses: 100, either 102 or 104, and 134A. The student must take at least two courses in each of groups A, B, and C. The required courses 102 or 104, and 134A, in groups A and B respectively, will satisfy A and B requirements in part, but may not be counted toward satisfaction of the 24-unit requirement.

Philosophy 12A–12B or 91A–91B must be passed before the end of the junior year.

Philosophy 100 should be taken as soon as possible after declaring a major.

With the approval of the departmental adviser, 5 units of the major may be taken in another department, provided the course selected is relevant to the major.

Honors Program  Students who have achieved honors standing at the end of the junior year will be permitted to enter the departmental honors program in the senior year. This program demands completion with a grade of B or better of one of the following three options: (1) Philosophy H195, Philosophy Tutorial; (2) Philosophy H197, Senior Colloquium; (3) a graduate seminar. With the approval of the departmental honors committee and the instructor in charge, the student will be permitted to enroll in a seminar, approval being based on the adequacy of the student’s preparation and the likelihood of his profiting from such study. In addition the student will submit an acceptable thesis, for which no unit credit will be assigned.

Higher Degrees  See page 27 of this catalogue. Attention is called to the requirement of a reading knowledge of French or German and one other foreign language for the Ph.D. in philosophy. Students who contemplate advanced study in philosophy should prepare themselves for the requirement in their undergraduate years.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

1. General Introduction to Philosophy. (4)

Three hours of lecture and one hour of section meeting for discussion and written work. The nature and range of philosophical enquiry. The role of philosophy in relation to problems of everyday life and to problems of other intellectual disciplines. Students interested in a more detailed examination of specific problems in ethical and political philosophy and the theory of knowledge are advised to take Philosophy 2 and 4 as introductory courses.

Mr. Hoffman (W)

2. Introduction to Philosophy: Ethical and Political Philosophy. (4)

Three 1-hour lectures per week and one weekly section meeting for discussion and written work.

Mr. Tusman (F, W)

4. Introduction to Philosophy: Theory of Knowledge. (4)

Three 1-hour lectures per week and one weekly section meeting for discussion and written work.

Mr. Hoffman (F); Mr. Feyerabend (Sp)

11A–11B. Theory of Argument. (4–4)

A study of the concepts and procedures of logic, semantics, and methodology, entering into the construction and criticism of arguments directed towards truth and knowledge.
12A–12B. Introduction to Logic. (5–5)

Three hours of lecture and two hours of discussion per week. Course 12A in itself should not be regarded as a terminal course in logic.

Mr. Chihara, Mr. Adams, Mr. Craig, Mr. Mates (F, W, Sp)

12C. Introduction to Logic. (4)

Three 1-hour lectures per week. Prerequisite: 12A and 12B. Introduction to metamathematics, Cantor's diagonal arguments, Paradoxes of set theory, Intuitionistic criticisms of traditional logic, Hilbert's formalism. Formal number theory. Decision procedures and computability. Turing machines, Church's thesis. Undecidability, Gödel's incompleteness theorems.

Mr. Chihara (Sp)

25A. Ancient Philosophy. (5)

Three 1-hour lectures per week and one weekly section meeting.

Mr. Matson (F)

25B. Medieval and Early Modern Philosophy. (5)

Three 1-hour lectures per week and one weekly section meeting.

Mr. Frede (W)

25C–25D. Modern Philosophy to Kant. (5–5)

Three hours of lecture and one section meeting per week. 25C, (W) Mr. Myro; 25D, (Sp) Mr. Stroud

§ 91A–91B. Rudiments of Logic and the Philosophy of Logic. (5–5)

Normally three hours of lecture and one hour of section meeting per week; at certain points, two hours of lecture and two hours of section. A sequence in which approximately equal time will be given to an elementary treatment of propositional and predicate logic, and to an elementary examination of philosophical questions directly raised thereby.

The course is introduced as an experiment, and in 1973–74 will be allowed as an alternative to 12A and 12B in the lower division requirement for the major. 91A, (F) Mr. Myro; 91B, (W) Mr. Adams

Upper Division Courses

General Prerequisites.—Students enrolling in any restricted upper division course must have completed 8 units in courses 1, 2, 4, or 25A, 25B, 25C, and 25D, or have completed, under conditions specified below, course 101. Additional prerequisites are indicated in certain courses.

Unrestricted Course

101. Philosophical Theories. (5)

Three 1-hour lectures and one section meeting per week. Fundamental problems in metaphysics and the theory of knowledge. Careful reading and discussion of selected texts of Plato, Hume, Kant and recent authors. Course 101 is open to juniors and seniors who are not majors in philosophy and who have not taken course 4 or its equivalent. It will be accepted as prerequisite for other upper division courses in the department in lieu of course 4. Mr. Matson (F); Mr. Feyerabend (W); Mr. Searle (Sp)

Restricted Courses

100. Philosophical Methods. (5)

Two hours of lecture per week and two hours of section meeting. Prerequisite: two courses from Philosophy 1, 2, 4, 25A–25B–25C–25D and 101, at least one of those not to be a member of the 25 series. The course is designed to acquaint students with the techniques of philosophical reasoning through detailed study of selected philosophical texts and through extensive training in philosophical writing, based on those texts. Restricted to majors and to be taken as early as possible after declaring the major. Must be passed with grade not less than B−. In event of failure to fulfill this grade requirement, course may be retaken once without additional unit credit.

Mr. Sluga (F)

Group A.—Courses concerned with a critical analysis and appraisal of specific human interests, such as art, literature, morality, religion, science, and society.

102. Practical Ethics. (4)

Three hours of lecture per week. A course in the nature of moral arguments, using a variety of contemporary examples of personal and social problems.

104. Ethical Theories. (4)

Three hours of lecture per week. The fundamental concepts and problems of morality examined through the study of classical and contemporary philosophical theories of ethics.

Mr. Searle (F); Mr. Sluga (Sp)

*106. Philosophy in Literature. (4)

Three hours of lecture per week. Philosophical issues as expressed in poetry, drama, and the novel. At the discretion of the instructor, the general prerequisite may be waived for major students in literature or in the fine arts.

107. Existentialism in Literature and Film. (4)

Three hours of lecture per week. Film viewing per week. Prerequisite: at the discretion of the instructor, the general prerequisite may be waived for students in literature. Dostoevsky's Brothers Karamazov, Kafka's The Castle, and Miller's After the Fall, studied as expressions of Christian, agnostic, and atheist existential attitudes. Four films (Day of Wrath, The Third Man, Hiroshima mon amour, and Breathless) which take up related issues will be shown and discussed. ——— (Sp)

108. Social Philosophy. (4)

Three hours of lecture per week. Fundamental notions involved in the explanation and evaluation of social structures and processes. Basic problems of human personality and values in relation to their social matrix.

112. Philosophy of Religion. (4)

Three hours of lecture per week. The nature and the validity of religious ideas.

118. Philosophy of Law. (4)

Three hours of lecture per week. Philosophical problems arising in the legal context.

Mr. Tussman (F, Sp)

*124. Theory of Historical Inquiry. (4)

Three hours of lecture per week.

125. Theory of Value. (4)

Three hours of lecture per week. The principles of evaluation in relation to both individual and social problems.
126A-126B. Aesthetics. (4)
Three hours of lecture per week. Course 126A is not prerequisite to 126B. At the discretion of the instructor, the general prerequisite for upper division courses in philosophy may be waived for major students of literature or the arts. Form, expression, representation, style; interpretation and evaluation.

126A. The Visual Arts. 
126B. Literature and Music. 

Mr. Aschenbrenner (W)

*127. Philosophy of History. (4)
Three hours of lecture per week. Theories of history: Augustine, Vico, Hegel, and others.

128. Political Philosophy. (4)
Three hours of lecture per week. Analysis of political obligation and related problems.

Mr. Tussman (W)

129. Aesthetic Theories. (4)
Three hours of lecture per week. A study of aesthetic theories based on historical and recent materials.

Mr. Schiffer (F)

Group B.—Courses dealing with the methods of reflective thinking and the more general features of experience. Philosophy 11A or 12A is recommended as preparation for courses in this group.

130. Philosophy of Action. (4)
Three hours of lecture per week. A consideration, inter alia, of some of the following questions: What is an action? What is rational action? Are intentions causes of actions? What is the structure of practical arguments? What is the structure of explanations of actions?

Mr. Myro (Sp)

131. Metaphysics. (4)
Three hours of lecture per week. 

Mr. Myro (Sp)

132. Philosophy of Mind. (4)
Three hours of lecture per week. Mind and matter; other minds; the concept "person."

Mr. Myro (Sp)

133A-133B. Philosophy of Language. (4-4)
Three hours of lecture per week.

133A. Mr. Searle (W)
133B. Mr. Mate (Sp)

134A-134B. Theory of Knowledge. (4-4)
Three hours of lecture per week.

134A. Mr. Myro (W)
134B. Mr. Stroud (Sp)

135. Philosophy and Linguistics. (4)
Three hours of lecture per week. Prerequisite: consent of instructor. This course approaches philosophy of language within the perspective of modern linguistics. It introduces what is philosophically relevant in generative transformational grammar.

136. Special Topics in the Philosophy of Science. (4)
Three hours of lecture per week. A discussion in some depth of one or a few special issues in, or approaches to, the philosophy of science. Details of current topics are available in the departmental guide for each quarter in which the course is given.

Mr. Feyerabend (W)

137. Philosophy of Science. (4)
Three hours of lecture per week. A survey of main topics in the logic of science—the nature of laws, explanation, probability, reduction, etc.—and of other issues coming under the general heading of philosophy of science—overviews of science and its direction, etc.

138. History of Science. (4)
Three hours of lecture per week. Philosophical topics arising from physics, biology, etc.

Mr. Adams (W)

140. Philosophy of the Natural Sciences. (4)
Three hours of lecture per week. Philosophical topics arising from psychology, economics, sociology, etc.

Mr. Scriven (F)

142. Probability and Induction. (4)
Three hours of lecture per week. Different approaches to the foundations of probability; inductive confirmation of scientific theories.

Mr. Adams (Sp)

143A-143B. Logic. (4-4)
Three hours of lecture per week. Prerequisite: course 12A-12B or equivalent.

Sequence beginning (F) Mr. Craig

*144. Philosophy of Mathematics. (4)
Three hours of lecture per week. Foundations of mathematics: logicism, intuitionism, formalism. Set theoretical paradoxes, definition of number, problems of continuum.

Mr. Chihara (W)

145. Modal Logic. (4)
Three hours of lecture per week.

146. Philosophical Logic. (4)
Three hours of lecture per week. Main subject of study will be logical aspects of natural language, and their relations to formal logic. Special attention will be given to unsettled questions of logical theory, including the nature of generalizations, time and tense, etc.

*147. History of Logic. (4)
Three hours of lecture per week. Aristotelian and Stoic logic; problems in medieval logic; Leibniz; the nineteenth century to Frege.

Mr. Mate (W)

150. Anglo-American Philosophy, 1900-1945. (4)
Three hours of lecture per week.

Mr. Schiffer (Sp)

*151. Anglo-American Philosophy Since 1945. (4)
Three hours of lecture per week.

*152A-152B. Phenomenology and Existentialism. (5-5)
Three hours of lecture and one hour of discussion section per week. Course 152A is prerequisite to 152B. Credit and grade will be awarded upon completion of the sequence.

152A. Backgrounds of phenomenology and existentialism: Kierkegaard, Nietzsche and Husserl. 
152B. Contemporary existential phenomenology: Heidegger, Sartre, and Merleau-Ponty.

Sequence beginning (F) Mr. Dreyfus

159. Semantics. (4)
Three hours of lecture per week. Prerequisite: 8 units of Philosophy, or equivalent at the discretion of instructor. Recommended: an acquaintance with the truth-tables techniques of elementary proposi-
tional logic. A systematic discussion of the theory of
meaning based on the verifiability principle; criteria
and procedures for ascertaining the significance of
linguistic expressions of the several main types de-
developed against the background of a general theory
of signs

Group C.—Courses dealing with individual
thinkers and epochs in the history of ideas. Course 25A—25B—25C or its equivalent is pre-
requisite to courses in this group.

160A-160B. Plato. (4-4)
Three hours of lecture per week.
160A: Mr. Matson (F)
160B: Mr. Frede (Sp)

161. Aristotle. (4)
Three hours of lecture per week.

168. Medieval Philosophy. (4)
Three hours of lecture per week.

170. Descartes. (4)
Three hours of lecture per week. Mr. Schiffer (W)

*171. Hobbes. (4)
Three hours of lecture per week.

*172. Spinoza. (4)
Three hours of lecture per week.

173. Leibniz. (4)
Three hours of lecture per week. Mr. Sluga (W)

*174. Locke. (4)
Three hours of lecture per week.

175. Berkeley. (4)
Three hours of lecture per week.

176. Hume. (4)
Three hours of lecture per week. Mr. Stroud (F)

178A-178B. Kant. (4-4)
Three hours of lecture per week.
178A. Mr. Aschenbrenner (F)
178B. Mr. Aschenbrenner (W)

*180. Philosophy of the 19th Century. (4)
Three hours of lecture per week.

181. Classical American Philosophy. (4)
Three hours of lecture per week. Readings in
A. B. Johnson, C. Peirce, W. James, J. Royce, G.
Santayana, J. Dewey, and others.

*182A—182B. Marxism. (4-4)
Three hours of lecture per week. A critical ap-
proval of the philosophical foundations and implica-
tions of Marx's view of man and society. During the
first quarter, particular attention will be devoted to
Hegel and Feuerbach and their influence on the de-
velopment of Marxian thought.

*183. Materialism and Naturalism. (4)
Three hours of lecture per week. Historical and
critical studies of the chief philosophical materialists
from Democritus to Dewey.

*184. Nietzsche. (4)
Three hours of lecture per week.

*190. The Later Wittgenstein. (4)
Three hours of lecture per week.

191. Experimental Course. (1-5)
Topics to be announced. Mr. Hoffman (F, Sp)
Mr. Dreyfus (F); Mr. Frede (Sp)

H195. Philosophy Tutorial. (5)
Restricted to senior honor students majoring in
philosophy. The department will designate a tutor,
with whom the student will meet once a week, sub-
mitting written work on topics designated by the
tutor.
Mr. Tussman in charge (F, W, Sp)

H197. Senior Colloquium. (5)
Restricted to senior honor students majoring in
philosophy. A seminar course for a group of honor
students on a topic to be announced. The colloquium
will meet once or twice a week. Emphasis on the
writing of papers and discussion of them in the
colloquium.
Mr. Searle

198. Group Study. (1-5)
Directed study on special topics. Prerequisite:
consent of instructor.
The Staff (Mr. Tussman in charge) (F, W, Sp)

199. Supervised Independent Study and Research.
(1-5)
Enrollment is restricted by regulations listed on
page 87. Must be taken on a passed or not passed
basis. The Staff (Mr. Tussman in charge) (F, W, Sp)

Graduate Courses

201. Graduate Tutorial. (5)
Two to four hours per week. Required of first
year graduate students. The student will write a
number of papers and discuss them with a design-
nated member of the faculty. Must be taken on a
passed or not passed basis.
Mr. Schiffer, Mr. Stroud (W),

204. Recent Work in Ethics. (5)
Prerequisite: course 104 or equivalent. Open to
advanced undergraduates.
Mr. Vermazen (Sp)

*231. Metaphysics. (5)
Three hours of lecture per week. An examination of
the concept "metaphysics" (as exemplified in the
writings of selected authors) with the aim of ascer-
taining whether there is such a discipline and if so
what might be its philosophic interest of value.

233. Recent Work in Philosophy of Language. (5)
Two to four hours per week.

234. Recent Work in Theory of Knowledge. (5)
Two to four hours.

237. Philosophical Problems. (5)
Two to four hours per week. Restricted to gradu-
ate students who have not yet passed the Qualifying
Examination.
Mr. Grice (F)

*240. Philosophy of Science. (5)
Two to four hours per week. Survey course for
graduate students with extensive philosophical back-
ground and substantial special knowledge in philos-
ophy of science; intensive discussion of the major
logical problems in philosophy of science including
induction, reduction, predication, valuation, and ex-
planation.
Mr. Feyerabend (Sp)
PHYSICAL EDUCATION

(Office of the Department, 103 Harmon Gymnasium)

Professors:
G. Lawrence Rarick, Ph.D.
Deobold B. Van Dalen, Emeritus Ph.D.
Anna S. Espenschade, Ph.D. (Emerita)
Franklin M. Henry, Ph.D. (Emeritus)
Pauline Hodgson, Ph.D. (Emerita)
Carl L. Nordly, Ph.D. (Emeritus)

Associate Professors:
Helen M. Eckert, Ph.D.
Mary Lou Norrie, Ph.D. (Chairman)
Joseph Royce, Ph.D.

Assistant Professors:
Barbara J. Hoeppner, Ph.D.
George A. Brooks, Ph.D.

Supervisors:
Frances L. Boland, M.S.
Koeman Boycheff, Ph.D. (Coordinator of Men's Intramural Sports and Recreation)
Lance Flanagan, Emeritus Ed.D.
Harold J. Frey, Ph.D.
Chester W. Murphy, Ed.D.

Graduate Advisers: Miss Norrie, Mr. Rarick.

The undergraduate major in physical education is designed to develop the scientific bases for understanding the physiological status of the individual and his ability to engage in motor activity. This includes the motor performance of daily life as well as that of a recreational, competitive, or aesthetic nature. The role of athletics, dance and other physical activities, both historical and contemporary, in the United States and certain other cultures is examined.

NOTE: For key to footnote symbols, see page 86.
The Major

Lower Division  High school chemistry or equivalent; elementary statistics (psychology 5 recommended); Anatomy 104 (formerly Anatomy 25) and Physiology 1 (or equivalent) or Physiology 108A–108B and 109A; Physics 10; Psychology 1. Recommended: History 4A or 4B or 4C or 4D or 17A or 17B or 17C or 17D; a lower division sociology course.

Upper Division  Physical Education 101, 105A, 110, 111, 121, 130; 12 units from Physical Education 102, 105B, 106, 112, 120, 135A, 135B, 140.

Honors Program  Physical Education H195, or H195 and 200—6 units; Physical Education H196—3 units. One course in the major will be waived with the approval of the adviser.

Teaching Credential  Candidates for a teaching credential with a major in physical education see the Announcement of the School of Education.

Preparation for Graduate Study  Students must complete the equivalent of the undergraduate major.

The Graduate Major

For the M.A. degree, either Plan I requiring 30 units and a thesis or Plan II requiring 36 units and a comprehensive final examination may be followed. Programs of study with sponsorship in Education and Physical Education lead to the Ed.D. or Ph.D. degree. Candidates for the latter degrees should consult graduate advisers in the School of Education as well as in the Department of Physical Education.

Activities Instructions

The Department of Physical Education offers to all students an opportunity in instructional classes to learn and to improve skills in a wide variety of sports, dance, and gymnastic activities and to maintain or develop physical fitness.

Fees  The incidental fee payable by all students at the time of registration entitles students to use of gymnasiums, swimming pools, towels, showers, lockers, tennis courts, and the athletic fields; also to the use of costumes for certain physical education activities, including swimming.

A few special activity classes such as bowling, and sailing require payment of extra fees.

Fines  Fines are imposed for each formal transaction necessitated by failure of the student to comply with the regulations of the department: (a) failure to return equipment or clothing on or before the date posted for such return at the end of each quarter, or at the end of each special session of the University, or failure to return athletic supplies (balls, bats, etc.) on the date of issue, $1 for each twenty-four hours until the full purchase price of the article has been reached; (b) overnight use of dressing locker, $2; (c) failure to renew or close out locker at the end of each quarter, $5.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

1. Physical Education Activities Primarily for Men. (1/2)
Sections meet two hours per week. Student selects section by activity, level, and time preference. A wide variety of sports, exercise, and conditioning activities are offered. Students should consult the Schedule of Classes each quarter to determine the particular activities and levels of instruction available. Sections of this course are designed primarily for men (women see courses 12 [coed] and 26 [women]).

The Staff (Mr. Van Dalen in charge) (F, W, Sp)
12. Physical Education Activities for Men and Women (co-educational). (1/2)

Sections meet two hours per week. Student selects section by activity, level, and time preference. A wide variety of sports, exercise, and conditioning activities are offered. Students should consult the Schedule of Classes each quarter to determine the particular activities and levels of instruction available.

Elementary School Activities: These sections are designed primarily for elementary teaching credential candidates.

The Staff (Mr. Van Dalen in charge) (F, W, Sp)

26. Physical Education Activities Primarily for Women. (1/2)

Sections meet two hours per week. Student selects section by activity, level, and time preference. A wide variety of sports, exercise, and conditioning activities are offered. Student should consult the Schedule of Classes each quarter to determine the particular activities and levels of instruction available. Sections of this course are designed primarily for women (men see courses 104 and 112). The Staff (Mr. Van Dalen in charge) (F, W, Sp)

30. Theory and Practice of Staged Combat. (3)

Two 1-hour lectures and one 3-hour laboratory per week. Prerequisites: elementary or theatrical fencing, or consent of instructor. The mechanics of movement in staged combat. Analysis and practice of related skills in dramatic scenes; choreography of physical conflict.

Mr. Palfly-Alpar (W, Sp)

50. First Aid. (2)

(Formerly numbered 5)
One 1 1/2-hour lecture and one 1 1/2-hour laboratory per week. Standard and advanced course. Upon successful completion of the course, an American Red Cross Certificate is awarded. Offered on a passed/not passed basis only. Miss Scott (F, W, Sp)

Upper Division Courses

101. Kinesiology and Body Mechanics. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Physiology 1 and Anatomy 104 (formerly Anatomy 25) or equivalent and Physics 10. Physical structure and muscular movements in various physical activities. Anatomical concepts and physical laws related to joint and muscle action.

Mr. Royce (W, Sp)

102. Adapted Physical Education. (3)

Two 1 1/2-hour lectures per week. Prerequisite: course 101. Adaptation of exercise for individuals with postural deviations from the normal or with physical disabilities requiring modification of activity.

Mr. Royce (Sp)

105A–105B. Physiological Hygiene. (4–4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Physiology 1 and Anatomy 104 (formerly numbered Anatomy 25) or equivalent. The physiology of exercise: diet, ventilation, training, fatigue, and health in relation to physical activity. Individual differences in cardio-vascular and respiratory function. Limitations of work in relation to altitude and climate.

Mr. Brooks 105A (F, W)

Mr. Brooks 105B (Sp)

106. Energy Sources for Human Movement. (3)

Three hours of lecture per week. Prerequisite: course 105B or permission of instructor. Lectures on the transduction of potential, organic energy sources to work in the human. Emphasis will be placed on direct and indirect methods of calorimetry, digestion, pathways of intermediary metabolism, the concept of rate-limiting reactions, and the substrates used at rest, during various forms of physical exercise, and in starvation.

Mr. Brooks (Sp)

110. Psychologic Bases of Physical Activity. (4)

Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: Psychology 1, elementary statistics (Psychology 5 recommended). Perception, motivation, learning, and emotion as factors in physical activity; reaction time and coordination; the psychology of competition.

Miss Norrie, ——— (W, Sp)

111. Motor Development. (4)

Three 1-hour lectures and one hour of section per week. Prerequisite: Psychology 1, and a course in elementary statistics. Motor development from birth to maturity, age changes, sex and individual differences, maturation, and motor learning in childhood and adolescence, relation of motor performance to other aspects of behavior. Miss Eckert (F, W, Sp)

112. Motor Development of the Handicapped. (3)

Three hours of lecture per week. Prerequisite: course 111 or equivalent. Motor development of the handicapped as a function of age, sex, and type of disability. Influence of maturational and environmental factors on motor development according to the type of handicapping condition. Mr. Rarick (W)

120. Sports in American Society. (3)

Three 1-hour lectures per week. Prerequisite: Sociology 1 or equivalent. Interrelationships of sports and physical recreation with other aspects of American culture. Emphasis on the twentieth century.

——— (F, Sp); Mr. Flanagan (W)

121. Social-Cultural Bases of Human Movement. (4)

Two hours of lecture and two hours of discussion per week. Prerequisite: one lower division sociology course, or consent of instructor. Emphasis will be devoted toward the social and cultural importance and structure, variety, and extent of sport in modern societies. Social factors such as institutions, processes, and systems are examined in relation to sport and sport groups as subcultures.

Mr. Van Dalen (Sp)

130. History and Theories of Physical Education. (4)

Three 1-hour lectures per week and one section meeting. Prerequisite: History 4A or B, or History 17A or B. Sports, dance, and gymnastics in selected historical and contemporary cultures. Political and social influences on theories and practices.

——— (F, Sp)

*131. Curriculum Development and Administration. (4)

Four 1-hour lectures per week. Prerequisite: course 130. Curriculum development and evaluation in school programs of physical education including the instructional program, intramural sports and interscholastic athletics. Administrative policies and procedures pertaining to staff, facilities, equipment, budget and program.

Miss Eckert

135A–135B. Measurement and Evaluation in Physical Education. (4–4)

135A. Three hours of lecture and 2 hours of laboratory per week. Prerequisite: a course in elementary statistics.

Miss Eckert (F)
135B. Three hours of lecture and three hours of laboratory per week. **Prerequisite: course 135A.** Historical development of evaluation in physical education; measurement of physical abilities and specialized motor skills; analysis of selected research studies in the field. Inferences from hypothesis testing, correlational and variance analysis and regression. The statistical nature of individual differences and error. Miss Norrie (F)

140. Community Recreation. (3)

Three 1-hour lectures per week. **Prerequisite: Sociology 1 or equivalent.** Nature, scope and significance of recreation in the social and economic life of the American people. History, purpose, organizational patterns and interrelationships of agencies and institutions which serve the recreational needs of the community and the nation. ——— (W)

160. Theory of Dance. (4)

(Formerly 160A-B)

Two 1-hour lectures and six hours of laboratory per week. **Prerequisite: course 12 (sections in dance); Psychology 1.** Ethnic, social, and contemporary dance forms; development of folk forms in Europe and the Americas; present trends in the United States; nature and function of rhythm in dance; theories and principles of technique and composition. Mrs. Bloland (Sp)

165A-165B. Theory of Sports Activities. (3-3)

165A. Two 1-hour lectures and 4 hours of laboratory per week. **Prerequisite: courses 12 and 26 (sections in individual sports, team sports, track and field).** The mechanics of movement in sports for women. Analysis of complex skills. Game structure and strategy. Competition for women. Miss Park (F)

1165B. Two 1-hour lectures and 4 hours of laboratory per week. **Prerequisite: course 165A, courses 12 and 26 (sections in gymnastics, apparatus, and individual exercise).** The mechanics of movement in gymnastic activities for women. Analysis of complex skills in a wide range of gymnastic activities and the analysis of exercise as it is related to gymnastic activities. Miss Park (Sp)

171. Conditioning of Athletes and Care of Injuries. (2)

One 1-hour lecture and 2 hours laboratory per week. **Prerequisite: course 5; Physiology 1 or Anatomy 104 (formerly 25) or equivalent.** Conditioning and care of athletes; sleep, diet, health, and activity habits. Care of injuries, with special emphasis on therapy, taping, and protective equipment. Mr. Royce (F)

H195. Honors Course. (3-6)

Individual conferences to be arranged. Special study and/or research in the field of the major.

The Staff (Mr. Van Dalen in charge) (F, W, Sp)

H196. Honors Thesis. (3)

Individual conferences to be arranged.

The Staff (Miss Norrie in charge) (F, W, Sp)

197. Field Study in Physical Education. (1-5)

Supervised experience relevant to specific aspects of Physical Education in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required. Must be taken on a **passed/not passed** basis. Miss Norrie (F, W, Sp)

199. Supervised Independent Study and Research for Undergraduates. (1-5)

Enrollment is restricted by regulations listed on page 87. Must be taken on a **passed or not passed** basis. The Staff (Miss Norrie in charge) (F, W, Sp)

Professional Course

300. Problems and Methods in Teaching Physical Education. (3)

Three 1-hour lectures per week. **Prerequisite: satisfactory score in qualifying examinations in physical education activities; course 101 or 105; 110 or 135A.** Analysis of modern, practical and theoretical problems in teaching physical activities to secondary school boys. Study of methods and outcomes and the desirable progression and sequences of skills, especially as applied to developmental activities and individual, dual, and team sports. ——— (Sp)

Graduate Courses

200. Seminar in Physical Education. (3)

One 3-hour meeting per week. Critical review of literature and research methods. Mr. Barick (F)

201. Seminar in Movement and Body Mechanics. (3)

One 3-hour meeting per week. **Prerequisite: course 101.** Neurophysiological concepts, physical laws, and kinesiology. Mr. Royce (W)

205. Seminar in Physiological Hygiene. (3)

One 3-hour meeting per week. **Prerequisite: course 105.** Immediate and long-range adaptations of the body to exercise. Physiological limits and work capacities in relation to age, sex, diet, environmental factors, and nature of activity. Mr. Brooks (F, Sp)

210. Seminar in Psychologic Bases of Physical Activity. (3)

One 3-hour meeting per week. **Prerequisite: course 110.** Kinesthetic perception, motor coordination and learning, motivation, tension, subjective psychological factors, and related topics. Miss Norrie (F, W)

211. Seminar in Motor Development. (3)

One 3-hour meeting per week. **Prerequisite: course 111.** Contemporary theories of development. Changing motor abilities and behavior from childhood through youth and age. Miss Eckert (W); Mr. Barick (Sp)

230. Seminar in Cultural and Historical Foundations of Physical Education. (3)

One 3-hour meeting per week. **Prerequisite: course 130.** Historical and cultural analyses of athletics, physical exercises and dance in primitive and modern societies. Mr. Van Dalen (F, W)

231. Seminar in Contemporary Administrative and Curricular Theories and Problems in Physical Education. (3)

One 3-hour lecture per week. **Prerequisite: course 131 or instructor's consent.** Theories, policies, and practices relative to the administrative process and curriculum planning in physical education. Mr. Van Dalen (Sp)
PHYSICAL EDUCATION; PHYSICAL SCIENCE

290. Research. (2–6)
Hours to be arranged.
The Staff (Miss Norrie in charge) (F, W, Sp)

299. Special Study for Graduate Students. (2–4)
Hours to be arranged. Advanced study of special topics under the direction of a faculty member.
The Staff (Miss Norrie in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1–8)
Hours to be arranged. Individual study to prepare for master's comprehensive. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Miss Norrie in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Hours to be arranged. Individual study in consultation with major field adviser to prepare for doctoral examinations. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Miss Norrie in charge) (F, W, Sp)

PHYSICAL SCIENCE

Field Major in Physical Sciences

Adviser: Mr. Alan M. Portis.

This program, which is offered in the College of Letters and Science, has been developed for students who wish to concentrate in the physical sciences on a broader basis than is possible in a departmental major. Two plans are offered within the major. Plan A is based on Physics 6, which is required of biology students, and Mathematics 16, which is required in part by biology departments. Through this plan a student preparing for a career in environmental or health science may major in physical science and at the same time acquire the necessary pre-professional preparation. For example, Plan A, together with organic chemistry and a year of biology, will meet the entrance requirements of most medical schools. Plan B is based on Physics 4 and Mathematics 1, which are required by physical science and engineering departments. Within this plan it is possible to complete much of the departmental major in, for example, physics or chemistry, while also studying astronomy and geology as well as computer science.

Plan A  (broad introduction to physical science)

Lower Division Courses  Mathematics 16A, 16B, 16C; Physics 6A, 6B, 6C; Chemistry 1A, 1B, 1C.

Additional Required Course  Computer Science 2 or 100.

Upper Division Courses  Physics 106B, 132; Chemistry 109A, 109B; Statistics 134A, 134B. Electives in physical science to complete a total of 45 upper division units in the major.

Plan B  (option of departmental concentration)

Lower Division Courses  Mathematics 1A, 1B, 1C, 51A, 51B; Physics 4A, 4B, 4C, 4D, 4E; Chemistry 1A, 1B, 1C or 4A, 4B, 4C; 14. Strongly Recommended: Mathematics 51C.

Additional Required Course  Geology 5A or 101 or Astronomy 101 or 127A.

Upper Division Courses  Physics 105A, 137A; Chemistry 110A. Electives in computer science, mathematics, statistics, and physical science with approval of the adviser to complete a total of 36 upper division units. Up to 12 upper division units in engineering science will be accepted with the approval of the adviser.

Honors Program

An individual honors program may be arranged.

NOTE: For key to footnote symbols, see page 86.
Secondary Teaching Credential

The interdepartmental teaching major in physical science will be satisfied by either Plan A or Plan B of the physical science field major as long as 23 of the upper division units are in one departmental area. Students preparing for the secondary credential are encouraged to complete a teaching minor as part of their undergraduate program. The attention of these students is directed to Education 198 (Science Education for Physical Science Majors) as offered.

The interdepartmental teaching minor in physical science is satisfied by 30 units in physical and engineering science as approved by the subject representative. At least 18 of the 30 units must be in one departmental area and at least 10 of the 30 units should be at the upper division level.

For further information on teaching majors and minors for the Secondary Credential, see the Announcement of the School of Education.

PHYSICS

(Department Office, 366 LeConte Hall)

Professors:
Louis W. Alvarez, Ph.D., Sc.D.
Kinsey A. Anderson,† Ph.D.
Korkut Bardakci, Ph.D.
Harry H. Bingham, Ph.D.
Robert R. Brown, Ph.D.
Owen Chamberlain, Ph.D.
Geoffrey F. Chew, Ph.D.
William Chinowsky, Ph.D.
Marvin L. Cohen, Ph.D.
Eugene D. Commins, Ph.D.
Frank S. Crawford, Ph.D.
Kenneth M. Crowe, Ph.D.
Sumner P. Davis, Ph.D.
Leo M. Falicov, Ph.D.
William B. Fretter, Ph.D.
Donald A. Glaser, Ph.D., Sc.D.
Gerson Goldhaber, Ph.D.
Erwin L. Hahn, Ph.D., D.Sc.
August C. Helmholtz, Ph.D.
J. David Jackson, Ph.D.
Carson D. Jeffries, Ph.D.
Robert Karplus,† Ph.D.
Allan N. Kaufman, Ph.D.
Leroy T. Kerth, Ph.D.
Arthur F. Kip,† Ph.D.
Charles Kittel,† Ph.D.
Walter D. Knight, Ph.D.
Wulf B. Kunkel, Ph.D.
Edwin M. McMillan, Ph.D., Sc.D.
Stanley Mandelstam, Ph.D.
Richard Marrus, Ph.D.
Forrest S. Mozer, Ph.D.
Alan M. Portis, Ph.D.
P. Buford Price, Ph.D.
Frederick Reif,† Ph.D.
John H. Reynolds, Ph.D.
Paul L. Richards,† Ph.D.
Arthur H. Rosenfeld, Ph.D.
Ronald R. Ross, Ph.D.
Rainer K. Sachs, Ph.D.
Charles L. Schwartz,† Ph.D.
Yuen-Ron Shen, Ph.D.
Howard A. Shugart, Ph.D.
Herbert M. Steiner, Ph.D.
M. Lynn Stevenson,† Ph.D.
Edward Teller, Ph.D., LL.D., Sc.D., L.H.D.
(University Professor)
Charles H. Townes, Ph.D., LL.D., Sc.D., D.Eng. (University Professor)
George H. Trilling,† Ph.D.
Robert D. Tripp, Ph.D.
Kenneth M. Watson, Ph.D.
Eyvind Wichmann, Ph.D.
Robert B. Brode, Ph.D., D.Sc., LL.D.
(Emeritus)
Victor F. Lenzen, Ph.D. (Emeritus)
Leonard B. Loeb, Ph.D. (Emeritus)
Wilson M. Powell, Ph.D. (Emeritus)
Emilio G. Segrè, Ph.D., Hon.D. (Emeritus)
Robert L. Thornton, Ph.D. (Emeritus)
Harvey E. White, Ph.D., Sc.D. (Emeritus)

Associate Professors:
Raymond Y. Chiao, Ph.D.
John Clarke, Ph.D.
Robert P. Ely, Ph.D.
Martin B. Halpern, Ph.D.
Harry L. Morrison, Ph.D.
Gilbert Shapiro, Ph.D.
Mahiko Suzuki, Ph.D.

Assistant Professor:
Richard E. Packard, Ph.D.

Senior Lecturer:
David L. Judd, Ph.D.
The Major

The physics major is designed to give the student a broad and thorough understanding of the fundamentals of physics. The emphasis is, therefore, on this general understanding rather than on specialized skills, although some specialized courses are among the options open to the student. Those considering a physics major are urged to consult a departmental adviser early, in order to discuss the content of the major and also the opportunities after graduation. Recent graduates have entered graduate work in a number of scientific fields such as biophysics and geophysics as well as in physics, and others have gone on to jobs in industrial and government laboratories. Students who are considering high school teaching as a career are especially urged to consult with their adviser early.

Preparation for the major ordinarily requires the following courses: Physics 4A–4B–4C–4D–4E, Mathematics 1A–1B–1C–51A–51B–51C. Those who have not taken a substantial chemistry course in high school are urged to take Chemistry 1A–1B, or preferably Chemistry 4A–4B.

The physics major includes the following courses: Physics 105A, 105B; Physics 110A, 110B, 110C; Physics 112; Physics 137A, 137B; two quarters of Physics 111; two additional courses from the following list chosen with the approval of the major adviser; Physics 124, 129A, 129B, 137C, 140, 141A, 141B, 142, 143, 150, and 152. These options will give the student an introduction to some areas of current research.

Special programs may be worked out in consultation with the adviser. Completion of the physics major is usually required for admission to graduate work. Additional mathematics from among the courses Mathematics 104A–104B, 120A–120B–120C, 121A–121B, 185 is recommended. See below for foreign language requirements for graduate work.

Honors Program  Students with a grade-point average of 3.0 or better may consult the major adviser concerning the honors program. This program requires completion of the major, at least one quarter of Physics H190 and a senior thesis, Physics H195A–H195B.

Biophysics  An individual major may be arranged for students who wish to obtain a broad introduction to the physical sciences and their application to biology. Advisers: Mr. Lawrence, Mr. Nichols.

Engineering Physics  The College of Engineering, with the cooperation of the Department of Physics, offers a curriculum in engineering physics leading to the degree of Bachelor of Science. Major Adviser: Mr. Chinowsky.

Field Major in Physical Sciences  Students interested in this major please see Physical Science page 424 for description of the major program.

Graduate Programs

Graduate work leading to the M.A. and Ph.D. degrees is offered in the Department of Physics, with emphasis placed on the Ph.D. In addition to applications and transcripts of undergraduate work, applicants for admission must submit scores on the graduate record examination in physics.

Requirements for the Ph.D. include the contents of the following courses: Physics 210A–210B–210C and 221A–221B–221C plus 21 units (7 quarter-courses) of material elected from upper division or graduate courses (not including any upper division material required for the undergraduate major), of which at least 12 units must be in 200 courses. Some of these 21 units could include courses in mathematics, biophysics or astrophysics. Mathematics 224 is recommended. Courses 290, 295, and 299 are
excluded from the 21 units considered above. In addition, language examinations in one of three languages, French, German, and Russian, must be passed. Research is a major part of the Ph.D. program, and the department offers opportunities in a wide variety of experimental and theoretical fields. The facilities of the Lawrence Radiation Laboratory are available for experimental and theoretical research in high energy and nuclear physics. Work in LeConte and Birge Halls includes, among other fields, solid-state physics (both experimental and theoretical), cosmic-ray and space physics, astrophysics, low-temperature physics, mass spectroscopy, optical spectroscopy and atomic beams. Students with special research interests should make inquiry in the department office.

The M.A. degree is offered under Plan II of the Graduate Division.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

Courses 4A–4B–4C–4D–4E are fundamental and are designed to meet the needs of students majoring in any of the physical sciences, or who are enrolled in the colleges of Chemistry or Engineering. Physics 6A–6B–6C is designed for premedical students, students in architecture, and students in the biological sciences. Physics 10 is recommended for the nonscience major student who desires to gain some understanding of basic physical concepts. These courses fulfill, in part, the natural science requirements of the College of Letters and Science.

All students planning to take lower division courses, except Physics 10, should have completed trigonometry.

4A. Physics for Scientists and Engineers. (4)

Four 1-hour lectures and one 1-hour discussion section per week. Prerequisite: high school physics or consent of instructor. Mathematics 1A; Mathematics 1B should be taken concurrently. Elementary mechanics, vectors, Galilean invariance, conservation of energy and momentum; harmonic oscillator; rigid bodies; inverse square law forces; special relativity. Mr. Karplus (F, W, Sp)

4B. Physics for Scientists and Engineers. (3)

Three 1-hour lectures and one 1-hour discussion section per week. Prerequisite: course 4A, Mathematics 1C should be taken concurrently. Electrodynamics, conductors and currents, dielectrics, magnetic fields and induction, Maxwell’s equations. Mr. Chinowsky (F, W, Sp)

4C. Physics for Scientists and Engineers. (4)

Three 1-hour lectures, and one 3-hour laboratory period per week. Prerequisite: course 4B. Waves and oscillations, electromagnetic waves, optics. Mr. Helmbolz (F, W, Sp)

4D. Physics for Scientists and Engineers. (4)

Three 1-hour lectures, one 1-hour discussion section, and one 3-hour laboratory period per week. Prerequisite: course 4C. Quantum physics; Planck’s constant; spectra; basic phenomena of atoms, molecules and nuclei; introduction to quantum theory. Mr. Bingham (F, W, Sp)

4E. Physics for Scientists and Engineers. (4)

Three 1-hour lectures, one 1-hour discussion section and one 3-hour laboratory period per week. Prerequisite: course 4D. Statistical physics; kinetic theory; heat. Mr. Packard (F, W, Sp)

6A. Introductory Physics. (4)

Four 1-hour lectures per week, five 3-hour laboratories per quarter. Prerequisite: Mathematics 16A, Mathematics 190A, or consent of instructor, and satisfactory performance on a written examination on pre-college mathematics to be given during the week of pre-enrollment. An introductory course using the rudiments of calculus and covering mechanics. Topics of biological interest will be emphasized in 6A–6B–6C. Laboratory work to accompany the lectures. Students with credit in Physics 4 will not receive credit in corresponding quarters of Physics 6. Mr. Fretter, Mr. Shugart, Mr. Trilling (F, W, Sp)

6B. Introductory Physics. (4)

Four 1-hour lectures per week, five 3-hour laboratories per quarter. Prerequisite: course 6A. Introductory electricity and magnetism, optics and wave motion. Mr. Fretter, Mr. Shugart, Mr. Trilling (F, W, Sp)

6C. Introductory Physics. (4)

Four 1-hour lectures per week, five 3-hour laboratories per quarter. Prerequisite: course 6B. Introductory atomic and nuclear physics; heat and thermodynamics. Mr. Fretter, Mr. Shugart, Mr. Trilling (F, W, Sp)

10. Descriptive Introduction to Physics. (4)

Four hours of class per week. Open to students with or without high school physics, but not open to those who have credit for any of 4A–4B–4C–4D–4E, 6A–6B–6C, or equivalent. A brief presentation of some of the more important phenomena in physics, with experimental illustrations. Mr. Ross, Mr. Ely (F, W, Sp)


Three hours of lecture per week. Prerequisite: satisfaction of Group A of natural science breadth requirement or consent of instructor. Intended for students with interest in music. A brief introduction to the physical principles encountered in the study of music. The applicable laws of mechanics, fundamentals of sound, harmonic content, principles of sound production in musical instruments, musical scales. Numerous illustrative lecture demonstrations will be given. Mr. Hahn (Sp)
49. Supplementary work in Lower Division Physics. (1-3) By arrangement.

Students with partial credit in lower division physics courses may, with consent of instructor, complete the credit under this heading.

Instructors in Lower Division Courses (F, W, Sp)

Upper Division Courses

Courses 4A-4B-4C-4D-4E, and differential and integral calculus are prerequisite to all upper division courses except 106A-106B, and 132.

Four unit upper division courses may have scheduled one additional hour to the three hours of lecture. See Schedule and Directory.

104. Mathematical Methods in Physics. (4)

Prerequisite: senior standing or consent of instructor. Vectors, tensors, matrices, symmetry principles, and invariance principles. Mr. Rosenfeld (Sp)

105A-105B. Analytic Mechanics. (4-4)

Three hours of lecture per week. Statics, oscillations, central force problems, motions of rigid bodies in three dimensions, accelerated coordinate systems, brief introduction to Lagrange's and Hamilton's equations, normal modes of vibration, mechanics of continuous media. Sequence beginning (F, W, Sp) Mr. Brown, Mr. Rosenfeld

106A. Geometrical Optics. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 6A-6B-6C. Designed for optometry students. Geometrical methods applied to the optics of mirrors, lenses, and prisms; laboratory work to accompany the lectures. Mr. Crawford (F)

106B. Physical Optics. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 6A-6B-6C. Physics 106A is not a prerequisite to 106B. Not open for credit to physics majors. Phenomena of diffraction, interference, and polarization of light, and their application; laboratory work to accompany the lectures. Mr. Crawford (W)

110A-110B-110C. Electromagnetism and Optics. (4-4-3)

Three hours of lecture per week. A course emphasizing applications of electromagnetic theory and problem-solving: electrostatics, magnetostatics, steady and time-varying currents, applications of Maxwell's equations, wave equation, physical optics. Sequence beginning (F, W, Sp) Mr. Crowe, Mr. Ketth, Mr. Ross, Mr. Stevenson

111. Modern Physics and Advanced Electrical Laboratory. (4)

Four hour laboratory per week. Prerequisite: course 137A or consent of instructor. Advanced laboratory for junior and senior students involving some of the significant experiments of atomic, nuclear, and solid-state physics. Individual work is encouraged. Two quarters required for physics majors; three may be taken for credit.

Mr. Packard, Mr. Reynolds, Mr. Shapiro (F, W, Sp)

112. Introduction to Statistical and Thermal Physics. (4)

Basic concepts of statistical mechanics, conclusions leading to macroscopic thermodynamics and its applications, applications based on microscopic models and Boltzmann factor, phase transformations and chemical equilibrium, quantum distributions, elementary kinetic theory of transport processes, fluctuation phenomena.

Mr. Clarke, Mr. Fretter, Mr. Kittel (F, W, Sp)

124. Introductory Nuclear Physics. (4)

Three hours of lecture per week. Prerequisite: course 137A. Not open for credit to those with credit for 129A. Tools of nuclear physics, alpha, beta, and gamma decay, nuclear interactions and structure, brief introduction to particle physics. Mr. Ely (F, Sp)

129A-129B. Nuclear and Particle Physics. (4-4)

Three hours of lecture per week. Prerequisite: course 137A and 137B. Properties and classification of the elementary particles, their weak and strong interactions, nuclear physics, and high energy phenomena, analyzed by quantum mechanical methods. Sequence beginning (W) Mr. Steinle

132. Modern Physics. (4)

Three hours of lecture per week. Prerequisite: course 6A-6B-6C, or equivalent or consent of instructor. Not open for credit to students who have completed 121 or 137A. A general descriptive course in modern physics: electrons and atoms, periodic table, X rays, spectra, nuclear physics, nuclear energy, solids, fundamental particles. Mr. Stevenson (Sp)

137A-137B-137C. Quantum Mechanics and Its Applications to Atomic Physics. (4-4-3)

Three hours of lecture per week. Course 137A is not open for credit to students who have completed 121. Introduction to the methods of quantum mechanics with applications to the physics of atoms, molecules, solid state, and nuclei. Sequence beginning (F, W, Sp) Mr. Chamberlain, Mr. Goldhaber, Mr. Jeffries

140. Introduction to Solid-State Physics. (4)

Prerequisite: course 137A or 121. Not open for credit to those with credit for 141A. Elementary survey of the classification and properties of solids. Ionic, covalent, molecular, metallic and semiconducting crystals. Dielectric, thermal, magnetic, conductive, and mechanical properties. Superconductivity, ferromagnetism, defects in solids.

Mr. Kip, Mr. Richards (W)

141A-141B. Solid-State Physics. (4)

Prerequisite: course 137A and 137B, or taken concurrently. A thorough introductory course in modern solid-state physics. Crystal symmetry; electromagnetic, elastic, and particle waves in periodic lattices; thermal, magnetic, and dielectric properties; magnetic order; magnetic resonance; theory of metals and semiconductors; superconductivity.

Sequence beginning (F, Sp) Mr. Kip, Mr. Kittel

142. Introduction to Plasma Physics. (4)

Prerequisite: courses 105A-105B, 110A or consent of instructor. Motion of charged particles in electric and magnetic fields, dynamics of fully ionized plasma from both microscopic and macroscopic point of view, magnetohydrodynamics, equilibria, waves and instabilities; examples from space sciences and controlled-fusion research. Mr. Kaufman (Sp)
143. Physics of Ionized Gases. (4)
Prerequisite: courses 112, 137A, or 121 or consent of instructor; course 142 is recommended. Basic processes in ionized gases, macroscopic description of partially ionized plasma including electronic reactions, radiation and transport phenomena, plasma production and decay. Application to atmospheric and astrophysical sciences, high speed gas dynamics, and electric discharges. Mr. Kaufman (W)

150. Introduction to Atmospheric and Space Sciences. (4)
Three hours of lecture per week. Senior standing in the physical sciences or consent of the instructor. Observational data and physical theories of processes in the atmosphere and solar system resulting from the interactions of particles, fields, radiation, and matter. Mr. Anderson (W)

152. Physics and Society. (3)
Three hours of lecture per week. Prerequisite: the equivalent of Physics 4ABCDE, or consent of instructor. A study of motivations and purposes of science in modern society. Precise subjects will vary from quarter to quarter. With consent of the instructor, may be repeated for credit. Not necessarily to be given every quarter. Mr. Chinowsky

H190. Physics Honors Course, (2)
A proseminar which includes study of a standard book on theoretical physics and reports on current theoretical and experimental problems. May be repeated for credit. The Staff (F, W, Sp)

H195A—H195B. Senior Honors Thesis Research. (3—3)
Open only to students in the Honors Program. Thesis work under the supervision of a faculty member. To get credit the student must, at the end of two quarters, submit a satisfactory thesis. Credit and grade will be awarded upon completion of the full sequence. The Staff (F, W, Sp)

198. Directed Group Study. (1—4)
The Staff

199. Supervised Independent Study and Research. (1—3)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

205A—205B. Advanced Dynamics. (2—3)
Prerequisite: course 105A—105B, or the equivalent. General principles of analytical mechanics of particles, systems of particles, and rigid bodies. Methods of Lagrange, Hamilton, and Jacobi, General treatment of kinematics, including collisions of relativistic particles. Inversions, symmetry, and conservation laws. Small oscillations, Approximate methods in mechanics. Mr. Judd, 205A. (F, W); 205B. (W, Sp)

205C. Advanced Dynamics. (4)
Prerequisite: course 205A and 205B. Advanced topics in classical dynamics, including selections from: Hydrodynamics, magnetohydrodynamics, theory of elasticity, mechanics of periodic structures, nonlinear mechanics, advanced perturbation theory, and computational methods. Mr. Judd (Sp)

208. Interactions of Light with Matter. (4)
Prerequisite: courses 110A—110B—110C and 137A or 121. Emission, absorption, and propagation of light treated classically. Limits of classical theory. Transition to quantum theory through the correspondence principle. Mr. Chiao, Mr. Hahn (F)

209A—209B. Interaction of Coherent Radiation and Matter. (3—3)
Three hours of lecture per week. Prerequisite: courses 205 and 112 or consent of instructor. Introduction to the theory of the laser; spontaneous and stimulated emission and scattering. Nonlinear polarization: its physical origins and its reaction on the radiation field; the production of coherent material excitations; parametric and self-induced processes. Sequence beginning (W). Mr. Chiao, Mr. Hahn

210A—210B—210C. Theory of Electricity and Magnetism. (3—3—3)
Prerequisite: course 110A—110B—110C and a working knowledge of differential equations. Classical description of the electromagnetic field, including special relativity and electron theory. Sequence beginning (F) Mr. Jackson

212A—212B. Statistical Mechanics. (3—3)
Prerequisite: course 112 or equivalent. Credit and grade will be given only on completion of the full sequence. Foundations of statistical mechanics; ensemble theory; degenerate systems; systems of interacting particles; nonequilibrium and transport theory; Brownian motion; Boltzmann equation; irreversibility and Onsager relations. Sequence beginning (F, W) Mr. Kaufman, Mr. Watson

213. Advanced Statistical Mechanics. (4)
Three hours of lecture per week. Prerequisite: course 212B or consent of instructor. Advanced topics in classical and quantum statistical mechanics.

221A—221B—221C. Quantum Mechanics. (3—3—3)
Three hours of lecture per week. Prerequisite: course 137A—137B or 115 or equivalent.

221A. Basic assumptions of quantum mechanics; quantum theory of measurement; matrix mechanics, Schroedinger theory; symmetry and invariance principles; theory of angular momentum; stationary state problems; variational principles; time independent perturbation theory.

221B. Time dependent perturbation theory; theory of scattering; many particle formalism; creation and destruction operators.

221C. Boson and fermion fields; radiative processes; the Dirac equation; applications in atomic physics and beta decay. Sequence beginning (F, W, Sp) Mr. Chew, Mr. Schwartz, Mr. Wichmann

222. Mathematical Methods of Physics. (4)
Three hours of lectures per week on the application of some particular branch of mathematics to physical problems. In the selection of specific topics, to be announced by the department each time the course is given, particular attention will be given to recent developments in methods and to the unifying mathematical ideas. With consent of instructor may be repeated for credit. Mr. Schwartz (F, Sp)

223. Group Theory and Quantum Mechanics. (4)
Three hours of lecture per week. Prerequisite: 221A—221B—221C, or consent in instructor. Introduction to theory of groups and group representations; brief survey of quantum mechanics of atoms,
molecules and solids, emphasizing applications of group theoretical methods.  
Mr. Wichmann (Sp)

225A–225B. Calculational Techniques and Symmetry Principles in Particle Physics. (3–3)  
(Formerly numbered 245A–245B)  
Three hours of lecture per week. Prerequisite: course 221A–221B–221C or the equivalent.  
225A, Feynman Diagram Calculation in Perturbation Theory. Quantized fields, perturbation expansion, rules for Feynman graphs, with examples such as Compton scattering, meson-nucleon scattering, and Bhabha scattering. Emphasis will be placed on getting answers.  
225B, Invariance Principles and Symmetries in Relativistic Particle Physics. Conservation laws, selection rules, discrete symmetries such as time reversal and space reflection. Group theory of SU(3) and SU(3) properties of particle interactions.  
Sequence beginning (F)  
Mr. Mandelstam

226A–226B. Properties and Interactions of Particles. (3–3)  
(Formerly numbered 245C–245D)  
Three hours of lecture per week. Prerequisite: course 225A–225B or the equivalent.  
226A, Experimental physics of strong interactions. Statistics, experimental techniques, discovery and properties of the most familiar particles, techniques for relating experiment to theory, electromagnetic interactions.  
226B, (may be taken before course 226A). Weak interactions. Fermi theory the universal weak current, beta decay, muon decay, nonleptonic decay of strange particles, lepton scattering.  
Sequence beginning (Sp)  
Mr. Tripp, Mr. Commings

227A–227B. Dynamics of Strong Interactions. (3–3)  
(Formerly numbered 224A–224B)  
Three hours of lecture per week. Prerequisite: course 221A–221B–221C and course 225A–225B or the equivalents. The theory of strong interactions, 227A will usually emphasize Regge theory. 227B will usually emphasize current algebra techniques.  
Sequence beginning (Sp)  
Mr. Jackson, Mr. Suzuki

Prerequisite: course 221A–221B–221C or the equivalent. An introduction to the relativistic quantum mechanics of fields and particles. Symmetry principles, S-matrix theory. Quantum electrodynamics, Phenomenological theories of weak and strong interactions.  
Sequence beginning (F)  
Mr. Bardaci, Mr. Halpern

231. Theory of General Relativity. (4)  
An introduction to Einstein's theory of gravitation with applications to cosmology and astrophysics.  
Mr. Joord (Sp)

Three hours of lecture per week. Prerequisite: course 221A–221B and course 141A–141B or the equivalents; or consent of instructor. Phonon, magnetic, plasmon, polaron, and electron fields in solids and their interactions; superconductivity; many-body techniques; Green's functions; Brillouin zones and symmetry; excitons; impurity states; transport processes; Fermi surfaces; neutron scattering; recoilless emission; theoretical methods in magnetic resonance.  
Sequence beginning (F) Mr. Falicov

Prerequisite: courses 210A–210B–210C, 212A–212B, 142, or consent of instructor. Analysis of plasma behavior according to the Vlasov, Fokker-Planck equations, guiding center, and hydromagnetic descriptions. Study of equilibria, stability, linear and nonlinear oscillations, transport, and interaction with radiation. Rigorous kinetic theory.  
Sequence beginning (F). Not given every year.

248A–248B. Stellar Structure and Evolution. (3–3)  
Three 1-hour lectures per week.  
248A, Prerequisite: course 221A–221B. Recommended: course 212A or equivalent, some knowledge of nuclear physics. Introduction to Stars and Stellar Systems, Cosmological models and observational tests. Protostar formation. Equations of normal stellar structure. Thermo-nuclear reactions and stellar energy generation.  
Mr. Chiao, Mr. Commings (W)

250. Special Topics in Physics. (2–4)  
Prerequisite: with consent of instructor, may be repeated for credit. Topics will vary from quarter to quarter. See Department of Physics announcements.  
The Staff (F, W, Sp)

251A–251B–251C. Introduction to Graduate Research in Physics. (2–2–2)  
One 1-hour lecture and one 1-hour discussion section per week. Prerequisite: Graduate standing in Physics Department, or consent of instructor. A survey of experimental and theoretical research in the Physics Department, designed for first-year graduate students. One regular meeting each week with supplementary visits to experimental laboratories. Meetings include discussions with research staff, Mr. Packard (F, W, Sp)

252. Advanced Topics in the Relation of Physics to Society, (3)  
Three hours of lecture per week. Prerequisite: equivalent of an undergraduate degree in Physics or consent of instructor. Interrelationship between technology and social problems with strong emphasis on relevant technical considerations. Precise subjects will vary from quarter to quarter. With consent of instructor, may be repeated for credit. Not necessary to be given every quarter.

290. Seminar. (2)  
The Staff (F, W, Sp)

295. Research. (1–8)  
The Staff (F, W, Sp)

299. Special Study for Graduate Students. (1–4)  
Prerequisite: graduate standing. This course is arranged to allow qualified graduate students to investigate possible research fields or to pursue problems of interest through reading or a collaborator study under the direction of faculty members who agree to give such supervision. The Staff (F, W, Sp)
602. Individual Study for Doctoral Students. (1-8)

Individual study in consultation with the major field adviser intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence re-

requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

IDS 7. Self-Paced Study in Introductory Physics and Calculus. (1-20)

See Interdepartmental Studies for the complete description of this course.

MEDICAL PHYSICS (see page 374)

PHYSIOLOGY–ANATOMY

(Department Office, 2549 Life Sciences Building)

Professors:
Horace Barlow, M.D.
Walter J. Freeman, M.D.
Hardin B. Jones, Ph.D.
Robert I. Macey, Ph.D.
Nello Pace, Ph.D.
Lester Packer, Ph.D.
Lawson L. Rosenberg, Ph.D.
Herbert H. Srebnik, Ph.D.
Paola S. Timiras, M.D., Ph.D.
Gerald Westheimer, Ph.D.
Sherburne F. Cook, Ph.D. (Emeritus)

Associate Professors:
Miriam E. Simpson, M.D., Ph.D., Docteur h.c., LL.D. (Emeritus)
Marian C. Diamond, Ph.D.
John G. Forte, Ph.D. (Chairman)
Charles S. Nicoll, Ph.D.
Peter Satir, Ph.D.

Lecturers:
Ernest L. Dobson, Ph.D.
Lola S. Kelly, Ph.D.

Graduate Advisers: Mr. Macey, Dr. Westheimer, Mrs. Timiras (Physiology); Mr. Srebnik (Anatomy).

Major in Physiology

The curriculum outlined below leads to the A.B. degree in physiology. It is intended to provide a broad understanding of the cellular mechanisms underlying the life process, of the functions of the various parts of living organisms, and of the integrated physiological response of whole organisms to the environments in which they live, together with the functional changes that occur in living organisms with the passage of time during their life span.

Lower Division
Chemistry 1A–1B–1C (4–4–4); Chemistry 8A–8B (4.5–4.5); Mathematics 16A–16B (4–4) or 1A–1B–1C (4–4–4); Physics 6A–6B–6C (4–4–4); Biology 1A–1B (6–6).

Upper Division
Physiology 101 (5); Physiology 102A–102B (5–5); Physiology 103A–103B (3–3); a morphological sequence consisting of either Physiology 105A–105B (3–3) or Physiology 108–108L (4–2) or Anatomy 104 (5); and three additional upper division courses in related biological sciences, at least two of which must be in physiology or anatomy. Recommended: three additional quarters of course work in chemistry (e.g., Chemistry 5 or 109, or Biochemistry 102), physics, or mathematics.

Honors Program
The student must: (1) maintain a 3.0 grade-point average in his overall college work and in the courses required for the undergraduate major in physiology, (2) complete the undergraduate major in physiology as stipulated above, (3) complete at least 4 units of course 199, and (4) submit a satisfactory thesis based upon the work performed for course 199.

NOTE: For key to footnote symbols, see page 86.
Graduate Major in Physiology

Students qualified for admission may elect a course of work leading either to the M.A. degree or directly to the Ph.D. degree in physiology. The M.A. degree is not prerequisite for the Ph.D. degree. On the other hand, candidates for either degree must have completed the equivalent of the requirements for the undergraduate major shown above, in addition to the minimum requirements for the particular graduate degree, as follows:

1. The M.A. degree in physiology is to be earned according to Plan I of the Graduate Division, which includes the satisfactory completion of 30 units of course work and a thesis.

2. The Ph.D. degree in physiology. Required: Biochemistry 102 (4); Chemistry 109A–109B (3–3); a course in statistics; at least 8 units of upper division or graduate courses each in physiology and morphology; at least 24 units of course 299. Recommended: Physics 132 (4).

Before advancement to candidacy for the Ph.D. degree the student must demonstrate that he can make an accurate written translation from the physiological scientific literature in two of the languages approved by the Department (French, German, Russian, or Computer Language). Selection of a major professor should also have been made by that time. The student must also pass an oral qualifying examination to test his general mastery of physiology and at least two other related subjects which are approved by his major professor and the graduate adviser. A dissertation based upon original research in physiology is to be prepared according to Plan B of the Graduate Division.

All candidates for the Ph.D. degree are required to acquire teaching experience equivalent to a minimum of one quarter of full-time teaching as a Teaching Assistant or Associate (e.g., 2 quarters of ½-time teaching; 4 quarters of ¾-time teaching, etc.).

For further details concerning the graduate degrees please consult the graduate adviser in physiology.

Major in Anatomy (Graduate Only)

In addition to meeting the general requirements of the Graduate Division, the student must have had the following courses, or their equivalents, before admission to the graduate degree program in anatomy: Biology 1A–1B (6–6); Chemistry 1A–1B–1C (4–4–4), 5 (4), 8A–8B (4–4); Mathematics 1A–1B–1C (4–4–4) recommended, or 16A–16B (4–4); Physics 6A–6B–6C (4–4–4).

1. The M.A. degree in anatomy is to be earned according to Plan I of the Graduate Division, which includes the satisfactory completion of 30 units of course work and a thesis. Required: course 151 (4); either course 209 (5), or courses 203 (4) and 205A–205B (5–5); at least 12 units of course 299.

2. The Ph.D. degree in anatomy. Required: course 151 (4); courses 209 (5), 203 (4), 205A–205B (5–5); at least 24 units of course 299; Physiology 101 (5); 102A–B (5–5); 103A–B (3–3); Biochemistry 102 (4). An adequate reading knowledge in two of the languages approved by the Department (French, German, Russian, or Computer Language) must be demonstrated before proceeding to the oral qualifying examination, which covers the major subdivisions of anatomy and related fields. A dissertation based upon original research in anatomy is to be prepared according to Plan A of the Graduate Division.

For further details concerning the graduate degrees, please consult the graduate adviser in anatomy.
Physiology

Lower Division Courses

1. Introductory Human Physiology. (5)
Three 1-hour lectures, one 1-hour conference, and one 3-hour laboratory per week. Prerequisite: either high school chemistry or a course in college physics or chemistry or biology. Introduction to the mechanisms underlying the life process in man. Lectures and laboratory experiences will include studies on blood and cardiovascular system, respiration, digestion, nervous system, endocrine and metabolic functions, and reproduction. Mr. Forte (Sp)

10. The Biology of Man. (4)
Three hours of lecture and one hour of demonstration per week. Prerequisite: intended for students not majoring in biological science. An introduction to the workings and evolutionary origins of the human body and brain. Emphasis is placed on understanding man's biological mechanisms and behavior in the context of the changed environment he has created. Mr. Forte (Sp)

99. Supervised Independent Study and Research. (1–3)
Prerequisite: consent of instructor. Limited to freshmen and sophomores. Must be taken on a pass/not pass basis. The Staff (F, W, Sp)

Upper Division Courses

101. Introductory Cell Physiology. (5)
(Formerly numbered 101A–101B)
Three 1½-hour lectures per week. Prerequisite: one year of calculus, Biology 1A–1B. Recommended: Physics 6, Chemistry 109, Biochemistry 102. Studies of fine structure and function in cells and organelles. Topics will include: membrane structure and transport, metabolism, secretion, bioelectricity, excitation, and cell motility. Mr. Macey, Mr. Satir (F)

102A–102B. Mammalian Physiology. (5–5)
(Formerly numbered 102A, 103A, 103B, 103C)
Three 1½-hour lectures per week. Prerequisite: Biology 1A, 1B. Recommended: course 101, Physics 6. Physical and chemical basis of organ and tissue function. Winter: vegetative and homeostatic functions, including cardiovascular, respiratory, gastrointestinal, and renal systems. Spring: communicative and integrative functions, including endocrine glands, neuroendocrine inter-relationships, neural function and integrative functions of the brain. Mr. Forte, Mrs. Timiras (W) Mr. Nicoll, Mr. Barlow (Sp)

103A–103B. Physiology Laboratory. (3–3)
(Formerly numbered 101C, 102C, 103L)
One and one-half hours of lecture and four and one-half hours of laboratory per week. Prerequisite: course 101 and course 102A–102B should be taken concurrently. Laboratory experiments to teach basic principles and techniques of cellular and organism physiology. Mr. Forte, Mrs. Timiras, Mr. Nicoll, Mr. Barlow (W)

105. Histophysiology. (5)
(Formerly numbered 101D, 102B)
Two 1½-hour lectures and one 4½-hour laboratory per week. Prerequisite: Biology 1A–1B. Mammalian organology. Mr. Forte (W)

108. General Human Anatomy. (4)
(Formerly numbered 108A)
Three 1½-hour lectures per week. Prerequisite: a college course in Biology or Chemistry. The functional anatomy of the human body as revealed by gross and microscopic examination. Mrs. Diamond (F)

108L. General Human Anatomy Laboratory. (2)
(Formerly numbered 109A)
One 1½-hour lecture and one 3½-hour laboratory per week. Prerequisite: course 108 should be taken concurrently. Prepared human dissections, models, and microscope slides. Mrs. Diamond (F)

109. Survey of Mammalian Physiology. (4)
(Formerly numbered 109B)
Three and one-half hours of lecture per week. Prerequisite: Biology 1A–1B. Mechanisms of life processes by the study of function of cells, tissues, and organ systems. Emphasis will be placed on man. Mr. Barlow (W)

109L. Introductory Physiology Laboratory. (2)
(Formerly numbered 109B)
One 1½-hour lecture and one 3-hour laboratory per week. Prerequisite: course 108, 109 should be taken concurrently. Laboratory experiments demonstrating the functional mechanisms underlying life processes in mammalian systems. Mr. Barlow (W)

110. Introduction to Neurobiology. (3)
Three 1-hour lectures per week. Prerequisite: Biology 1A–1B or consent of instructor. The important contributions of neurological, anatomical, physiological, comparative and behavioral studies to the understanding of the nervous system, particularly that of man. Properties of neurons and neural systems in terms of structure and function and their evolution. Mr. Westheimer (Sp)

123. Comparative Physiology. (4)
Three 1½-hour lectures per week. Prerequisite: Biology 1A, 1B or equivalent; Organic Chemistry or consent of instructor. Comparative survey of physiological function among the various phyla of animals. The function of organs and processes which are peculiar to certain animal groups or species will be emphasized. Mr. Nicoll (W)

*123L. Comparative Physiology Laboratory. (4)
Two 4½-hour laboratories per week or arranged work schedule. Prerequisite: course 123 and consent of instructor. The bulk of this course will involve individual and original research projects. Some of these may be conducted at the Bodega Marine Laboratory. Mr. Nicoll (Sp)

131. Radiation Physiology. (3)
Three 1-hour lectures per week. Prerequisite: Chemistry 1A–1B–1C; Physics 6A–6B–6C; an introductory course in the biological sciences. Recommended: Mathematics 16A–16B; Physics 132. Physiological effects of radiation. Mr. Jones, Mr. Dobson, Mrs. Kelly (F)
132. Environmental Physiology. (4)
Three 1½-hour lectures per week. Prerequisite: an introductory course in the biological sciences. Physical, chemical and biotic influences of the environment on man, and the adaptive changes in response to environment.
Mr. Pace (W)

141. Physiology of the Endocrines. (4)
Three 1½-hour lectures per week. Prerequisite: an introductory course in the biological sciences. Recommended: Organic Chemistry. The endocrine glands of mammals and their hormones.
Mr. Rosenberg (F)

152. Physiology of Human Development. (4)
Three 1½-hour lectures per week. Prerequisite: an introductory course in the biological sciences. Recommended: Anatomy 151. Functional changes in man from prenatal life to maturity.
Mrs. Timiras (W)

153. Physiology of the Aging Process. (4)
Three 1½-hour lectures per week. Prerequisite: an introductory course in the biological sciences. Functional changes in man from maturity to old age.
Mrs. Timiras, Mr. Packer, Mr. Jones (Sp)

191A. Special Projects in Physiology. (4–6)
Prerequisite: courses 101, 102A–102B, 103A–103B and consent of instructor. Special laboratory projects in cellular and mammalian physiology. Topics will be individually selected and pursued to an experimental conclusion.
Mr. Packer (F, W, Sp)

197. Field Study in Physiology. (1–5)
Students must declare an undergraduate major. Supervised experience relevant to specific aspects of physiology in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required.
The Staff (F, W, Sp)

198. Directed Group Study. (2–3)
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Individual conferences to be arranged. Prerequisite: at least 8 units of upper division courses in physiology. Special library or laboratory projects may be assigned. Must be taken on a passed or not passed basis.
The Staff (F, W, Sp)

Graduate Courses

213. Seminar in Cell Physiology. (1)
One 1-hour meeting per week. Current research on cell structure and function.
Mr. Packer, Mr. Macey, Mr. Forte (F, W, Sp)

215. Neuroendocrinology. (4)
Four and one-half hours of lecture per week. Prerequisite: courses 101–103 or equivalent, or consent of instructor. Neurosecretory phenomena, neural control of endocrine glands and effects of hormones on brain functions. Mr. Nicoll, Mrs. Timiras (F)

216. Seminar in Neuroendocrinology. (2)
One and a half hours of lecture per week. Prerequisite: course 101–103, course 215 or consent of instructor. Current research in the field will be considered.
Mr. Nicoll (Sp)

223. Seminar in Comparative Physiology. (2)
One and a half hours of lecture per week. Prerequisite: course 123 or equivalent or consent of instructor. Selected subjects in the field will be considered.
Mr. Nicoll (Sp)

231. Seminar in Environmental Physiology. (2)
One 1½-hour meeting per week. Prerequisite: courses 102A and 132. Selected topics on the effects of environmental factors on man.
Mr. Pace (F)

233. Space Physiology. (2)
Two 1-hour lectures per week. Prerequisite: courses 103, 132, and 231. Physiological effects experienced by man and other mammals during extraterrestrial flight.
Mr. Pace (Sp)

241. The Endocrine Glands. (3)
Two 1½-hour lectures per week. Prerequisites: courses 101, 102, 103. A course in organic chemistry and in biochemistry. The endocrine glands of mammals and the metabolic reactions mediated by their hormones.
Mr. Rosenberg (F)

242. Seminar in Endocrine Physiology. (3)
Three hours of class per week. Prerequisite: consent of instructor. Selected topics on current research in endocrinology.
Mr. Rosenberg (W)

261. Seminar in History of Neurophysiology. (2)
Two hours of class per week. Prerequisite: consent of instructor. Selected readings in classical texts of physiology with emphasis on the historical development of ideas about the nervous system.
Mr. Freeman (F)

272. Physiological Transport Processes. (2)
Two 1-hour lectures per week. Prerequisite: differential and integral calculus, elementary physiology. Recommended: Chemistry 110A–110B. Mathematical analysis of physiological transport in cells and tissues.
Mr. Macey (W)

281. Seminar in Physiological Action of Drugs. (2)
One 1½-hour meeting per week. Prerequisite: courses 101, 102 and 103. Mode of action of drugs at the organic and cellular levels.
Mrs. Timiras (F)

290. Seminar in Neurobiology. (2)
Prerequisite: consent of instructor. Discussions and readings in special topics, to be varied each quarter. May be taken more than once for credit.
Mr. Barlow, Mr. Westheimer (F, W, Sp)

292. Seminar. (1)
One hour of lecture per week. Departmental seminar dealing with various topics in functional biology. Each quarter will emphasize a selected topic to be announced at the beginning of the quarter. To be taken pass/not pass.
The Staff (Mr. Forte in charge) (F, W, Sp)

299. Individual Research in Physiology. (1–12)
Individual arrangement to be made. Prerequisite: consent of instructor. Original research in physiology.
The Staff (F, W, Sp)

491. Physiological Surgery. (2)
One 4½-hour laboratory per week. Prerequisite: course 103, and graduate standing in physiology, or consent of the instructor. Techniques of anes-
*492. Physiological Instrumentation. (2)

One 4½-hour laboratory per week. Prerequisite: graduate standing in Physiology or Anatomy or consent of the instructor. Instruction in the design and construction of mechanical instruments, application of individual mechanical instrumentation projects to monitoring of physiological parameters.

Mr. Barlow (W)

*493. Physiological Instrumentation—Electronics. (4)

Two 1-hour lectures and one 4½-hour laboratory per week. Prerequisite: graduate standing in physiology, or consent of the instructor. Modern physical techniques in physiological research. Topics will cover problems in the detection, amplification, and recording of bioelectric phenomena, together with the use and design of transducers. Mr. Macey (Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major professor, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of the candidate for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

IDS. 191C. Community Health. (2–10)

See Interdepartmental Studies for the complete description of this course.

IDS 201. Cellular Mechanisms Underlying Nervous Activity. (3)

See Interdepartmental Studies for the complete description of this course.

IDS 201L. Laboratory Cellular Mechanisms Underlying Nervous Activity. (3)

See Interdepartmental Studies for the complete description of this course.

IDS 202. Neural Integration and Coordination. (3)

See Interdepartmental Studies for the complete description of this course.

IDS 202L. Advanced Laboratory in Neural Integration and Coordination. (3)

See Interdepartmental Studies for the complete description of this course.

IDS 205A–205B–205C. Clinical Correlates of Human Morphology, Physiology, and Biochemistry. (3–3–3)

See Interdepartmental Studies for the complete description of this course.

IDS 206A–206B–206C. Introduction to Patient Care. (2–2–2)

See Interdepartmental Studies for the complete description of this course.

Anatomy

99. Supervised Independent Study and Research. (1–3)

Limited to freshmen and sophomores. Consent of the instructor required. To be taken on a passed/not passed basis.

The Staff (Mr. Forte in charge) (F, W, Sp)

Upper Division Courses

151. Developmental Anatomy. (4)

Three 1-hour lectures, and one 3-hour laboratory per week. Prerequisite: Biology 1A–1B–1C; or Biology 11A–11B. Conception, nidation, and the development of the human embryo and fetus. Determinants of abnormal development and introduction to experimental teratology. Mr. Srebnik (F)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87. Individual conferences to be arranged. Prerequisite: course 104. Special library and laboratory projects may be assigned. Must be taken on a passed or not passed basis.

The Staff (Mr. Srebnik in charge) (F, W, Sp)

Graduate Courses

203. Functional Neuroanatomy. (4)

Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: consent of instructor. Development, structure (gross and microscopic) and functional relationships of the mammalian nervous system. Mrs. Diamond (W)

204. Cellular and Subcellular Design Principles. (3)

Two 1½-hour lectures per week. Prerequisite: consent of instructor. Molecular, physiological and evolutionary determinants of cell and tissue fine structure. Mr. Satir (Sp)

205A–205B. Systematic and Regional Human Anatomy. (5–5)

Two 1-hour lectures and two 4½-hour laboratories per week. Prerequisite: either course 151 or Zoology 105 or other advanced work in mammalian biology; consent of instructor. Dissection, x-ray, and surface anatomy of the body, with special reference to the functional capacities of the structures examined.

Mr. Srebnik (W, Sp)

209. Histology. (5)

Two 1-hour lectures, and two 4-hour laboratories per week. Prerequisite: consent of instructor. Tissues and organs of the mammalian body, including histophysiological and histochemical aspects.

210. Physiological Anatomy of Reproduction. (2)

One 1½-hour meeting per week. Prerequisite: graduate standing in a biological science. Informal conferences and demonstrations. Outside reading required.

Mr. Srebnik (Sp)

211. Seminar in Hematology. (2)

One 1½-hour meeting per week. Prerequisite: graduate standing in a biological science. Selected topics on the humoral control of blood formation.
PLANT PATHOLOGY

(Department Office, 147 Hilgard Hall)

Professors:
Kenneth F. Baker, Ph.D.
A. Herbert Gold, Ph.D.
John R. Parmeter, Jr., Ph.D.
Robert D. Raabe, Ph.D.
David E. Schlegel, Ph.D. (Chairman)
Milton N. Schroth, Ph.D.
William N. Takahashi, Ph.D.
Albert R. Weinhold, Ph.D.
Stephen Wilhelm, Ph.D.
Cecil E. Yanwood, Ph.D.
Peter A. Ark, Ph.D. (Emeritus)
Max W. Gardner, Ph.D., D.Sc. (hon. c.)
(Emi­eritus)
William C. Snyder, Ph.D. (Emeritus)
H. Earl Thomas, Ph.D. (Emeritus)

Associate Professors:
Fields W. Cobb, Jr., Ph.D.
Joseph G. Hancock, Jr., Ph.D.

Assistant Professor:
Oenes C. Huisman, Ph.D.

Professor:
James B. Kendrick, Jr., Ph.D. (Riverside)

Lecturers:
Lee J. Ashworth, Jr., Ph.D.
Robert V. Bega, Ph.D.
James E. Duffus, Ph.D.
Donald C. Hildebrand, Ph.D.
Arthur H. McCain, Ph.D.
Robert F. Scharpf, Ph.D.
Richard S. Smith, Jr., Ph.D.
W. Wayne Wilcox, Ph.D.

Undergraduate Adviser: Mr. Weinhold.
Graduate Advisers: Mr. Gold, Mr. Huisman.

The field of plant pathology is concerned with the study of plant diseases and the protection of crop plants from disease losses. The subject area is exceptionally broad, embracing the response of the plant to the environment and to disease agents such as bacteria, fungi, seed plants, and viruses, as well as their control. This leads to research on fundamental problems, such as host-parasite physiology or mode of action of fungicides, to applied problems, such as spray control programs or soil treatments, to teaching and extension. Because of this breadth, there is a place for anyone interested in biology.

Undergraduate Program

Although the Department of Plant Pathology in the College of Agricultural Sciences no longer offers an undergraduate major, students who are interested in preparing for this career may do so by selecting plant pathology as their field of emphasis in the agricultural science major, as described under that section of this catalogue. Details concerning the program may be obtained from the undergraduate adviser.

NOTE: For key to footnote symbols, see page 86. 
Graduate Programs

The department emphasizes graduate training and offers work leading to both the M.S. and Ph.D. degrees. Students interested in pursuing a career in Plant Pathology may prepare for graduate study by selecting the program described above or develop a broad background in the physical and biological sciences. The department also offers an M.S. degree program designed specifically for experienced elementary and intermediate school teachers who have a limited background in science. For further details, consult the graduate adviser.

Upper Division Courses

100. Diseases of Forest Trees. (4)

Two hours of lecture and six hours of laboratory per week. Prerequisite: one course in biology. Emphasis on the causes of forest tree diseases, their interactions with other components of the environment, their role in and impact on the ecosystem, the influence of man's activities on their occurrence and means of control.

114. Plant Diseases and the Protection of Plant Resources. (3)

Two hours of lecture and three hours of laboratory per week. The causes and nature of plant diseases, their role in the ecosystem, their historical and present impact on man, the effects of man's activities on disease, and the problems of protecting wild and cultivated plants.

120. Plant Diseases. (4)

Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: Biology 1A–1B or consent of instructor. A general course on the nature, cause, and control of plant diseases.

197. Field Study in Plant Pathology. (1–5)

Supervised experience in off-campus organizations relevant to specific aspects of plant pathology. Regular individual meetings with faculty sponsor and written reports required.

198. Directed Group Study. (1–5)

Prerequisite: consent of instructor. Special topics will be offered from time to time.

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (Mr. Hancock in charge) (F, W, Sp)

Graduate Courses

201. Seminar in Plant Pathology. (1)

The Staff (F, W, Sp)


Two hours of lecture, six hours of laboratory, and one hour of discussion per week. Prerequisite: course 120, Botany 101, or consent of instructor. Taxonomy, ecology, and behavior of plant pathogenic fungi with emphasis on problems in collection, cultivation, identification, and pathogenicity.

204. Bacteria in Relation to Plant Diseases. (4)

Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 120; Biochemistry 102; Bacteriology 102 and 102L; or consent of instructor. Biology and pathogenesis of bacterial diseases of plants.

206. Viruses in Relation to Plant Diseases. (4)

Lecture, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 120 or consent of instructor. Characterization of viruses which cause plant disease; environmental factors relating to incidence and field spread of virus infections; approaches to control.

208. Physiology of Plant Virus Infection. (4)

Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 206 or consent of instructor. Detailed consideration of plant virus interactions in virus infections; mechanisms of infection and immunity; morphology and functional responses of cells and tissues to infection.

210. Plant Disease Control. (4)

Lectures, 2 hours per week; laboratory, 3 hours per week. Prerequisite: course 120. Principles broadly applicable to fungal, bacterial, virus, and nutritional diseases of plants.

212. Advanced Plant Pathology. (4)

Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: course 120. Dosage response relations; graphic methods; control by exclusion, eradication, protection, immunization, and therapy.

216. Physiology of Plant Pathogens. (4)

Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: Chemistry 5 and 5A–5B, or equivalent. Recommended: Botany 140; Biochemistry 102. Physiology and biochemistry of plant pathogenic fungi.

218. Physiology of Plant Diseases. (4)

Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 120. Dosage response relations; graphic methods; control by exclusion, eradication, protection, immunization, and therapy.

220. History and Literature of Plant Pathology. (4)

Lectures, 4 hours per week. Prerequisite: consent of instructor. The development of concepts in plant pathology.

222. Epidemiology and Diagnosis of Plant Diseases. (4)

Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: consent of instructor. May be taken twice for credit. Experience in field and laboratory diagnosis of plant diseases.
298. Directed Group Study. (1–6)
The Staff (Mr. Takahashi in charge) (F, W, Sp)

299. Research in Plant Pathology. (1–12)
The Staff (Mr. Schlegel in charge) (F, W, Sp)

601. Individual Study for Master’s Students. (1–8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Schlegel in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. degree. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Schlegel in charge) (F, W, Sp)

IDS 10A–10B–10C. Man and His Environment—Crisis and Conflict. (5–5–5)
See Interdepartmental Studies for the complete description of this course.

IDS 136. Biological Deterioration of Wood. (3)
See Interdepartmental Studies for the complete description of this course.

[Department Office, 210 Barrows Hall]

**POLITICAL SCIENCE**

Professors:
- Reinhard Bendix, Ph.D.
- A. James Gregor, Ph.D.
- Ernst B. Haas,† Ph.D.
- Warren F. Ilchman,† Ph.D.
- Norman Jacobson, Ph.D.
- Martin Landau, Ph.D.
- Eugene C. Lee, Ph.D.
- George Lenczowski, LL.M., J.S.D.
- Albert L. Lepawsky, Ph.D.
- Leslie Lipson, Ph.D.
- Herbert McClosky,† Ph.D.
- Nelson W. Polsby, Ph.D.
- Carl G. Rosberg, D.Phil. (Chairman)
- Robert A. Scalapino,† Ph.D.
- Paul Seabury, Ph.D.
- Kenneth N. Waltz, Ph.D. (Ford Professor)
- Aaron Wildavsky, Ph.D.
- Raymond E. Wolfinger, Ph.D.
- Charles Aikin, LL.B., Ph.D. (Emeritus)
- Eric C. Bellquist, Ph.D. (Emeritus)
- Thomas C. Blaisdell, Jr., Ph.D. (Emeritus)
- Joseph P. Harris, Ph.D. (Emeritus)
- Hans Kelsen, Ph.D., D.L., Dr.honoris causa, LL.D. (Emeritus)
- N. Wing Mah, Ph.D. (Emeritus)

Assistant Professors:
- William K. Muir, J.D., Ph.D.
- Hanna Pitkin, Ph.D.
- Ralph H. Retzlaff, Ph.D.
- Michael P. Rogen, Ph.D.
- Peter W. Sperlich, Ph.D.

Assistant Professors:
- Robert M. Axelrod, Ph.D.
- Robert L. Ayres, Ph.D.
- William E. Bicker, Ph.D.
- Jacob Citrin, Ph.D.
- Karl D. Jackson, Ph.D.
- Kenneth T. Jowitt,† Ph.D.
- Andrew S. McFarland, Ph.D.
- Robert M. Price, Ph.D.
- J. Merrill Shanks, Ph.D.
- John B. Starr, Ph.D.

Lecturers:
- James M. Boyd, Ph.D.
- William H. Gardner, M.S.
- Gail W. Lapidus, M.A.
- David K. Leonard, M.A. (Visiting)
- Stefan A. Riesenberg, LL.B., Dott. in giur., S.J.D.
- Leo E. Rose, Ph.D.
- Allan A. Samson, Ph.D.
- Jack H. Schuster, LL.B., M.A.

**The American Institutions Requirement**
This requirement may be satisfied by completing an approved course, or by passing an examination. See page 25.

**The Major**
Prerequisites for entrance into the major are: satisfactory completion of 90 quarter units (junior standing), two quarters of Political Science 1 and one quarter

NOTE: For key to footnote symbols, see page 86.
of Political Science 4. The upper division component of the major consists of Political Science 101A-101B, and any other seven upper division courses in the department.

**Honors Program**  Students at the end of their junior year, who have an overall average of 3.0 or better, are encouraged to apply for admission to the honors program. Honors courses are offered in several fields of political science and span 2 to 3 quarters. The writing of a senior thesis is required in the last quarter.

For updated information on the major, honors program offerings, undergraduate course content, and faculty scheduling, contact the departmental Undergraduate Office, 210A Barrows Hall.

Booklets describing both the undergraduate and the graduate programs for the year 1973–74 are available in 210 Barrows Hall.

**Higher Degrees**  Inquiries should be addressed to the departmental Graduate Office, 210B Barrows Hall.

*Letters and Science List:* for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

**Lower Division Courses**

1. **Introduction to Politics. (5)**
   
   Three hours of lecture and one hour of conference per week. Introduction to the study of politics and to political science as a discipline, presented in multiple sections with enrollment limited to forty students each. Course may be repeated once for credit with a different instructor. Section topics may be obtained from Political Science Undergraduate Office; those satisfying American Institutions requirement will be indicated. The Staff (F, W, Sp)

4. **Tutorial in Political Science. (5)**
   
   Two 2-hour seminars and one 1/2-hour tutorial per week. Prerequisite: two courses in lower division political science, or consent of instructor. Major themes in the study of politics. The Staff (F, W, Sp)

5. **American Institutions. (5)**
   
   Three hours of lecture and one hour of conference per week. Intended for students who wish to fulfill the Institutions part of the American History and Institutions requirement. A survey of the powers, structure, and operations of government, primarily at the national level. Mr. Samson (F, W, Sp)

33A–33B–33C. **American Studies. (5–5–5)**
   
   One 1-hour lecture and one 2-hour seminar per week. Prerequisite: open to sophomores; limited to fifteen students. Admission by interview with the three instructors during registration. An honors course in the study of American culture. The class will study significant ideas and issues, drawing on material from history, literature, political science, philosophy, and other fields. The course will emphasize discussion and the writing of essays and will include occasional joint meetings with the staff and students of the two equivalent courses (English 33A–33B–33C and History 33A–33B–33C).
   
   Mr. Rogin (F, W, Sp)

41. **Experimental Course. (1–5)**
   
   Prerequisite: consent of instructor. Topics, experimental in nature, will vary from year to year.

52. **National Security Policy. (3)**
   
   Two hours of lecture per week. Analysis of the evolution, development and formulation, and execution of current U.S. National Security Policy. Will include consideration of the fundamental concepts of national interest; the translation of these concepts into specific policy objectives and supporting programs; the relationship to foreign policy; and current national security policy problems. Mr. Boyd (Sp)

**Upper Division Courses**

101A–101B. **Political Inquiry. (5–5)**
   
   Three hours of lecture per week. Upper division requirement for the major. Introduction to the major analytical and methodological problems of political inquiry. Themes include epistemology, methodology, research design, data analysis, ethical issues in social research and the social implication of social science research. Multiple sections offered quarterly; detailed information available in undergraduate office. The Staff (F, W, Sp)

106. **The Conduct of American Foreign Relations. (5)**
   
   Three 1½-hour lectures per week. Constitutional arrangements, federal-state relations, and national supremacy. The roles of the President in his various capacities, the Senate, the House of Representatives, key committees, and pressure groups. The Department of State and the Foreign Service. The Military, NSC, USA, other official agencies and public opinion. Mr. Bellquist (W)

107. **The American Executive. (5)**
   
   Two 1½-hour lectures and one 1-hour conference per week. Analysis of principal institutions, functions and problems of the Presidency and the federal executive branch. Special attention will be given to topics of presidential leadership, staffing, executive-legislative relations, and policy formation. Comparative reference to executive processes in other political systems. Mr. Plishy (F)

108. **Congress. (5)**
   
   Three hours of lecture and one 1-hour conference per week. Nomination and election; constituent relations, the formal and informal structures of both houses, relations with the executive branch, interest groups, and policy formation. Mr. Wolinger (Sp)

109. **The American Legal System. (5)**
   
   Three hours of lecture and one 1-hour conference per week. The nature of the American legal system; the interrelationships of judges, lawyers, police, political officials, bureaucrats, and the people; the political and social aspects of the legal process. (W)
110. State Governments. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Comparative study of politics in American states, federal-state relations, elections; policies; administrative problems. Mr. Bicker (F); Mr. Lee (Sp).

111A—111B. Urban Government and Politics. (5–5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Urbanization and the growth of cities; the metropolitan community; historical development of local government; general patterns of central-local relations; local politics and decision-making; administrative organization and process. 111A—A comparative study with emphasis on the United States. 111B—Prerequisite: 111A or consent of instructor. A comparative study with emphasis on local government outside the United States. Mr. Jones (W).

112. Basic Problems in American Government. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Detailed examination, with emphasis on causes, consequences, and remedies, of important political problems in contemporary America. The subject matter of the course will vary depending upon the instructor. Course may be repeated once subject to approval by the department. Mr. Samson (F), (Sp).

113A—113B. American Political Theory. (5–5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Prerequisite: 113A: consent of instructor. 113B: 113A or consent of instructor. Basic problems of political theory as viewed within the context of American history and institutions. Mr. Jacobson (F); (W).

Three hours of lecture, one hour of conference and one hour of section per week. Separate section meetings will be scheduled for undergraduate and graduate students. Major political theories from the Greeks to modern period.

118A. Classical political theories and the political ideas of ancient Judaism, early Christianity, up to and including St. Augustine. Mr. Lipson (F).

118B. Early modern theories up to the French Revolution, including Machiavelli, Hobbes, Locke, and Rosseau. Mr. Jacobson (W).

118C. Modern theories of the nineteenth century including Hegel, Burke, the Utilitarians, and Marx. Mr. Bendix (W).

118D. Recent and contemporary political theories. Mr. Bendix (W, Sp).

120. International Relations. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. The nature of the international state system, analysis of political, military, cultural, economic and ideological factors affecting the behavior of states and international organizations in world politics. Mr. Seabury (F); Mr. Waltz (W, Sp).

121. International Organization. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Military security, peaceful change and social economic welfare under the United Nations system. Mr. Ruggie (Sp).

122A–122B. International Law. (5–5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Nature, sources, function and evolution of international law; principal law-making and adjudicatory agencies; international legal personality; treaties and executive agreements, United Nations Charter, power over persons and places and person. Diplomatic and consular intercourse; treaties and executive agreements; pacific settlement; war and neutrality. Mr. Riesenfeld (F, W).

123. Regional Communities. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Examination of supranational regional communities: the processes of political, cultural, economic and military integration occurring within them.

Two 1 1/2-hour lectures and one 1-hour conference per week. The interrelationships among military strategy, technology, science; relationships between strategic doctrine, national security concepts, and domestic politics. Mr. Seabury (W).

128. American Foreign Policy. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Analysis of competing concepts of the American "national interest" operative since World War I; Wilsonianism, isolationism, the Open Door, the Monroe Doctrine, and the Good Neighbor Policy; continentalism; national security, containment and liberation: their relation to substantive policies, and to the character of American democracy.

129. Soviet Foreign Policy. (5)

139. Totalitarianism and Dictatorship. (5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Comparative analysis of modern non-democratic political systems in developed and modernizing societies; characteristics of social control, ideology and the nature of coercion in totalitarian systems. Mr. Gregor (W).

140A–140B. Comparative analysis of Political Systems. (5–5)
Two 1 1/2-hour lectures and one 1-hour conference per week. Survey of social and political theory of relevance to comparative studies. Emphasis upon the problem of political development, with a consideration both of established models and of contemporary patterns in the Third World. (F, W).

140C. Comparative Communism. (5)
Three hours of lecture and one hour of discussion per week. The formation and evolution of communist elites; organizational patterns; methods of economic modernization; education principles and practices; role of socio-economic groups in communist society; revolutionary tactics and strategy; foreign policies. Examples drawn from Asia, East Europe, Latin America.

140D. Introduction to Theory and Practice of Development Politics. (5)
Two 1 1/2-hour lectures and one hour of discussion per week. An introduction to the major theories of development offered in growth economics, social change theory, and comparative politics in the light of contemporary experience in selected countries.
pursuing different goals and processes of development. Particular attention given to political strategies of agrarian, industrial, educational, and regional development and the distributive outcomes associated with general results of development. Mr. Retzlaff (F)

141A—141B. Government and Politics in the Soviet Union. (5-5)
Two 1½-hour lectures and one 1-hour conference per week.
141A. Introduction to Soviet government and politics. Bases of the Soviet system. Political history of the USSR. The Communist Party: objectives, organization, and operational dynamics. Formal institutions of government; federalism, the Soviets, the administrative system. Law, economics, and society as related to government and politics.
141B. Prerequisite: 141A or permission of instructor. A more advanced course based on 141A. Selected themes in Soviet internal politics; elites and functional groups; political leadership, factionalism and succession crises.
Mr. Breslauer (F, W)

141C—141D. Government and Politics in Eastern Europe. (5-5)
Two 1½-hour lectures and one 1-hour conference per week.
141C. A study of the political process in relation to social structure and national diversity. A comparison of Communist and prewar political systems, and an analysis of contemporary political developments.
Mr. Janos (F)
141D. The rise of the nation state, and the persistence of nationalist aspirations. Relations with the West and the Soviet Union with a particular reference to national communism and "domesticism."

141E—141F. Political Theory in Communist Societies. (5-5)
Two 1½-hour lectures and one 1-hour conference per week. An examination of Marxist or Marxist-Leninist theories of society, the state, and international politics in Communist bloc nations, the relationship of neo-Marxist thought to other political systems and concepts, nationalism, existentialism and democratic theory.
141F. Mrs. Lapidus (W); 141E. Mr. Gregor (Sp)

142A—142B—142C. Government and Politics in the Middle East. (5—5—5)
Two 1½-hour lectures and one 1-hour conference per week.
142A—142B. The Middle East in World Affairs. International relations and domestic policies of contemporary states in the Middle East; policies and strategy of major powers; supranational movements; regional political and security organizations. The area comprises Turkey, Iran, Afghanistan, Israel, and the Arab countries.
Mr. Lenczowski (F, W)
142C. Evolution and Revolution in the Middle East. Foundations of Islamic society and its political institutions, comparative analysis of the Islamic and Western systems, process of modernization; traditional, constitutional and revolutionary states; parties, mass organizations, ideologies, and development policies.

143A—143B—143C. Government and Politics in Northeast Asia. (5—5—5)
Two 1½-hour lectures and one 1-hour conference per week. The structure and evolution of political institutions in China, Japan, and Korea. Emphasis upon such topics as nationalism, political modernization, and ideology.
Mr. Starr (F, W, Sp)

143D—143E. Government and Politics in Southeast Asia. (5—5)
Two 1½-hour lectures and one 1-hour conference per week. The structure and evolution of political institutions in Southeast Asia in the post-colonial period.
Mr. Jackson (F, W)

144. Government and Politics in Great Britain. (5)
Two 1½-hour lectures and one 1-hour conference per week. The British political tradition; evolution from oligarchy to democracy; elections and parties; the constitutional system; parliament, cabinet, and administration; functions of the welfare state.
Mr. Lipson (Sp)

145A—145B. Government and Politics in South Asia. (5—5)
Two 1½-hour lectures and one 1-hour conference per week. A comparative analysis of development and change in the political systems of contemporary South Asia.

145C—145D. American Role in Asia. (5—5)
Two 1½-hour lectures and one 1-hour conference per week.
145C. The role which the United States has played in the Far East, examining such topics as America's role in Asian Westernization, United States/Far Eastern foreign policy. Oriental attitudes towards America. Evaluation of present-day problems.
Mr. Rose (W)
145D. Analysis of the origins and characteristics of American interests and involvements in South and Southeast Asia, with emphasis on the Indian subcontinent, Indochina and Indonesia.
Mr. Rose (Sp)

145E. Political Theory in Non-Western Societies. (5)
Two 1½-hour lectures and one 1-hour conference per week. Analysis of political thought in Far Eastern, South Asian and African societies. The impact of modern Western thought on traditional political theories and values. Emphasis on current ideological trends, nationalist movements, and the impact of modern Western and neo-Marxist thought.
Mr. Das Gupta (F)

146A—146B. Government and Politics in Africa. (5—5)
Two 1½-hour lectures and one 1-hour discussion per week.
146A. Introduction to African Politics. Social, economic, and political change in pre-independence Africa. Focus on aspects of pre-independence period which influence contemporary political events. Traditional African social and political systems; colonialism and its legacy; development of African independence movements and political parties.
Mr. Price (F)
146B. The Politics of Independent Africa. Analytic discussion of the factors shaping contemporary African political systems. Attention focused on problems of nation-building, integration of society and policy, and economic development. Specific topics include the single-party state phenomenon,
the military in politics, and "neo-colonialism." Case studies of particular African states will be introduced. Mr. Price (W)

146C. Selected Topics in African Politics. (5)
Two 1½-hour lectures and one 1-hour discussion per week. An in-depth analysis of a problem area, which will vary depending upon the instructor. Course may be repeated once subject to approval by the department.

147A–147B. Government and Politics in Western Europe. (5–5)
Two 1½-hour lectures and one 1-hour discussion per week. An analysis of political behavior and institutions in continental western Europe, Constitutional history and present governmental history and present governmental systems.

148A–148B. Government and Politics in Latin America. (5–5)
Two 1½-hour lectures and one 1-hour conference per week. Political institutions, groups and parties in Latin American countries. Basic characteristics of political processes in Latin America; problems of political development and modernization and political change. Comparative study of political systems; institutions, groups and political culture.

151. Legal Theory. (5)
Three hours of lecture and one 1-hour conference per week. Fundamental legal principles, especially from the analytical, historical, philosophical, and sociological points of view. Particular attention will be given to modern theories of the function of law.

152. Legal Institutions. (5)
Three hours of lecture and one 1-hour conference per week. The development and agencies of legal growth since primitive times and the interrelations between law and government. The early legal institutions of Europe and their influence on the modern juridical systems.

Two 1½-hour lectures and one 1-hour conference per week. 157A. The Federal System. 157B. Civil Liberties. 157C. Judicial Control of the Economy.

Mr. Muir (F, W)

160. Social Groups and Political Power. (5)
Two 1½-hour lectures and one 1-hour conference per week. Private power and public policy; the nature and courses, strategy and tactics of group power within the context of the American institutional setting. Business, agriculture, labor, the military, black protest, and other significant loci of power. Ramifications for a democratic society.

161A–161B–161C. Political Behavior. (5–5–5)
Two 1½-hour lectures and one 1-hour conference per week. The individual and group aspects of political behavior; social and psychological factors in politics; consideration of available research on voting behavior, ideology, extreme belief and affilition, leadership, participation, personality factors, public opinion, and group influence processes.

Mr. Citrin (F, W)
Mr. Axelrod (Sp)

162A–162B. Public Opinion. (4–4)
The first quarter will treat the nature of public opinion and propaganda and the home, school, and church as basic factors in the opinion forming process. In the second quarter emphasis will be placed upon the mass media and other instrumentalities of opinion formation. Our overseas information program. Stress upon political implications.

Mr. Bellquisit (F)

163. Political Parties. (5)
Two 1½-hour lectures, one section meeting, and one 1-hour conference per week. Nature and functions of political parties; origin, development, structure, economic and social composition, internal management and control; relation of parties and pressure groups to legislation and administration.

164A–164B. Comparative Political Behavior. (5–5)
Two 1½-hour lectures and one hour of discussion per week. Comparison of styles of political behavior in different nations. Attention will be given to similarities and differences among Western and non-Western politics.

Mr. DiPalma (W, Sp)

181. Public Administration. (5)
Two 1½-hour lectures and one 1-hour conference per week. The function of administrative institutions in society; the growth of administration as an art and science; contemporary and comparative forms and theories of organization and bureaucracy; the responsibilities of public servants; the political power of bureaucracies in various regimes.

Mr. Leonard (F); Mr. Lepawsky (Sp)

182. Public Policy and the Planning Process. (5)
Two 1½-hour lectures and one 1-hour conference per week. The substantive policies of government in relation to economic, social and political programs; the process of policy formulation; governmental planning; administrative programming in the execution of governmental policies and public projects.

Mr. Leonard (W)

183. The Public Service in the Modern State. (5)
Two 1½-hour lectures and one 1-hour conference per week. The role of civil servants in society; specialization and professionalization of public employees; human relations in organizations, recruitment and training of public personnel; elements of public personnel administration.

184. Policy and Administration of Public Finances. (5)
Three hours of lecture and one 1-hour conference per week. Financial administration in the modern state—American, comparative, historical; fiscal implications of governmental activity; the budget process in public administration; management devices to secure administrative accountability and political responsibility.

186. Administrative Behavior. (5)
Two 1½-hour lectures and one 1-hour conference per week. Concepts of administrative behavior with particular reference to public organization, including decision-making, leadership, small group behavior, and public organization as a social system related to a modern technological culture. Mr. Leonard (Sp)

187A–187B. Technological Change and Contemporary Politics. (5–5)
Four hours of lecture per week. An examination of the implications of rapid and uncontrolled tech-
nological implementation of scientific innovations for contemporary political life. Mr. Ruggie (W, Sp)

188. Science, Technology, and Politics. (5)
Two 1½-hour lectures and one 1-hour conference per week. History of science and government in the United States; contemporary structure of science advisory and implementing systems; and perspectives in the uses of science for public objectives. Mr. LaPorte (W)

H190A–H190B–H190C. Honors Program. (5–5–5)
Three hours to be arranged (seminar, tutorial, or both). Prerequisite: seniors with honors standing. Offerings in 1972–73 will be announced from departmental undergraduate office. Last quarter may be devoted to writing senior thesis. Credit and grade awarded upon completion of full sequence. The Staff (F, W, Sp)

191. Experimental Course. (1–5)
Prerequisite: consent of instructor. Topics, experimental in nature, will vary from year to year.

197. Field Study in Political Science. (1–5)
Meetings to be arranged. Prerequisite: consent of faculty sponsor and department chairman. Supervised experience relevant to specific aspects of Political Science in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required. The Staff (F, W, Sp)

198. Directed Group Study for Undergraduates. (1–5)
Meetings to be arranged. Prerequisite: course must be an extension of an existing Political Science course; submission of study proposal by faculty sponsor to the department chairman one month in advance of the quarter to be offered. Group studies of selected topics which vary from year to year. The Staff (F, W, Sp)

199. Supervised Independent Study and Research for Undergraduates. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis. The Staff (F, W, Sp)

Graduate Courses
A statement on admission to graduate work may be obtained from the graduate office in the department. Properly qualified undergraduates may be admitted to graduate courses or seminars with special permission of the instructor. For updated information on graduate course descriptions and faculty scheduling, consult the departmental graduate office.

Comparative Analysis

COURSES

200. Theories for Comparative Analysis. (4)
One 2-hour session and one 1-hour conference per week. Mr. Scalapino (F)

201A–201B. Comparative Analysis of Western Political Systems. (4–4)
201A. The comparative study of politics in Western societies; development of subject matter and methodology; political culture and social structure; electoral and parliamentary systems; governmental structures and functions. 201B. The comparative study of political parties in Western societies; the origins, development, structures, programs and clienteles of parties; the relation of party systems to constitutional focus; the comparative study of interest groups. Mr. DiPalma (W, Sp)

202A–202B. Comparative Analysis of Developing Political Systems. (4–4)
One 2-hour session and one 1-hour conference per week. An analysis of the processes of political modernization and change in developing countries. Major emphasis will be given to comparative analytical theory and methodology. Credit and grade will be awarded upon completion of the full sequence. Mr. Janos (W); Mr. Price (Sp)

203A–203B. Comparative Analysis of Communist Political Systems. (4–4)
One 2-hour session and one 1-hour conference per week. The comparative analysis of the processes of political modernization and change in Communist systems with particular reference to institutional and ideological differences, presented at an advanced level for graduate students. Discussion and papers required. 203B, Mr. Lenczowski (W)

*205. The Nation-Building Process. (4)
Three hours of lecture and one hour of consultation per week. The nation-state is the most significant political unit in the contemporary world. This course focuses on its origins, essential characteristics, as well as on different patterns of national development, the relation of national development to modernization, the role of internal and external factors in the national development process and current challenges to the national definition of political life.

SEMINARS

*207A–207B. Revolutionary Change. (4–4)
One 2-hour session and one 1-hour conference per week. Analysis and comparative study of the occurrence of various forms of revolution in society. Materials are drawn from political philosophy, systems theory, and empirical research.

208A–208B. Theory and Practice of Development Politics. (4–4)
One 2-hour session per week. Students from other disciplines are welcome. A critical survey of major theories of development in growth economics, social change theory, and comparative politics in light of contemporary experience in selected countries pursuing different goals and processes of development. Particular attention given to political strategies of agrarian, industrial, educational, and regional development and the distributive outcomes associated with general results of development. Mr. Retzlaff (W)

Political Theory

COURSES

213. American Political Theory. (4)
One 2-hour session and one 1-hour conference per week. Prerequisite: course 113A or 113B or consent of instructor. Basic problems of political theory will be examined within the context of American political development.
218A–218B. Colloquium in Political Theory. (4-4-4)
One 2-hour session and one 1-hour conference per week. An intensive examination of the nature and aims of various forms of political theory. Attention will also be given to selected theories in the social sciences and to relevant aspects of philosophy.
Mrs. Pitkin (F, W)

SEMINARS

214A–214B. Themes in Western Political Theory. (4-4)
One 2-hour session per week. Themes to be specified each year. Credit and grade will be awarded upon completion of the sequence.
Mr. Bendix (W, Sp)

215. Marxist Theory. (4)
One 2-hour session and one 1-hour conference per week.
Mr. Gregor (Sp)

219A–219B. Perspectives in Political Theory. (4-4)
One 2-hour session and one 1-hour conference per week. Politics and political theory are viewed from the standpoint of science and of art. Credit and grade will be awarded upon completion of the full sequence.
Mr. Jacobson (W)

International Relations

COURSES

220. Theories of International Relations. (4)
One 2-hour session and one 1-hour conference per week. Origin, application and utility of major concepts featured in the study of international relations. Relation of various strands of political and social theory to international relations.
Mr. Waltz (F)

221. American Foreign Policy. (4)
One 2-hour session per week. Typical patterns in American foreign policy.

222. Nationalism and Imperialism. (4)
One 2-hour session per week. Prerequisite: course 200 or 220. Themes in the theory of nation-building, illustrated with Western and non-Western case studies.

One 2-hour session per week. Prerequisite: courses 220 and 231A–231B (or equivalent). Survey of methods applicable to systematic research in international relations, with emphasis on quantitative techniques, interrelations of research techniques, research concepts in theory-building in international politics.
Mr. Axelrod (W)

SEMINARS

225. International Law. (4)
One 2-hour session and one 1-hour conference per week. Selected problems in modern international law.

226A–226B. International Organization. (4-4)
One 2-hour session and one 1-hour conference per week. First quarter: readings and discussion concerning methodological issues in the study of international integration. Second quarter: papers dealing with specific organizational situations, regional and United Nations.

227A–227B. International Relations and Foreign Policy. (4-4)
One 2-hour session and one 1-hour conference per week. Convergence and interaction among national foreign policies in international politics; the nature of national decision-making in foreign policy; comparison of diplomatic bargaining, military, and other behavioral styles in international politics.
Mr. Seabury (W, Sp)

228. National Security Policy. (4)
One 2-hour session and one 1-hour conference per week. Strategic concepts, theories of national security, and the relationship of conflict-theory to policy planning and national action. Special, but not exclusive, emphasis on United States data and policy problems.

Empirical Theory and Quantitative Methods

230. Foundations of Political Inquiry. (4)
One 2-hour session and one 1-hour conference per week. Prerequisite: consent of the instructor. A systematic introduction to the philosophy of science and the language of contemporary political inquiry. This will include theory construction; conceptualizing; the use of inference and induction; the process of generalizing knowledge claims; confirmation; and the role of values in political inquiry. Mr. Gregor (F)

231A–231B–231C. Quantitative Analysis in Political Research. (4-4-4)
(Formerly 260A–260B–260C)
One 2-hour session and one 1-hour conference per week.
231A. Prerequisite: Statistics 130A or its equivalent. Introductory course in the analysis of political data.
231B. Prerequisite: 231A or its equivalent. Intensive course in data analysis. Focus on the explicit (and implicit) use of multi-equation causal models. Special attention to procedures appropriate for survey data.
231C. Prerequisite: 231B. Seminar structure with individual analysis projects. Also extension of multivariate topics from 231B.
Mr. Shanks (F, W, Sp)

232A–232B. Formal Models of Politics. (4-4)
(Formerly 217A–217B)
One 3-hour session per week. Prerequisite: Second-year graduate standing and some college-level mathematics, or consent of instructor. Languages, concepts, and models for the analysis of basic problems of political theory and behavior. Applications to policy formation, party cooperation and competition, democratic theory, political change, international conflict. Illustrative use of game theory, set theory, systems analysis, differential equations, matrix algebra, computer simulation.

Area Studies

SEMINARS

240A–240B–240C. Western and Northern European Government and Politics. (4-4-4)
One 2-hour session and one 1-hour conference per week.
241A–241B. Soviet Government and Politics. (4-4)
Two hours per week.
241A: The historical roots of Soviet Communism. The strains of institutionalization and political development from the revolution through the Stalinist period. Cross references to other national models of communism and revolutionary change. (F)
241B: Selected topics of Soviet Government and politics since Stalin, focusing on the political process, the character of the elite, and the capabilities of the political system. Mr. Breslauer (W)

241C–241D. East European Government and Politics. (4-4)
Two hours per week. The governments of East Europe (defined as the area between the Soviet Union and West Germany) with emphasis on growing ideological and institutional diversity. The relationship between national tradition, social structure, and political change. Credit will be awarded upon completion of the sequence. Offered in alternate years only.
Mr. Janos (Sp)

242A–242B. Politics and Diplomacy in the Middle East. (4-4)
One 2-hour session and one 1-hour conference per week.
Mr. Lenczewski (F)

242C. Political Thought in the Middle East. (4)
One 2-hour session and one 1-hour conference per week.

243A–243B. Contemporary Problems of the Far East. (4-4)
One 2-hour session and one 1-hour conference per week.
243A, Mr. Rose (Sp)

243C–243D. Political Problems of Southeast Asia. (4-4)
One 2-hour session and one 1-hour conference per week.
Mr. Jackson (W)

244A–244B. China-Japan. (4-4)
One 2-hour session and one 1-hour conference per week.
Mr. Starr (W, Sp)

245A–245B. South Asian Politics. (4-4)
One 2-hour session and one 1-hour conference per week. Prerequisite: 145A or consent of instructor.
Mr. Das Gupta (F); Mr. Retzlaff (Sp)

246A–246B. African Politics. (4-4)
One 2-hour session and one 1-hour conference per week.
Mr. Rosberg (F, W)

247A–247B–247C. American Government and Politics. (4-4-4)
One 2-hour session and one 1-hour conference per week. Credit and grade for 247A will be awarded upon completion of 247B.
247A–247B, Mr. Polsby (F, W); 247C, Mr. McFarland (Sp)

248A–248B. Latin American Politics. (4-4)
One 2-hour session and one 1-hour conference per week.
Mr. Ayres (W, Sp)

249A–249B. Politics and Culture. (4-4)
Three hours per week. An examination of the interrelationships of politics, personality, and culture, normally with specific focus on American materials. Research papers will be written and discussed during the second quarter.
Mr. Rogin (F, W)

Public Law and Jurisprudence

250. Comparative Law. (4)
One 2-hour session and one 1-hour conference per week. A comparative study of legal processes within Western and Communist systems of law, and an examination of the impact of such systems on the exercise of public power and on the determination of private rights and privileges.

257A–257B. Constitutional and Administrative Law. (4-4)
One 2-hour session and one 1-hour conference per week. Prerequisite: enrollment in full two-quarter sequence. Fundamental principles of constitutional law; leading cases; judicial decisions affecting the liabilities, rights, duties, and procedures of governmental officers and agencies. Credit and grade will be awarded upon completion of the full sequence.
Mr. Muir (F, W)

Political Behavior (American and Comparative)

261A–261B. Political Behavior. (4-4)
One 2-hour session per week. A comprehensive review of the major topics in political behavior through intensive examination of the theories, findings, and proceedings of the most significant studies in the field. Credit and grade will be awarded upon completion of the full sequence.
Mr. Citrin (F, W)

261C. Political Behavior: Personality and Politics. (4)
One 2-hour session per week.

262A–262B. Voting Behavior and Public Opinion. (4-4)
One 2-hour session and one 1-hour conference per week. Examination of the basic literature on American voting behavior and public opinion, and student research on individually selected topics in this field. Credit and grade will be awarded upon completion of the full sequence.

263A–263B–263C. Research Seminar in Political Behavior. (4-4-4)
One 2-hour session per week. Research seminar on selected topics in political behavior; experience in research design, procedures, and analysis.
The Staff (F, W, Sp)
265A—265B. Special Topics in Political Behavior. (4-4)

One 2-hour session per week. Review of research on special topics in political behavior. Topics may vary from year to year. Mr. Jackson (Sp)

266A—266B. Conflict and Politics. (4-4)

One 2-hour session per week. Analysis of conflicts of various types: intrapersonal, interpersonal, intragroup, intergroup, intranational, international. Examination of theories (psychological, sociological, political) specifying causes, structures, and consequences of conflicting and harmonious relations. Investigation of conflict perspectives in political systems and ideologies. Mr. Sperlich (F, W)

267A—267B. The Legislative Process. (4-4)

One 3-hour session per week. Research on legislative process and behavior, with attention to legislation and constituency relations. Credit and grade will be awarded upon completion of the full sequence. Mr. Wolfinger (F, W)

268. Local Politics. (4)

One 2-hour session and one 1-hour conference per week. Research on local political processes, decision-making and community power structure. Mr. McFarland (F)

269. The Executive Process. (4)

One 2-hour session and one 1-hour conference per week. Research on bureaucracy and the executive process.

Public Administration and Public Policy (American and Comparative)

COURSES

260A. Public Organization Theory. (4)

One 2-hour session and one 1-hour conference per week. A survey of the literature of organization and management theory, emphasizing the major writers and distinctive contributions of various disciplines. Mr. LaPorte (F, W)

260B. The Political Environment of Public Organizations. (4)

(Formerly 281)

One 2-hour session and one 1-hour conference per week. An analysis of the factors that contribute to the relative power, survivability, and adaptability of public organizations in a variety of political settings. Relationship between public servants and other participants in the political process will be stressed. Mr. Leonard (Sp)

260C. Public Policy and Decision Theory. (4)

(Formerly 271)

One 2-hour session and one 1-hour conference per week. The process of public policy formulation, governmental planning and programming, and administrative decision-making. Mr. Lepawsky (W)

SEMINARS

*282. Federalism and Intergovernmental Relations. (4)

(Formerly 274)

One 2-hour session and one 1-hour conference per week. The relationship of constitutional doctrine and political thought to the organization and practice of intergovernmental relations.

283. Government and Politics in Metropolitan Areas. (4)

(Formerly 275)

One 2-hour session and one 1-hour conference per week. The relationship of the governmental, economic, social, and physical organization of metropolitan areas to metropolitan planning, decision-making, and administration. Mr. Jones (Sp)

284A—284B. Municipal Administration. (4-4)

One 2-hour session per week. The social, political, economic, and legal background in which municipal administration is set. The facilities and processes of organization, budgeting, accounting, personnel, and management methods of the municipal administrator. 284A, Mr. Lee, Mr. Gardner (W)

285A—285B—285C. Budgets as Political Instruments. (4-4-4)

Three hours per week. Budgetary calculations and strategies primarily in American national government but also in Soviet and American industrial firms and foreign governments. Core readings and research paper emphasizing theoretical statements about how budgets are and ought to be made. Students may take the course for one, two, or three quarters. An "in progress" grade will be given to students taking a two or three quarter sequence.

Mr. Wildavsky (F, W, Sp)

*285D. The Politics of Taxation. (4)

(Formerly numbered 285C)

One 3-hour session per week. Taxation as policy and a unit of political analysis. Public organization tactics for getting taxes and revenue. Public tax preferences.

286. Governmental Planning and Societal Purpose. (4)

Two hours per week. The principles and processes of public planning for socio-economic goals and ecologic-environmental objectives. Mr. Lepawsky (F)

287A—287B. Development Administration and Political Economy. (4-4)

One 2-hour session and one 1-hour conference per week. The structure and functions of public administration in the development process of "low-income" countries; the relationship of administration to a nation's political regime, social structure, and economic organization and objectives; an assessment of the comparative success enjoyed by various regimes in achieving their public purposes. Mr. Leonard (W)

*288A—288B. Science and Politics. (4-4)

One 2-hour session and one 1-hour conference per week. The structure of science and politics, public problems and technological change; the governance of science and technology and the administration of science and technology.

289A—289B—289C. Research in Public Organization. (4-4-4)

(Formerly 281A—281B)

One 2-hour session and one 1-hour conference per week. Mr. Landau (F, W)
Nonfield Courses

291. Experimental Course. (1–5)
Prerequisite: consent of instructor. Topics, experimental in nature, will vary from year to year.

292. Directed Advanced Study. (1–9)
Prerequisite: consent of instructor and graduate adviser. Open to qualified graduate students wishing to pursue special study and research under direction of a member of the staff. The Staff (F, W, Sp)

296. Directed Dissertation Research. (1–9)
Open to qualified students advanced to candidacy for the Ph.D. degree. To be taken on a pass/not pass basis; may be repeated for credit.
The Staff (F, W, Sp)

299. Independent Study in Preparation for the M.A. Essay. (1–8)
Open only to qualified first-year graduate students working toward the M.A. degree. Credit and grade will be awarded upon completion of the M.A. essay.
The Staff (F, W, Sp)

398. Professional Preparation for Teaching Assistants. (4)
Special study under the direction of a staff mem-

PSYCHOLOGY

(Department Office, 3210 Tolman Hall)

Professors:
Frank A. Beach, Jr.,† Ph.D., D.Sc.
Jack Block, Ph.D.
Hubert S. Coffey, Ph.D.
Richard S. Crutchfield, Ph.D.
Russell L. DeValois,‡ Ph.D.
Stephen E. Glickman, Ph.D.
Harrison G. Gough, Ph.D.
Geoffrey Keppel, Ph.D. (Chairman)
Sheldon J. Korchin, Ph.D.
Jonas Lange, Ph.D.
Richard S. Lazarus, Ph.D.
Gerald A. Mendelsohn, Ph.D.
William M. Meredith, Ph.D.
Paul H. Mussen, Ph.D.
Leo J. Postman, Ph.D.
Donald A. Riley, Ph.D.
Benbow F. Ritchie,‡§ Ph.D.
Mark R. Rosenzweig,‡ Ph.D.
Alex C. Sherriffs,‡ Ph.D.
Dan I. Slobin, Ph.D.
Read D. Tuddenham,‡† Ph.D.
Olga L. Bridgman, M.D., Ph.D., Sc.D. (Emeritus)
Edwin E. Ghiselli, Ph.D. (Emeritus)
David Krech, Ph.D. (Emeritus)
Catherine Landreth, Ph.D. (Emeritus)
Jean Walker Macfarlane, Ph.D. (Emeritus)
Donald W. MacKinnon, Ph.D. (Emeritus)

Associate Professors:
Martin V. Covington, Ph.D.
Philip A. Cowan, Ph.D.
Kenneth H. Craik, Ph.D.
Rhee M. Jarrett, Ph.D.
Arnold L. Leiman, Ph.D.
John S. Watson, Ph.D.
Irving Zucker, Ph.D.
Gordon Wood, Ph.D. (Visiting)

Assistant Professors:
Milton R. Blood, Ph.D.
Thomas J. Crawford, Ph.D.
Carl H. Frederiksen, Ph.D.
Ervin R. Haftel,‡ Ph.D.
Christina Maslach, Ph.D.
Robert M. Olton, Ph.D.
Eleanor R. Rosch, Ph.D.
Sheldon Zedeck, Ph.D.

Lecturers:
Lynette Beall, Ph.D.
Hilde S. Burton, Ph.D.
Clementina K. Hollenberg, Ph.D.
Marjorie P. Honzik, Ph.D.
Thomas O. Hilliard, Ph.D.
Raymond J. Kearns, Ph.D.
William D. Pierce, Ph.D.
William Saufley, Ph.D.
Gregory K. Sims, Ph.D.
Margaret T. Singer, Ph.D.
R. James Yandell, M.D., Ph.D.
Joan E. Zweigen, Ph.D.

NOTE: For key to footnote symbols, see page 86.

400A–400B–400C. Field Work in the Legislative Process. (4–4–4)
Prerequisite: enrollment limited to persons appointed as Legislative Interns. Supervised full-time research and other work with the California Legislature. Course includes a seminar on the legislative process, under the direction of faculty supervisor.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

IDS 175. A Nontechnical Introduction to Operations Research. (4)
See Interdepartmental Studies for the complete description of this course.
Psychology represents an extremely broad discipline, ranging from the study of behavior of the simplest of organisms to the behavior of humans and groups of humans in complicated situations. The major is designed to provide an introduction to this multi-faceted behavioral science. This is accomplished by two different plans which are described below. Both plans attempt to ensure that the student becomes aware of this diversity and of the interrelationships among the different sub-areas of psychology. Plan A divides psychology into two parts, a psycho-biological division and a social science division; under this plan, the student is required to sample several courses from each of these divisions. Plan B is an experimental program which attempts to accomplish the same goal by offering a year-long advanced general psychology course which will be team-taught with guest lectures given by members of the department; this course will help to integrate the various sub-disciplines currently defining the area of psychology.

The Major

**Lower Division**  Psychology 1 and completion of two lower division courses of at least 4 units, one from Group A and one from Group B.

Group A: Cultural anthropology, economics, linguistics, sociology.
Group B: Biology, genetics, physical anthropology, physiology, zoology.

**Upper Division**  Not less than 36 upper division units in psychology selected to fulfill the set of requirements listed below. The major is designed to offer (1) training in design and statistical analysis, (2) an exposure to different areas of psychological research and theory, and an opportunity to explore in depth several of these areas.

1. **Statistics:** Either (a) 101A–101B or (b) 102A–102B–102C. Alternative (a) is intended for most majors, while (b) consists of a more thorough introduction to the topic. (In 1973–74, Psychology 5, Statistics 2, or an equivalent may be substituted for 101A.)

2. **Breadth and core content:** There are two options, Plan A, which allows a choice of specific courses, and Plan B, which combines an integrated core course and subsequent individual choice of upper division courses.

**Plan A:**

a. two courses from among 110, 115, 120, 121, and 129
b. two courses from among 130, 140, 150, 160, 170 and 180
c. two courses having as prerequisites courses listed under (a) or (b) or 102A–102B–102C; and two courses drawn from different categories below:
   1. mathematical—105, 106, 107, 108
   2. physiological—111A, 111B, 112
   3. comparative—116
   4. learning and memory—122
   5. sensory—123, 124
   6. developmental—141, 142, 143, 173
   7. personality—clinical—151, 152, 153
   8. social—161, 162, 163, 164
   9. individual differences—171, 171L, 172, 172L
   10. industrial—182, 183A, 183B
   11. senior seminar—190a–m
d. other upper division courses to bring the total in the major to 36 units (only one individual study course—197, 198, 199—may be included in this total).

**Plan B:**

a. course 100A–100B–100C
b. other upper division courses to bring the total in the major to 36 units (only one individual study course—197, 198, 199—may be included in this total).
Up to 10 of the 36 upper division units may, upon approval of the adviser, be drawn from upper division courses in other departments. A list of substitutable courses may be obtained from the Undergraduate Office, 3305 Tolman Hall.

Subject to the provisions of the passed or not passed option, any or all of the lower division courses in the major may be accepted with a passed grade, but no courses to be counted toward the completion of the upper division 36 units may be taken on a passed or not passed basis except with the explicit approval of the major adviser.

**Honors Program** The honors program in psychology is a senior program. To be eligible for admission, a student must have attained senior standing with a grade point average of B or better in all of his University work and in psychology. Students in the honors program must complete at least one seminar in the 190 series with a minimum grade of B, and the Special Study sequence H195A–B (4–4) culminating in the Senior Honors Thesis. Requirements (1), (2), as stipulated in the preceding section, should be completed prior to the senior year; honors students are advised to take Psychology 100 during either the junior or senior year. Additional information concerning the honors program is available in the Undergraduate Office, Room 3305 Tolman Hall.

**Letters and Science List:** for regulations governing this list, see the Announcement of the College of Letters and Science.

**Lower Division Courses**

1. **General Psychology.** (5)
   Three 1-hour lectures and one 1-hour section meeting per week. Introduction to the principal areas, problems, and concepts of psychology.
   - Mr. Ritchie (F); Mr. Covington (W);
   - Mr. Riley (Sp)

2. **Problems and Methods in Experimental and Biological Psychology.** (5)  
   Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 1. Primarily for majors and prospective majors. Introduction to problems and methods in experimental and biological aspects of psychology.

3. **Problems and Methods in Social and Individual Psychology.** (5)  
   Three 1-hour lectures and one 1-hour section meeting per week. Prerequisite: course 1. Primarily for majors and prospective majors. Introduction to problems and methods in social, developmental, differential and personality areas of psychology.

4. **Introduction to Psychological Measurements.** (5)  
   Five 1-hour lectures per week. Prerequisite: second-year high school algebra or consent of instructor. Primarily for majors and prospective majors. Not open to students who are taking, or have taken, another course in statistics. (Statistics 2 is equivalent course which will satisfy the major requirement.) Arrays of experimental measurements, central tendencies, variability, correlation, estimation, and testing of hypothesis.

5. **Personal and Social Adjustment.** (4)  
   Three 1-hour lectures and one 1-hour section meeting per week. Prerequisite: course 1. Primarily for nonmajors. Dynamics of normal personality development. Family relationships, social adjustment, and factors modifying self-evaluation.

*40. Childhood and Adolescence.** (4)  
Three 1½-hour lectures per week. Prerequisite: course 1. Primarily for nonmajors. Intellectual, social, and personality development during childhood and adolescence.

*41A–41B, Introductory Psychology.** (5-5)  
Three 1-hour lectures and one 1-hour discussion (41A), one 3-hour laboratory (41B). An introductory course on psychology emphasizing an integration of facts and theories of learning, motivation, and perception from the human and animal laboratories with their application to personality development, personality theory, and social psychology. The course must be taken for two quarters to obtain credit. Grades will be assigned upon completion of the sequence. It may be offered in lieu of Psychology 1 and either Psychology 2 or 3 for credit toward the major.

**Upper Division Courses**

Psychology 1 is prerequisite for all upper division courses. Additional requirements are also stated for certain courses.

*100. History of Psychology.** (5)  
Three 1½-hour lectures per week.
   - Mr. Rosenzweig (W)

101A. **The analysis of Psychological Data.** (5)  
Three 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: course 1. An introduction to the use of statistical and data analytic techniques as employed in psychological research. Topics to be covered include comparison of means, comparison of frequency distributions, tests of hypotheses, regression and correlation.
   - Mr. Meredith (F);
   - ——— (W, Sp)

101B. **The Analysis of Psychological Data.** (5)  
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 101A. Continuation of 101A with heavy emphasis on application. Students will be expected to collect and analyze their own data. The topics of reliability, validity, and level of measurement will be introduced.
   - Mr. Raben (F, W); Mr. Wood (Sp)
102A–102B–102C. Research Design in Psychology. (4–4–4) Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: course 1. A broad survey of statistical and data analytic techniques generally found useful by psychologists. Random sampling, hypothesis testing, and estimation will be emphasized as will problems related to the formulation of scientifically testable research problems.

Mr. Jarrett (F, W, Sp)

*103. Advanced Statistical Methods in Psychology. (5) Two 2-hour lectures and one 2-hour laboratory per week. Prerequisite: course 5 or an equivalent course. Probabilistic considerations involved in the interpretation of psychological data derived from controlled observation; large-sample and small-sampling theory frequently employed in psychological research; analysis of variance and linear regression problems in experimental psychology.

Mr. Leiman (W)

*104. Theory of Psychological Measurement. (5) Two 1 1/2-hour lectures and one 3-hour laboratory per week. Prerequisite: course 5 or an equivalent course. Scaling of psychological measurement; reliability and validity of tests; dimensions of psychological traits.

Mr. Meredith (W)

105. Theory of Multivariate Psychological Experimentation. (5) Three 1 1/2-hour lectures per week. Prerequisite: course 103 or 104. General uses of multiple measurements in psychological research. Multiple prediction methods, configural scaling, stochastic models for psychological tests, theoretical basis of psychometric methods, factor analysis, multidimensional scaling, personnel classification and assignment problems.

Mr. Block (Sp)

*106. Mathematical Theory of Behavior. (5) Three 1 1/2-hour lectures per week. Prerequisite: course 103 or 104. History and philosophy of mathematical behavior theory. Rational and stochastic behavior models. Examples from choice, learning, perception, social interaction, psychophysics, preference, and evaluation.

Mr. Ritchie (F)

*107. General Traits and Types of Individuals. (5) Two 1 1/2-hour lectures and one 3-hour laboratory per week. Prerequisite: course 103 or 104 or consent of instructor. Introduction to cluster and factor analysis of individual and group differences; methods and findings.

Mr. Leiman (F); Mr. Rosenzweig (Sp)

110. Introduction to Biological Psychology. (5) Two 2-hour lectures and one 1-hour discussion section per week. Prerequisite: course 5 or equivalent. Survey of relations between behavioral and biological processes. Topics include sensory and perceptual processes, neural maturation, neural bases of motivation, learning.

Mr. Leiman (F); Mr. Rosenzweig (Sp)

108. Psychological Scaling. (5) Three 1 1/2-hour lectures per week. Prerequisite: Psychology 103 or 104, or consent of instructor. Introduction to theory of fundamental and derived measurement in behavioral science. Discussion of psychophysical methods, Thurstonian scaling, multidimensional scaling, nonmetric and ordered-metric procedures, unfolding of rank order data. Meaning and interpretation of numbers assigned to empirical events. Application of scaling methods.

111A. Advanced Biological Psychology. (5) Two 1 1/2-hour lectures and one 3-hour laboratory per week. Prerequisite: course 110 and consent of instructor. Current experimental studies of sensory mechanisms and perceptual processes.

Mr. Leiman (W)

111B. Advanced Biological Psychology. (5) Two 1 1/2-hour lectures and one 3-hour laboratory per week. Prerequisite: course 110 and consent of instructor. Current experimental studies of neural development and behavior, neural bases of learning and memory, and of motivation.

Mr. M. Block (Sp)

*112. Advanced Laboratory Studies in Biological Psychology. (5) One 1 1/2-hour lecture and six hours of laboratory per week. Prerequisite: courses 110, and either 111A or 111B, consent of instructor. Original laboratory studies in current problems relating to biological psychology.

113. Experiments in Animal Psychology. (4) Two 1 1/2-hour lectures and six hours of laboratory per week. Prerequisite: consent of instructor. Individual and group research in animal psychology.

Mr. Block (F)

*114A–114B. Behavioral Genetics. (3–3) One 1 1/2-hour lecture and two 2-hour laboratories per week. Prerequisite: courses 110A–110B or equivalent, and consent of instructor. Intensive survey of the evidence regarding the inheritance of behavioral characteristics in animals and man, with emphasis on animal research, implications of behavioral genetics for psychological theory and research design.

115. Introduction to Comparative Psychology. (4) Two 1 1/2-hour lectures and one hour of section per week. Prerequisite: course 5 or equivalent. Studies of animal behavior in evolutionary perspective, including analysis of behavior development, reproduction, aggression, territoriality.

Mr. M. Block (F); Mr. Riley (W)

*116 Advanced Comparative Psychology. (4) Two 1 1/2-hour lectures and one hour of section per week. Prerequisite: course 115 and consent of instructor. Current experimental studies in comparative psychology.

120. Animal Learning. (4) Two 1 1/2-hour lectures and one 1-hour discussion section per week. Theoretical and experimental analysis of classical conditioning, instrumental conditioning, and discrimination learning. Additional topics of current interest in the area of animal learning will also be considered. Course 101A is useful but not necessary.

Mr. Riley (W)

121. Human Learning and Memory. (4) Two 1 1/2-hour lectures and one 1-hour discussion section per week. Theoretical and experimental analysis of human learning transfer, and memory. The course will stress the learning and retention of verbal materials. Course 101A is useful but not necessary.

Mr. Postman (F); Mr. Wood (Sp)

122. Laboratory in Learning and Memory. (4) Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: either course 120 or 121 and consent of instructor. Laboratory research on
123. Sensory and Perceptual Processes. (5)
(Formerly numbered 123A–123B)
Two 2-hour lectures per week. Prerequisite: Psychology 5 and Psychology 110. Lectures and discussion of selected topics in psychophysics and sensory physiology. Mr. Jarrett (Sp)

124. Laboratory in Sensory and Perceptual Processes. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: course 110 or consent of instructor. Laboratory research on selected topics in the psychophysics of perception.

129. Cognitive Processes. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: courses 1, 2, or 3, and 5, or consent of instructor. Principal concepts and research concerning human processing of visual, auditory, and symbolic information; object recognition and classification; perception and comprehension of language; attention; theoretical models and experimental techniques in the study of imagery and other cognitive processes.

Miss Rosch (W); Mr. Frederiksen (Sp)

130. Thinking. (5)
Three 1½-hour lectures per week. Review of principal concepts and research concerning processes of human thought. Complex problem solving; critical, productive and creative thinking; other related aspects of higher-order cognitive functioning.

Mr. Olton (Sp)

131A–131B. Introductory Psychology of Language. (5–5)
Two 2-hour lectures and one 2-hour laboratory. Prerequisite: Senior status. Introduction to psycholinguistics, emphasizing effects of psychological variables on the learning and use of language; influence of language behavior on psychological processes; special attention to psychological applicability of modern linguistic theory and to social psychological aspects of language behavior.

Mr. Slobin (W, Sp)

132. Psychology of Language and Communication. (5)
Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: consent of instructor. Special topics in language and communication.

133. Psychology of the Unconscious. (5)
Two 1½-hour lectures and one 1-hour discussion section per week. Nature and role of unconscious psychological processes in behavior.

134. Programmed Instruction and Learning. (5)
Three 1½-hour lectures per week. Prerequisite: course 5 or an equivalent course, and consent of instructor. Study of psychological principles of programmed instruction and learning. Survey of available programs, and teaching machines. Role of these methods in a science of instruction. Application to training of cognitive skills in thinking and problem solving.

140. Developmental Psychology. (5)
Two 1½-hour lectures and one 1½-hour section per week. Prerequisite: course 5 or an equivalent course. Survey of theory and research in developmental psychology; growth and development of sense, motor, cognitive, learning, intellectual functions; personality and social behavior from birth to adulthood.

141. Laboratory in Developmental Psychology. (2)
Two 3-hour laboratories per week. Prerequisite: course 140, and consent of instructor. Empirical methods of investigation used in developmental psychology. Group and individual research projects.

142. Psychology of Infancy. (3)
Two 1½-hour lectures per week. Prerequisite: course 140. Theory and research on the maturation and learning of the human infant from a developmental comparative point of view.

143. Advanced Problems in Developmental Psychology. (5)
Three 1½-hour lectures per week. Prerequisite: course 140 and consent of instructor. Discussions of theoretical and empirical analyses of selected topics in the development of sensation, perception, learning ability, cognition, and socialization from birth to maturity.

Mr. Cowan (W); Mr. Langer (Sp)

Courses 171 through 173 are directly relevant to the above courses in developmental psychology.

150. Psychology of Personality. (5)
Two 2-hour lectures and one 1-hour section meeting per week. Prerequisite: course 5 or an equivalent course. A consideration of general and systematic issues in the study of personality, and an evaluation of major theories and points of view.

Mr. J. Block (W)

151. Assessment of Personality. (5)
Two 1½-hour lectures and two 1½-hour laboratories per week. Prerequisite: course 150, and consent of instructor. Theoretical and methodological issues in the assessment of personality; observational procedures; the interview; problems of test interpretation and psychodiagnosis.

Mr. J. Block (Sp)

152. Behavior Disorders and Their Modifications. (5)
Three 1½-hour lectures per week. Prerequisite: course 150 or consent of instructor. Critical evaluation of current models of behavior pathology and their implications of psychological treatment. Social psychological and intrapersonal antecedents and consequences of behavior deviations. Evaluation and treatment of behavior deviations.

Mr. Lazarus (F)

153. Stress and Adjustment. (5)
Two 1½-hour lectures and one 1½-hour laboratory per week. Prerequisite: course 150, and consent of instructor. Examines stress theory and research from clinical field and laboratory setting dealing with the psychological issues involved in adjustment to life stresses.

Mr. Lazarus (F)

160. Social Psychology. (5)
Three 1-hour lectures and one 2-hour discussion section per week. Survey of social psychology including language and communication, social interaction, social norms, social roles, leadership, influence of culture and social structure on personality, social attitudes, propaganda, and attitude change.

Miss Maslach (W); Mr. Crawford (Sp)
161. Psychology of Social Problems. (5)
Three 1½-hour lectures per week. *Prerequisite: course 160. Selected social problems in the light of social psychological research and theory. Such problems as mental illness, prejudice and desegregation, propaganda, delinquency, and social conflict will be treated. (Sp)

162. Attitudes, Belief, and Influence Processes. (5)
Two 1½-hour lectures one 3-hour laboratory plus two hours of field work per week. *Prerequisite: course 5 or an equivalent course; and course 160. Primarily for majors. Nature and measurement of attitudes and beliefs; theory of attitude change; experiments or field studies concerning attitudes and attitude change. Mr. Crawford (F)

*163. Small Group Structure and Processes. (5)
Two 1½-hour lectures and two 2-hour laboratories per week. *Prerequisite: course 5 or an equivalent course; and course 160. Primarily for majors. Lectures, research laboratory, and sensitivity training groups. Social psychological theories, research methods, and training techniques in the area of small groups.

*164. Social Structure, Culture, and Personality. (5)
Three 1½-hour lectures per week. *Prerequisite: course 150 or 160. Relationships among social structure, culture, and personality.

170. Differential Psychology. (5)
Two 1½-hour lectures and one 1½-hour section per week. *Prerequisite: course 5 or an equivalent course. Individual and group differences in psychological characteristics. Structure of intelligence and personality, cognitive style, heredity and environmental bases of individual differences, family, sex, class, and race differences. Mr. Meredith (Sp)

171. Psychology of Abilities and Aptitudes. (5)
Three 1½-hour lectures per week. *Prerequisite: course 104; course 170 is recommended. Theory and evaluation of the principal tests of abilities and aptitudes. Historical development of psychological test methods. Mr. Tuddenham (W)

*171L. Laboratory in Abilities and Aptitudes. (2)
One 1-hour lecture and one 2-hour laboratory per week. *Prerequisite: course 171 and consent of instructor. (May also be taken concurrently with 171.)

*172. Appraisal of Personality Differences. (5)
Three 1½-hour lectures per week. *Prerequisite: course 104; course 170 is recommended. Evaluation of methods for the description and measurement of individual differences in personality, including personality inventories, measures of interests and values, projective tests, and approaches to ego-organization.

*172L. Laboratory in Appraisal of Personality Differences. (2)
One 1-hour lecture and one 2-hour laboratory per week. *Prerequisite: course 172. (May also be taken concurrently with 172.)

173. Laboratory on Tests of Infants and Preschool Children. (5)
One 1½-hour lecture and two 2-hour laboratories per week. *Prerequisite: course 140, and consent of instructor. Mental and cognitive development. Class demonstrations and experience in testing and measuring infants and young children. Mrs. Honzik (W)

180. Industrial Psychology. (5)
Three 1½-hour lectures per week. *Prerequisite: course 5 or an equivalent course. Primarily for majors. Introduction to the field of industrial psychology, covering fundamental theory and concepts in personnel and social aspects of the field. Mr. Blood (F)

*181. Psychological Problems in Industry. (5)
Three 1½-hour lectures per week. For nonmajors only. Theory and research in industrial psychology. Personnel selection and placement, conditions of work, training, formal and informal organization, communications, leadership.

182. Personnel Psychology. (4)
Two 1½-hour lectures and one 2-hour laboratory per week. *Prerequisite: course 150. Emphasis on psychological contributions in the development of techniques and practices in personnel management. Mr. Zedek (Sp)

183A–183B. Social Psychology of Industry. (5–5)
Three 1½-hour lectures per week. *Prerequisite: course 180. Psychological approaches to organization theory, with emphasis on the social, motivational, and attitudinal aspects of the work situation. 183A may be taken alone. Mr. Raben 183A (W)

190. Topical Seminars in Psychology. (4)
Two 2-hour lectures per week. *Prerequisites as indicated below, or equivalent, and consent of instructor; Twelve sections are offered: (a) general; (b) pre-major course; (c) equivalent course; (d) courses 103 or 104; (e) biological; (f) prerequisite course 110; (g) comparative; (h) course 115; (i) learning; (j) course 120 or 121; (k) cognitive; (l) course 130; (m) psycholinguistic; (n) course 131, (o) developmental; (p) course 140; (q) social; (r) course 160; (s) differential; (t) course 170, (u) industrial; (v) course 180; (w) clinical.

191T. Community Psychology. (3)
One 2-hour meeting and one 2-hour discussion section per week. *Prerequisite: course 152. Study of mental health problems from a social psychological perspective, with particular concern for ecological, epidemiological, and sociological factors. Critical examination of emerging methods of community intervention. Mr. Korchin (Sp)

*H192A–H192B. Honors Seminar in Social and Personality Psychology. (4–4)
One 2-hour meeting per week. *Prerequisite: senior major honor status; consent of instructor.
H192A: Mr. Covington, Mr. Crutchfield, Miss Maslach, Mr. Olton (F); ———— (W); H192B: Mr. Block, Mr. Crawford, Mr. Crutchfield (W); Mr. Korchin (Sp)

*H193A–H193B. Honors Seminar in Experimental and Biological Psychology. (4–4)
One 2-hour meeting per week. *Prerequisite: senior major honor status; consent of instructor.
H193A: Mr. Ritchie (W); H193B: Mr. Glickman (Sp)

*H194A–H194B. Honors Seminar in Developmental and Differential Psychology. (4–4)
One 2-hour meeting per week. *Prerequisite: senior major honor status; consent of instructor.
H194A: Mr. Watson (F); H194B: Mr. Musen (W)
197. Field Study in Psychology. (1–5)

Individual conferences to be arranged. Prerequisite: Psychology 1 and 2 or 3; appropriate upper division work in psychology (to be determined by instructor); consent of instructor. Supervised experience relevant to specific aspects of psychology in off-campus settings. Individual and/or group meetings with faculty sponsor and written report required. Offered on a passed/not passed basis only. (May be repeated for up to 10 units total, and no more than 5 units may be counted toward the major.)

198. Directed Group Study. (1–5)

Prerequisite: consent of instructor. Group study of a selected topic or topics in psychology.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Prerequisite: consent of instructor. Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.

The Staff (F, W, Sp)

Graduate Courses

Graduate standing and the consent of the instructor are prerequisites for all graduate offerings.

201A–201B–201C. Proseminar in Mathematical Psychology. (5–5–5)

Four and one half hours of lecture per week. Prerequisite: calculus, a course in linear algebra (may be taken concurrently), and an advanced course in psychological statistics and experimental design or consent of instructor. Fundamentals of the quantitative study of behavior.

Mr. Meredith (F); Mr. Frederiksen (W); —— (Sp)

203. Quantitative Methods in Psychology. (3)

Two 1½-hour lectures per week. Quantitative research methods in psychology. Rational and empirical equations, statistical testing of hypotheses.

Mr. Jarrett (W)

210A–210B–210C. Proseminar in Experimental and Biological Psychology. (5–5–5)

Three 2-hour lectures per week. Prerequisite: graduate standing. Required of entering graduate students in experimental and biological psychology. Current theories and research on learning, sensation, perception and the relation between biological processes and behavior.

Mr. Keppel, Mr. Wood (W); Mr. Leiman, Mr. Zucker (Sp)

212A–212B–212C. Laboratory in Experimental and Biological Psychology. (3–3–3)

Two 4-hour laboratories per week. Prerequisite: graduate standing. Required of entering graduate students in experimental and biological psychology. Laboratory to accompany psychology 210A–210B–210C. Principles and techniques of instrumentation in current theories and research on learning, sensa-

240A–240B–240C. Proseminar in Developmental Psychology. (5–5–5)

Five hours of lecture per week. Comprehensive coverage of significant theories and empirical findings on all aspects of developmental psychology. Areas covered will include biological bases of development; comparative studies; learning and perception (fall quarter); the learning of language; cognition (winter); personality and social behavior (spring).

Mr. Langer (W)

245A–245B–245C. Proseminar in Personality Assessment. (5–5–5)

One 3-hour lecture and five hours of laboratory per week. Prerequisite: completion of Psychology 250A–B–C or equivalent. Historical and theoretical background of personality assessment, laboratory problems and field work. Credit and grade will be awarded upon completion of the full sequence.

250A–250B–250C. Tutorial in Developmental Personality, Clinical, Social Psychology. (5–5–5)

One 3-hour meeting per week. Required of all graduate students in developmental, personality, clinical and social psychology, in preparation for advanced graduate work. Grade awarded upon completion of entire sequence.

Mr. Crawford, Mr. Korchin, Mr. Musen (Sp)

251A–251B–251C. Theory and Method of Clinical Assessment. (5–5–5)

Two 2-hour lectures and two hours of demonstration-observation per week. Prerequisite: completion of Psychology 250 and/or consent of instructor. Principles and methods of clinical interviewing, intellectual, objective, and projective personality testing, in the context of personality theory and psychopathology. Required of second year clinical students. Grade awarded on completion of entire sequence. With consent, others can take one or two quarters.

Miss Singer, Miss Hollenberg (F, W, Sp)


Twelve hours of laboratory per week. Prerequisite: completion of 250 and concurrent registration in 251A–251B–251C. Practice and supervision in the assessment techniques of clinical psychology. Periods are spent in various mental health agencies, schools, and in the Psychology Clinic. Required of second-year clinical students. Grade awarded on completion of entire sequence.

Mr. Korchin, Mr. Pierce (F, W, Sp)

252A–252B–252C. Advanced Clinical Psychology: Seminars of the Psychology Clinic.

From six to twelve hours per week of seminars, supervised experience, and colloquia in the Psychology Clinic and cooperating field settings. Prerequisite: completion of courses 251A–251B–251C and
251D–251E–251F and/or consent of the instructor. Study of clinical intervention through guided experience, reading, and discussion. There are seven independent sections, taught as three-quarter sequences.

1. Clinical Issues (3–3–3)
2. Clinical Research (3–3–3)
3. Individual Psychotherapy (3–3–3)
4. Special Topics in Psychotherapy (3–3–3)
5. Family and Child Therapy (3–3–3)
6. Group Psychotherapy (3–3–3)
7. Community Psychology (3–3–3)

Third-year clinical graduate students are to take the first two, and three of the remaining five. Others may register separately in one or more sections. Credit and grade will be awarded on completion of the three-quarter sequence.

*253A–253B. Clinical Psychology of Children. (3–3)

Two 1½-hour lectures per week. Prerequisite: consent of instructor. Focus on issues in the treatment of the child and family. The relevance of the field of child development to the study of psychopathology will be emphasized. Normally taken in the third year by students in clinical program with particular interest in children.

*260A–260B. History, Theories, and Methods of Social Psychology. (4–4)

Two 2-hour lectures per week. Primarily for second- and third-year graduate students. An intensive analysis of the basic issues and directions of social psychology.

271A–271B–271C. Appraisal of the School-Age Child. (5–5–5)

Two 3-hour laboratories or equivalent field work, one hour individual recitation and one 3-hour lecture-discussion per week. Primarily for first-year graduate students. Appraisal of the child under individual supervision, integrating the methods of observation, mental testing and interview.

Mr. Tuddenham, 271B (W); 271C (Sp)

280A–280B–280C. Proseminar in Industrial Psychology. (5–5–5)

One 3-hour lecture per week. Required of first-year graduate students in industrial psychology program. Comprehensive survey of historical and contemporary developments in organization theory, personnel management, employee attitudes, motivation and perception.

Mr. Raben (F); Mr. Blood (W); Mr. Zedek (Sp)

281. Methodology in Industrial Psychology. (3)

One 3-hour lecture per week. Required of second-year graduate students in the industrial psychology program. Analysis of methodology and research design problems in the field of industrial psychology.

Mr. Zedek (F)

290. Seminars. (3)

(a) Measurement, (b) Biological, (c) Comparative, (d) Learning, (e) Perception, (f) Thinking, (g) Language and Communication, (h) Developmental, (i) Personality, (j) Social, (k) Clinical, (l) Differential, (m) Industrial, (n) Mathematical Models in Learning and in Psychophysics, (o) Analysis of Variance Techniques, (p) Additional seminars on special topics to be announced. (q–r) Design and analysis of experiments. Credit and grade will be given upon completion of sequence.

298. Directed Study. (1–6)

Special study under the direction of a member of the staff.

The Staff (F, W, Sp)

299. Research. (1–6)

Individual research.

The Staff (F, W, Sp)

*300. Seminar in the Presentation and Teaching of Psychological Material. (3)

Principles and methods of the presentation of psychological material in lectures, demonstrations, publications, etc., with emphasis on the teaching of undergraduate courses in psychology.

401A–401B–401C. Clinical Internship (Psychology Clinic). (3–12; 3–12; 3–12)

Prerequisite: previous field placement and consent of the Head of the Clinic. Individual programs of practice and supervision in the Psychology Clinic maintained by the Department of Psychology for study, treatment and research on problems of mental health. Credit and grade will be awarded on completion of the internship appointment.

(F, W, Sp)

402A–402B–402C. Clinical Internship (Off-Campus). (3–12; 3–12; 3–12)

Prerequisite: consent of Clinical Training Committee. Individual programs of practice and supervision in approved off-campus agencies. Credit and grade will be awarded on completion of the internship appointment.

(F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)

Individual study in consultation with the major field adviser, intended to provide opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

[NOTE: For key to footnote symbols, see page 86.]

PUBLIC HEALTH

(Department Office, 19 Earl Warren Hall)

Professors:
Henrik L. Blum, M.D., M.P.H.
Chin Long Chiang, Ph.D.
Leonard J. Duhl, M.D.
Sanford S. Elberg, Ph.D.
Edwin M. Gold, M.D. (In Residence)
William Griffiths, Ph.D.
Ruth L. Huenemann, Sc.D.
Andie L. Knutson, Ph.D.
Stewart H. Madin, D.V.M., Ph.D.
William J. Oswald, Ph.D.
Marc Pilisuk, Ph.D. (In Residence)
William C. Reeves, Ph.D., M.P.H.
William W. Stiles, M.D., M.P.H.
S. Leonard Syme, Ph.D.
Keith O. Taylor, Ph.B., M.B.A.
Bernard D. Tebbens, Sc.D.
Constantine H. Tempeles, Ph.D.
Neylan A. Vedros, Ph.D.
Helen M. Wallace, M.D., M.P.H.
Warren Winkelstein, Jr.; M.D., M.P.H. (Chairman)
Margaret Beattie, M.A., Gr.P.H. (Emeritus)
Jessie M. Bierman, M.D., M.S.P.H. (Emeritus)
A. Harry Bliss, M.S., M.P.H., Dr.P.A. (Emeritus)
Nell F. Hollinger, Ph.D. (Emeritus)
Albert P. Krueger, M.D. (Emeritus)
Edith M. Lindsay, Ed.D. (Emeritus)
Percy H. McGauhey, M.S. (Emeritus)
Walter S. Mangold, B.S. (Emeritus)
John H. Northrup, Ph.D., Sc.D., LL.D. (Emeritus)
Dorothy Bird Nyswander (Dorothy Nyswander Palmer), Ph.D. (Emeritus)
Edward S. Rogers, M.D., M.P.H. (Emeritus)
Irving R. Tabershaw, M.D. (Emeritus)
Jacob Yerushalmi, Ph.D. (Emeritus)

Associate Professors:
Richard M. Bailey, D.B.A. (In Residence)
William H. Bruvold, Ph.D. (In Residence)
Robert C. Cooper, Ph.D.
James L. Hardy, Ph.D.
Octavio I. Romano-V, Ph.D.
Richard H. Seiden, Ph.D., M.P.H. (In Residence)
David B. Starkweather, M.S., Dr.P.H.
Michael E. Tarter, Ph.D.
Samuel J. Wycoff, D.M.D., M.P.H. (In Residence)

Assistant Professors:
Sarah E. Archer, M.P.H. (Acting)
Richard J. Brand, Ph.D.
Carol A. D’Onofrio, M.P.H. (Acting)
Don C. Holloway, Jr., Ph.D. (In Residence)
Carl A. Keller, D.V.M., M.P.H., Ph.D.
Eileen B. Peck, Dr.P.H. (In Residence)
Steve Selvin, Ph.D. (Acting)
Robert C. Spear, Ph.D.
Eddie Tak-Fung Wei, Ph.D.

Professors:
Don Cahalan, Ph.D. (Adjunct)
Victor Eisner, M.D., M.P.H. (Clinical)
Cecil Entenman, Ph.D. (Adjunct)
Alan Foord, M.D., M.P.H. (Clinical)
Ralph S. Paffenberger Jr., M.D., Dr.P.H. (Adjunct)
Alberta Parker (Alberta Parker Horn) M.D., M.P.H. (Clinical)
Wiktoria Winnicka, M.D. (Clinical)

Associate Professors:
Alfred W. Childs, M.D., M.P.H. (Clinical)
Robert L. Johnson, M.S. (Adjunct)
Thomas H. Milby, M.D., M.S., M.P.H. (Adjunct)
Allan C. Oglesby, M.D., M.P.H. (Clinical)

Assistant Professor:
M. Mary Murai, M.S., Dr.P.H. (Clinical)

Lecturers:
Elizabeth Adler, M.P.H.
Laura Anderson, M.P.H.
Robert Z. Apte, Ph.D.
Donald F. Austin, M.S., M.D., M.P.H.
Nedra B. Bellocc, M.A.
Mark S. Blumberg, D.M.D., M.D.
Stephen M. Brown, M.D., M.P.H.
Andre Chabot, M.D., M.P.H.
James Chin, M.D., M.P.H.
Natalie A. Cremer, Ph.D.
Loring Dales, M.D., M.P.H.
Robert M. Elashoff, Ph.D.
Richard W. Emmons, M.D., M.P.H., Ph.D.
Constance Fraser, M.A., M.P.H.
Fern E. French, M.A., Dr.P.H.
Annette Fuller, M.S.W.
William R. Gaffey, Ph.D.
Victor Garlin, Ph.D.
Hyman Goldstein, Ph.D.
Stuart C. Goldstein, M.D., M.P.H.
Harold C. Gustafson, Dr.P.H.
Joseph M. Hafey, M.P.A.
Harold A. Harper, Ph.D.
Robert J. Heckly, Ph.D.
Albert Holloway, M.B.A.
Rose Horn, R.N., C.N.M., M.S., M.P.H.
Portia Bell Hume, M.D.
Carlessia, A. Hussein, M.S.
Lou Ann Irion, M.S.
Robert C. Jackson, M.S.W., M.P.H.
Edwin H. Lennette, M.D., Ph.D.
Sarah Mazelis, M.P.H.
William J. McEwen, Ph.D.
George A. McKray, LL.M., M.P.H.
Sheldon Margen, M.D.
C. Jean McKay, LL.M., M.P.H.
Eric A. Plaut, M.D.
Ronald R. Roberto, M.D., M.P.H.
Robin Room, M.A.
Helen S. Ross, M.P.H.
Frances Saunders, M.P.H.
Nathalie Schmidt, Ph.D.
John R. Seeley, A.B.
Leona Shapiro, M.S.
Elizabeth Sprowles, M.S.
Ruth H. Stinson, M.H.A.
Faith Chandler Thesingh, M.P.H.
Barbara J. van den Berg, M.D., D.P.H.
Howard J. Weddle, M.S., M.P.H.
Sanford B. Werner, M.D., M.P.H.
Dorothy Whissell-Buechy, M.D., Ph.D.

Lower Division Course

*5A–5B–5C. Individual and Community Health. (3–3–3)

Three 1-hour lectures per week. Prerequisite: 5A is prerequisite to 5B; 5B to 5C. A survey of the field of health, including field observations and a consideration of the evolution of disease prevention and control; the social, medical, and economic aspects of sickness, disability, and death. ———; 5A (F, W); 5B (W, Sp); 5C (Sp)

Upper Division Courses

102. Administrative Behavior and Processes in Health Agencies. (3–4)

Two 1-hour lectures and one 2-hour discussion-laboratory session per week. Introduction to health administration, focusing on organizational structure, budget, personnel, administrative behavior and processes, innovation, and inter-organizational relationships. Use of cases, games, and simulations. Four units may be earned by submitting a term paper.

Mr. D. Holloway, Mr. Bailey (W)

106. Introduction to Human Ecology and Health. (4)

Two 2-hour lecture-discussions per week. Current theories concerning the role of social, economic, and other environmental factors in affecting the health status of individuals and populations, and the social response to these factors.

——— (W)

107. Introduction to Medical Care Administration. (3)

Two 1-hour lectures, one 2-hour group discussion per week. Prerequisite: consent of instructor. Consumer behavior; need and supply; manpower and facilities; organization; financing, planning and evaluation.

The Staff (F)

108. Medical Care Problems and Programs. (2)

One 2-hour lecture-discussion per week. Review of current issues in organizing and financing medical care in the United States. Not designed for students in the medical care or public health administration programs in the School of Public Health.

Mr. Bailey (Sp)

110. The Hospital in Contemporary Society. (4)

Two 2-hour lectures per week. Open to upper division and graduate students from any department. The hospital as a social institution, its role and functions in modern society, its relationship to other community agencies and health services. The hospital as a modern complex organization.

Mr. Starkweather, Mr. A. Holloway, Mrs. Thesingh (F)

111. Legal Aspects of Hospital Organization and Administration. (2)

One 2-hour lecture per week. Prerequisite: major in hospital or health administration or consent of instructor. Statutes, cases, and readings in law related to hospitals.

Mr. McKray (Sp)

Associates:
Donald Johnson, M.P.H.
David H. Null, M.A.
Betty H. Olson, M.S.

Assistant Field Program Supervisors:
Sherry Reinhardt, M.P.H.
Florence Stroud, M.S.

125A. Maternal Health. (2)

One 2-hour lecture per week. Prerequisite: consent of instructor. Public health aspects of care before, during, and after pregnancy. Programs for maternity care.

Mr. Gold (F)

125B. Relationship of Human Growth and Development to MCH Programs. (2)

One 2-hour lecture per week. Prerequisite: graduate standing in Public Health or consent of instructor. Principles of human growth and development in public health programs.

Mr. Risner (F)

125C. Mental Retardation and Associated Handicaps. (2)

One 2-hour lecture per week. Prerequisite: consent of instructor. Needs of handicapped children and their families; community programs for care of children with handicapping conditions.

Mr. Oglesby, Miss Fraser (W, Sp)

126. Principles of Maternal and Child Health. (2)

One 2-hour lecture per week. Prerequisite: consent of instructor. Health and social problems of mothers and children.

Mr. Oglesby (Sp)

127. Health Programs for the School Age Child. (2)

One 2-hour lecture per week. Prerequisite: consent of the instructor. A general introduction to organized health service programs for preschool and school age children.

Mr. Eisner (F)

130A–130B. Selected Topics in Health Education. (2–2)

One 2-hour lecture per week; field observations with scheduled conferences. Topics and laboratory demonstrations and field experiences will vary from year to year.

130A, Mrs. D'Onofrino (F)
130B, Mrs. Anderson (F)

130A, Sec. 1, Miss Anderson (W)
130A, Sec. 2, Mr. Weddle (W)
130B, Mrs. D'Onofrino (W)

130B, Mr. Gustafson (Sp)

*131. Introduction to Communications Research Applicable to Educational Aspects of Public Health. (2)

One 1-hour lecture, one 2-hour laboratory per week. Introduction to communications theory and research applicable to educational aspects of public health.

——— (F, Sp)

132. Planning Health Experiences for the School-Age Child. (3)

One 2-hour lecture, one 1-hour discussion per week; scheduled conferences. Exploration of health education as it pertains to problems and programs related to the school-age child.

Mr. Weddle, Mrs. D'Onofrino (Sp)
133. Introduction to Group Process. (2)
One 1-hour lecture, one 2-hour laboratory per week. Dynamics of interpersonal relationships.

134. Community Health Education. (2)
One 2-hour lecture, one 2-hour laboratory per week. Prerequisite: winter quarter: limited to undergraduates; spring quarter: limited to graduate public health students not specializing in public health education. A general introduction to the scope and nature of educational activities in a public health program. Mrs. D’Onofrio (F, Sp); Mrs. Adler, Mrs. D’Onofrio (W)

139A. Research Methods in the Behavioral Sciences. (3)
Two 2-hour lectures and group discussions per week. The study of theory, logic, concepts, methods, and techniques of the behavioral sciences as they apply to public health.
Mr. Bruvold, Mr. Seiden, Mr. Romano-V (F, W, Sp)

139B. Research Methods in the Behavioral Sciences. (3)
One 2-hour seminar and one 2-hour tutorial session per week. Prerequisite: course 139A. Provides field experience in applying research methods as member of interdisciplinary team. Small group field studies are designed and conducted with faculty guidance.
Mr. Bruvold, Mr. Seiden, Mr. Romano-V (W, Sp)

140. Introduction to Public Health Nutrition. (4)
(Formerly numbered 140A)
Two 2-hour lectures per week. Prerequisite: consent of instructor. Organization of health and nutrition services in the United States and the world; identification of problems; delivery of services; role of public health nutritionists and skill development. Concurrent field observations.
Miss Murnii, Miss Peck (W)

144. Nutrition in Public Health. (3)
Two 1½-hour lecture-discussions per week. Prerequisite: consent of instructor. Basic nutrition concepts and their implications for community health.
Miss Murnii, Miss Hueneeman (Sp)

149A. Occupational Health and Industrial Hygiene:
Introduction. (3)
Three 1-hour lectures per week. Industrial hygiene and safety practices for control of occupational hazards; environmental quality control in places of employment.
Mr. Tebbens (F)

149B. Occupational Health and Industrial Hygiene:
Sanitary Air Analysis. (3)
One 2-hour lecture, one 3-hour laboratory per week. Prerequisite: course 149A or consent of instructor. Analysis of air quality and other environmental factors affecting the health of people at work.
Mr. Tebbens (W)

149C. Occupational Health and Industrial Hygiene:
Industrial Toxicology. (3)
One 2-hour lecture, one 3-hour laboratory per week. Prerequisite: course 149A or consent of instructor. Basic concepts and techniques of toxicology with special emphasis on industrial chemicals.
Mr. Wei (Sp)

150. Environmental Health Sciences. (3)
Three 1-hour lectures per week. The elements of public health sanitation and of sanitary control of the environment. Survey of water, air, food, and other factors affecting man’s environment.
Mr. Oswald (F)

156. Microbiology of Water and Waste Water. (3)
Two 1-hour lectures and one 1-hour discussion per week. Prerequisite: consent of instructor. Principles of microbiology applicable to the aquatic environment and to waste water.
Mr. R. Cooper (W)

156L. Water and Waste Water Microbiology Laboratory. (2)
Two 3-hour laboratories per week. Prerequisite: course 156 (may be taken concurrently). A laboratory course in water microbiology with emphasis on the effect of microorganisms on water quality.
Mr. R. Cooper (W, Sp)

160A. Introduction to Probability and Statistics in Biology and Public Health. (4)
Three 1-hour lectures, one 3-hour laboratory per week. Prerequisite: two years of high school algebra. Descriptive statistics, probability, probability distributions, point and interval estimation, hypothesis testing, applications.
Mr. Selvin (F)

160B. Introduction to Probability and Statistics in Biology and Public Health. (4)
Three 1-hour lectures, one 3-hour laboratory per week. Prerequisite: course 160A or consent of instructor. The chi-square tests, bivariate normal distributions, regression, and correlation, with biomedical applications.
Mr. Selvin (W)

160C. Introduction to Probability and Statistics in Biology and Public Health. (4)
Three 1-hour lectures, one 3-hour laboratory per week. Prerequisite: course 160B or consent of instructor. Analysis of variance, designs of experiment, analysis of covariance, linear discriminant functions, and non-parametric statistics, with biomedical applications.
Mr. Selvin (Sp)

161A. Introduction to Biostatistics: Vital Statistics. (3)
Three 1-hour lectures per week. Statistical methods in study of human mortality, morbidity and natality. History of vital statistics, critical appraisal of census and vital data, measurement of risk and introduction to life tables.
Mr. Tarter (F)

161B. Introduction to Biostatistics: Life Tables. (3)
Three 1-hour lectures per week. Prerequisite: course 161A. Construction of life tables and their uses. Fertility measures. Cohort studies, medical record systems.
Mr. Tarter (W)

161C. Introduction to Biostatistics: Survey Methods. (3)
Three 1-hour lectures per week. Prerequisite: course 161B. Design of surveys in public health. Questionnaires, interviewing, sampling, and analysis.
Mr. Tarter (Sp)

162A. Introduction to Public Health Statistics. (4)
Three 1-hour lectures and one 3-hour laboratory section per week. Collection and analysis of vital data, measurements of risk, rate adjustment, introduction to life tables, descriptive statistics, statistical inference.
Mr. Brand (F)
180L. Introduction to Public Health Statistics. (3)
Three 1-hour lectures per week. Prerequisite: course 162A or consent of instructor. Statistical inference, regression, correlation, analysis of variance.
Mr. Brand (W)

182C. Introduction to Public Health Statistics. (3)
Three 1-hour lectures per week. Prerequisite: course 180B. Life table methods, follow-up studies, and health surveys.
Mr. Selvin (Sp)

Three 1-hour lectures per week. Prerequisite: course 182A or consent of instructor. Evaluation designs, indices and measures, sample designs, analysis.

175. Introduction to Epidemiology. (3)
Two 1-hour lectures and one 2-hour discussion per week. Prerequisite: prior background in biologic sciences is desirable. An introduction to the uses of epidemiology in public health practice, using selected diseases to illustrate the development of knowledge on disease causation and the application of such knowledge to disease control.
Mr. Winkelman, Mr. Reeves, Mr. Syme, Mr. Keller (W)

180A. Medical Microbiology. (3)
Two 1½-hour lectures per week. Prerequisite: Chemistry 8A–8B or 12A–12B; Biology 1A, 1B; Bacteriology 102, or equivalent; or consent of instructor. Basic principles of immunology; pathogenesis and immunity in bacterial and other microbial infections of man and animals.
Mr. Vedros (W)

180B. Medical Microbiology. (3)
Two 1½-hour lectures per week. Prerequisite: Chemistry 8A–8B or 12A–12B; Biology 1A, 1B; Bacteriology 102, or equivalent; or consent of instructor. 180A is a prerequisite for 180B. Basic principles of immunology; pathogenesis and immunity in bacterial and other microbial infections of man and animals.
Mr. Vedros (Sp)

180L. Medical Microbiology Laboratory. (2)
Two 3-hour laboratories per week. Prerequisite: course 180A (may be taken concurrently).
Mr. Vedros (W)

180M. Medical Microbiology Laboratory. (2)
Two 3-hour laboratories per week. Prerequisite: course 180B (may be taken concurrently) and course 180L.
Mr. Vedros (Sp)

182. Introduction to the Animal Viruses. (3)
Three 1-hour lectures per week. Prerequisite: Bacteriology 102, 102L, or equivalent, or consent of instructor. An introduction to the animal viruses, including pathogenesis, immunity, and virus-host relationship.
Mr. Hardy (F)

182L. Laboratory in Virology. (3)
Three 3-hour laboratories per week. Prerequisite: course 182 (may be taken concurrently). A basic laboratory course in animal virology, with emphasis on studies of the biological activities of animal viruses.
Mr. Hardy (F)

183. Survey of General Pathology. (3)
Two 1½-hour lectures per week. Designed for students who have no background in the biological sciences. General principles of disease response of higher mammals to infectious and noninfectious agents.
Mr. Madin (W, Sp)

§191A. Food and Drug Toxicology. (3)
Two 1-hour lectures and one 1-hour discussion per week. Prerequisite: a course in general biology. Problems relating to toxic chemicals in food and drugs; methods of evaluating and controlling chemical toxicity will also be discussed.
Mr. Wei (F)

§191C. Alcohol and Other Drugs: Behavioral Problems. (3)
One 2-hour lecture per week and individual consultation. Prerequisite: upper division or graduate standing. Presentation of latest research findings on psychological, sociological, and physiological correlates of alcohol and drug problems.
Mr. Seiden, Mr. Cahalan, Mr. Room (F)

§191D. Alcohol and Other Drugs: Treatment Approaches. (3)
One 2-hour lecture per week, and one-half day field visit on alternate weeks. Prerequisite: upper division or graduate standing in any U.C. department or school. Orientation on the clinical manifestations of alcoholism and drug addiction, and on various methods of treatment, through visits to treatment facilities, welfare agencies, and Skid Row missions.
Mr. Seiden, Mr. Cahalan, Mr. Room (W)

§191E. Alcohol and Other Drugs: Prevention and Social Policy Issues. (3)
One 2-hour lecture per week, and four one-half day field visits per quarter. Prerequisite: upper division or graduate standing in any U.C. department or school. A critical study of past and present preventive and treatment programs on local, state, and federal levels. Training in assessment of effectiveness of programs.
Mr. Cahalan, Mr. Seiden, Mr. Room (Sp)

194W. Introduction to Voluntary Health Agencies. (3)
One 2-hour lecture-discussion per week and field visits to voluntary health agencies. Survey of voluntary health agencies to determine their nature, extent, philosophy, and functions. Specific review and study of ongoing voluntary health agency program activities.
Mr. Weedle (W)

*195. Emergency and Disaster Health Services. (2)
One 1-hour lecture, one 2-hour discussion per week. Administrative and technical aspects of emergency and disaster services at the various echelons of governmental control. Particular emphasis on medical, health and related services.

197. Field Study in Public Health. (1–5)
Supervised experience relevant to specific aspects of Public Health in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required.
The Staff (F, W, Sp)

198. Directed Group Study. (1–5)
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.
The Staff (F, W, Sp)
Graduate Courses

200A. Introduction to the Organization and Administration of the Health Services System. (3)

Two 1-hour lectures and one 2-hour discussion per week. Prerequisite: graduate standing in the School of Public Health or consent of instructor. An introduction to the dimensions of the health system in its socioeconomic and political context, using an ecologic systems approach. The Staff (F)

200B. New Frontiers in Community Health. (2)

One 2-hour lecture-discussion per week. Prerequisite: graduate standing in the School of Public Health or consent of instructor. 200A is not prerequisite to 200B. Exploration of current major trends and problems with emphasis on the dimensions of poverty and its relationship to health status. Includes analysis of social, political, economic, and organizational factors affecting the delivery of health care services, especially for the low income populations. The Staff (Sp)

*201. Dental Health Administration. (3)

One 3-hour lecture-discussion per week. Prerequisite: D.D.S. degree, or consent of instructor. Special administrative problems and field study of dental programs for health agencies. (Sp)

202. Advanced Theory in Health Administration. (3)

Two 1½-hour seminars per week. Prerequisite: course 102 or equivalent and consent of instructor. Study of current approaches to the theories of administration and complex organization as they relate to health administration. (Sp)

203. Legal Basis for Health Administration. (2)

One 3-hour lecture-discussion per week. Statutes, cases, and readings in the legal basis for public health and medical care administration. Mr. McKray (W)

204A. Community Diagnosis. (2)

One 2-hour lecture-discussion per week. Prerequisite: primarily for students of health administration and planning. Others by consent of instructor. Study and discussion of community health in the context of a democratic society. Analysis of community dynamics as these affect the planning, financing, and implementing of community health activities. The social, cultural, and legal forces bearing upon organized health activities will be considered. (W)

204B. Principles of Public Health Practice. (3)

One 3-hour lecture-discussion per week. Prerequisite: course 204A or consent of instructor. Principles of organizing, implementing, and evaluating community health programs, using prototype programs for illustrative purposes. Discussion will focus on integrating specialized health activities in program areas selected according to current need and student interest. (Sp)

*204C. Principles of Community Health Practice. (3)

One 2-hour lecture, one 3-hour laboratory per week. Prerequisites: courses 200A and 204B or consent of instructor. Principles of organizing and implementing community health service programs. Laboratory sections (including field study) will cover a broad spectrum of community services concerned with the recognition, comprehensive care, and rehabilitation of the sick and disabled. (Sp)

205. Economics of the Health Services Industry. (3-4)

Two 2-hour lecture-discussions per week. Application of basic concepts and principles of macro and micro economics to the production and consumption of health services in the U.S. Oriented to students with little prior preparation in economics. Credit received depends on length and complexity of written assignments. Mr. Bailey (W, Sp)

*206. Ecological Theory and Health Organization. (2)

One 2-hour seminar per week. May be repeated for credit. Prerequisite: consent of instructor. Consideration of theory and research in human ecology in the context of human organization for health. (Sp)

207A. Advanced Medical Care Administration. (4)

Two 2-hour lecture-discussions per week. Prerequisite: course 107 or consent of instructor. Select topics in medical care administration, study of specific programs, and individual projects. (W)

207B. Advanced Medical Care Administration. (3)

Two 2-hour lecture-discussions per week. Prerequisite: course 107 or consent of instructor. Presentation of current issues and problems in the administration of public and private health care organizations by persons in the field; discussion and analysis of the economic, political, and social forces underlying these problems. (Sp)

208A. Health Planning. (3)

One 3-hour lecture-discussion per week. Prerequisite: consent of instructor. Theory and philosophy of planning as applied to health and well-being problems of the public; analysis of current problems of health in relation to national and regional needs, values, economy; application of technical planning tools to health problems. Mr. Blum (F, W)

208B. Health Planning Seminar. (3)

One 3-hour seminar per week. Prerequisite: course 208A or consent of instructor. Depth study of critical aspects of health planning with analysis of underlying concepts and theories of planning. Mr. Blum (W, Sp)

209. The Organization and Administration of Primary Health Care Systems. (3)

One 2-hour lecture and one 2-hour discussion per week. Prerequisite: consent of instructor. A review of primary health care, its organization and administration, using the neighborhood health center as a model for study. Will present history and antecedents of health center development, current patterns of organization, the role of community participation, and administrative issues. (W)

210. Hospital Programs and Trends. (2)

One 2-hour lecture-discussion per week. Prerequisite: consent of instructor. An introduction to current operations and trends in the hospital field and hospital relationships with public health. Mr. Starkweather, Mr. A. Holloway (W, Sp)

211. Advanced Study in Hospital Administration. (2)

One 2-hour tutorial or small group discussion per week. Prerequisite: consent of instructor. Open to graduate students from any department. Special study on hospital-related topics. Will differ from quarter to quarter and may be repeated for credit. The Staff (F, W, Sp)
212A. Hospital Organization and Administration. (2)
One 2-hour lecture, one 2-hour discussion per week. Prerequisite: primarily for hospital administration majors, others by consent of instructor. The organization of hospitals with emphasis on administrative functions, governing boards, and departmental organization and relationships.
Miss. Stimson and Staff (F)

212B. Hospital Organization and Administration. (2)
One 2-hour lecture, one 2-hour discussion per week. Prerequisite: primarily for hospital administration majors, others by consent of instructor. Detailed study of medical staffs, professional organizations, and the educational and research roles of the hospital.
Mr. Taylor (W)

212C. Hospital Organization and Administration. (2)
One 2-hour lecture, one 2-hour discussion per week. Prerequisite: primarily for hospital administration majors, others by consent of instructor. The application of financial management practices in the hospital.
Mr. Starkweather, Mr. D. Holloway (Sp)

213A. The Hospital and the Community. (2)
Two 1½-hour lecture-discussions, one 1-hour discussion per week. Limited to graduate students in hospital administration. The development of the hospital as a modern complex organization, its role and functions in the community, and its relationship to other community agencies and health services.
Mr. Starkweather, Mr. A. Holloway (Sp)

213B. The Patient and Hospital Care. (2)
Two 1½-hour lecture-discussions per week. Prerequisite: course 213A. Limited to graduate students in hospital administration. Organization of the hospital for patient care, with emphasis on nursing. An examination of the patient's needs and relationships with the hospital staff.
Mrs. Stimson (W)

213C. Patient Care Programs in the Hospital. (2)
Two 2-hour lecture-discussions per week. Prerequisite: course 213B. Limited to graduate students in hospital administration. Trends in hospital patient care, including psychiatric and geriatric care. Planning and coordination of hospital programs with other health care programs.
Mrs. Stimson (Sp)

214B. Theory and Research in Hospital Administration. (2)
Two 1-hour lectures, one 1-hour discussion per week. Prerequisite: course 214A. Limited to graduate students in hospital administration or consent of instructor. An examination of concepts of administrative analysis and the methods and techniques of administrative research.
Mr. Starkweather (W)

214C. Theory and Research in Hospital Administration. (2)
Two 1-hour lectures, one 1-hour discussion per week. Prerequisite: course 214B. Limited to graduate students in hospital administration or consent of instructor. Application of selected concepts and methods of administrative analysis and research relevant to the problems of the hospital through individual student projects.
Mr. D. Holloway (Sp)

One 2-hour lecture per week; individual conferences. Prerequisite: 215A is prerequisite to 215B; 215B to 215C. Limited to nurses enrolled in graduate programs.

215A. Theory and practice in public health nursing administration; nursing functions in public health programs.
Mrs. Hussein, Mrs. Stroud, Miss Archer (F)

215B. Organization and administration of public health nursing services; structure, staffing, control procedures.
Mrs. Hussein, Mrs. Stroud, Miss Archer (W)

215C. Evaluation of public health nursing services, current trends and issues in public health nursing administration.
Mrs. Hussein, Mrs. Stroud, Miss Archer (Sp)

One 2-hour lecture-discussion per week. For M.P.H. students not specializing in Public Health Social Work, or consent of instructor. Analysis of social welfare problems, programs, and issues as related to public health.
Mr. Jackson (Sp)

225A–225B–225C. Problems and Programs in Maternal and Child Health. (2–2–2)
Two 2-hour seminars per week plus conference periods. Prerequisite: previous training in pediatrics or obstetrics, or equivalent experience. Consent of instructor required for other than M.C.H. majors. 225A is prerequisite to 225B; 225B to 225C. Health and social needs of mothers and children. Programs for meeting these needs.
Sequence beginning (F), Miss Wallace, Mr. Jackson

226. Application of Genetics to Public Health. (2)
Two 2-hour lectures per week. Prerequisite: consent of instructor. Basic principles of genetics and recent advances with their application to public health programs.
Mrs. Whissell-Buechy (W)

227. International Maternal and Child Health. (2)
One 2-hour lecture per week. Prerequisite: graduate standing in public health or consent of instructor. Maternal and child health programs outside of the United States. May be repeated for credit.
Miss Winnicka (W, Sp)

231. Communications Research Applicable to Educational Aspects of Public Health. (3)
One 2-hour lecture, one 1-hour laboratory per week. Prerequisite: consent of instructor. Communication theory and research and its application to public health.
Mr. Griffiths, Mrs. D’Onofrio (Sp)

232. Community Organization and Concepts Basic to the Change Process. (3)
One 3-hour seminar per week. Prerequisite: major in public health education or consent of instructor. An examination of social-psychological concepts and theories basic to the practice of public health education, including analysis of community organization process, theory, and research.
Mr. Griffiths, Mrs. D’Onofrio, Mrs. Adler (F)

233. Group Work Procedures in Health Education. (3)
One 1-hour lecture, one 2-hour laboratory per week. Prerequisite: consent of instructor. Social and psychological factors which determine the effectiveness of group work in promoting public health activities.
Mr. Griffiths, Mrs. Ross (F, W, Sp)
234A. Public Health Education: Programs, Planning and Evaluation. (2)
One 2-hour seminar per week. Prerequisite: major in public health education or consent of instructor. Introduction to literature, theory, and current programs in health education.
Mr. Griffiths, Mrs. D'Onofrio, Mrs. Adler (W)

234B. Public Health Education: Programs, Planning and Evaluation. (2)
One 2-hour seminar plus one-half day of field visits per week. Prerequisite: major in public health education or consent of instructor. Planning of educational approaches to public health problems with emphasis on the formulation of objectives, methodology, and evaluation in public health education.
Mr. Griffiths, Mrs. D'Onofrio, Mrs. Adler (Sp)

234C. Selected Topics in Health Education. (2)
One 1-hour lecture and one 1-hour discussion per week. Prerequisite: major in public health education or consent of instructor. Analysis and application of educational approaches in selected areas of public health.
Mr. Griffiths (F); Mrs. D'Onofrio (W, Sp)

238. Advanced Study in Behavioral Sciences in Public Health. (3)
One 2-hour seminar per week and tutorial. Prerequisite: admission to the doctoral public health curriculum or its equivalent and consent of instructor. Advanced study of theory, logic, design, methods and techniques of behavioral science research, with special reference to public health.
Sec. 1, Mr. Knutson, Mr. Buys, Mr. Seiden, Mr. Romanos-V, Mr. McEwen (F, W, Sp)
Sec. 2, Mr. Cahalan, Mr. Room (F, W, Sp)

239A–239B. Proseminar in Behavioral Sciences in Public Health. (3–3)
One 3-hour seminar per week. Either A or B may be taken independently. Current developments in the behavioral sciences as they relate to the solution of public health problems.
Mr. Romanos-V, Mr. Seiden, 239A (W); 239B (Sp)

241. Current Developments in Public Health Nutrition. (3)
Two 1 ½-hour lecture-discussions per week. Prerequisite: previous course work in advanced nutrition or consent of instructor. Critical evaluation of current literature related to public health nutrition problems and implications for new programs and research.
Mr. Enteman (F)

242. Current Concepts in Metabolism and Clinical Nutrition. (2)
One 2-hour lecture per week. Prerequisite: previous course work in biochemistry. Recent developments in biochemical and metabolic aspects of nutrition.
Mr. Harper (W)

Two 2-hour lecture-discussions per week and four hours per week devoted to field work and observation. Prerequisite: admission to curriculum in public health nutrition or consent of instructor. Problems and programs in public health nutrition. Individual field research projects during winter and spring quarters.
Miss Huenemann, Miss Peck, Miss Shapiro 243A (F); 243B (W); 243C (Sp)

244. Program Development in Public Health Nutrition. (2)
One 2-hour lecture-discussion per week. Prerequisite: previous course work in nutrition and biochemistry. Implications of current nutritional findings for public health program planning. Course designed for physicians and other public health workers meeting prerequisite. Miss Huenemann, Mr. Morgen (W)

245. Biochemical Evaluation of Nutritional Status. (2)
Two hours of lecture per week. Prerequisite: Nutritional Sciences 160 and Biochemistry 102 and 102L, or equivalent, or consent of instructor. Evaluation of the biochemical methods presently used to assess the nutritional adequacy of vitamins and other nutrients in humans, including accuracy of methods, specificity, ease of use, apparatus required, and applicability to nutrition surveys.
Mr. Enteman (W)

*249A. Occupational Health Practices. (3)
Two 2-hour lectures per week. Prerequisite: consent of instructor. Advanced concepts in occupational diseases, occupational disease control and administration of occupational health programs.

*249B. Occupational Medical Practices. (3)
One 2-hour lecture, one 5-hour field trip per week. Prerequisite: course 249A. Techniques and standard procedures; special problems.

249C. Industrial Hygiene Practices. (3)
Two 3-hour lecture-discussions per week. Prerequisite: consent of instructor. Advanced techniques in occupational and environmental control.
Mr. Tebbens (Sp)

250. Environmental Health Sciences. (3)
Three 1-hour lectures per week. History, science, and practice of environmental sanitation and environmental control.
Mr. R. Cooper, Mr. Spear, Mr. Wei (Sp)

251A. Environmental Health Sciences: Biological Determinants of Health. (3)
Two 1 ½-hour lectures per week. Prerequisite: consent of instructor. A survey of biologic hazards in the environment which affect man's health, including means of measurement, monitoring and control.
Mr. R. Cooper (F)

251B. Environmental Health Sciences: Chemical and Physical Determinants of Health. (3)
Two 1 ½-hour lectures per week. Prerequisite: course 251A or consent of instructor. A survey of chemical and physical hazards in the environment which affect man's health. Evaluation and control of toxic chemicals in air, water and food. Physical factors affecting health, including noise and electromagnetic energy.
Mr. Wei, Mr. Spear (W)

251C. Environmental Health Sciences: Standards and Management. (3)
Two 2-hour lecture-discussions per week. Prerequisite: courses 251A and 251B, or consent of instructor. Background and development of health standards applied to air, water, and land environments; standards and measurements as administrative tools in environmental management.
Mr. Tebbens, Mr. Oswald (Sp)
252. Mathematical Models in Environmental Health. (3)
Two 1½-hour lectures per week. Prerequisite: Mathematics 16A and 16B or equivalent. Presentation and analysis of a class of mathematical models useful in the study of time varying phenomenon of concern in the environmental health sciences. Applications to problems in toxicology, microbiology, environmental engineering, and industrial hygiene.
Mr. Spear (Sp)

254. Management and Environmental Health and Safety. (2)
One 2-hour lecture-discussion per week. Prerequisite: course 253 or consent of instructor. Policy, organization, and fiscal decisions by management of institutional and industrial programs in environmental health and safety.
Mr. Spear (Sp)

260A. Stochastic Processes in Biology and Health. (4)
Three 1-hour lectures per week. Prerequisite: Mathematics 111 or 123; Statistics 100C; or consent of instructor. Probability generating functions; branching processes and extinction of species; waiting lines and service time; Poisson processes and frequency of illness; general birth processes; effect of migration on population growth; simple stochastic epidemics, birth-death processes; applications.
Mr. Chiang (F)

260B. Stochastic Processes in Biology and Health. (4)
Three 1-hour lectures per week. Prerequisite: course 260A or consent of instructor. Simple illness-death processes; multiple transition probabilities; multiple transition time; Chapman-Kolmogorov equations; applications.
Mr. Chiang (W)

260C. Stochastic Processes in Biology and Health. (4)
Three 1-hour lectures per week. Prerequisite: course 260B or consent of instructor. Kolmogorov differential equations, finite Markov processes; a general model of illness-death processes; migration processes; applications.
Mr. Chiang (Sp)

265A–265B–265C. Environmental Health and Safety. (2–2–2)
One 2-hour lecture-discussion per week. Prerequisite: consent of instructor. 255A or not prerequisite to 255B; 255B not prerequisite to 255C. Principles and theory of the prevention of disease by the control of environmental hazards.
Mr. Spear, 255A (F); Mr. Spear, 255B (W); Mr. Wei, 255C (Sp)

275. Advanced Epidemiology. (3)
Two 2-hour lecture-discussions per week. Prerequisite: prior doctoral degree in biomedical science or consent of instructor. The presentation of epidemiology as a research discipline essential to the description and understanding of the occurrence of disease in human populations. Emphasis is on human ecology as it affects health and disease.
Mr. Winkelstein, Mr. Reeves, Mr. Syme, Mr. Keller (F)

275L. Advanced Epidemiology Laboratory. (3)
Two 3-hour laboratories per week. Prerequisite: course 275. Analysis of epidemiologic data, including data reduction, interpretation, and preparation of summary analyses.
Mr. Keller, Miss French (W)

276. Current Problems in Epidemiology. (3)
One 3-hour lecture-discussion per week. Prerequisite: course 175 or 275 or consent of instructor. May be repeated for credit. Guest lecturers and staff present their current epidemiologic research, emphasizing the bases for development of epidemiologic research programs, methods employed, and difficulties encountered.
Mr. Reeves (Sp)

277. Epidemiology of Arthropod-borne Diseases and Zoonoses. (3)
One 3-hour discussion per week. Prerequisite: prior doctoral degree in biomedical science or consent of instructor. Group discussion of the transmission cycles and methods of laboratory and field investigations unique and pertinent to an understanding of these two groups of infectious diseases.
Mr. Reeves, Mr. Emmons (Sp)
278. Epidemiology of Noninfectious Diseases. (3)
One 3-hour discussion per week. Prerequisite: course 275 or consent of instructor. Analysis and discussion of selected topics illustrating the theory and practice of the application of epidemiologic methods to the study of noninfectious diseases.
Mr. Syme (W)

279. Population Genetics and Epidemiology. (3)
Two 1-hour lectures, one 3-hour laboratory per week. Prerequisite: a basic course in epidemiology and in statistics, or consent of instructor. A course in general genetics is recommended. The intersection of human genetics and epidemiology in relation to human disease.
Mr. Keller (Sp)

280A—280B—280C. Advanced Medical Microbiology. (4—4—4)
One 1-hour lecture, two 3-hour laboratories, one 1-hour discussion per week. Library and laboratory research outside of class period is expected. Prerequisite: course 180A—180B, course 182 and 182L, Bacteriology 202A—202B—202C, or consent of instructor. Studies on the dynamic processes of host-parasite interactions at the cellular and intact host levels with selected bacteria, fungi, and viruses that produce apparent, inflammatory, chronic, granulomatous, or neoplastic infections.
Mr. Medin, Mr. Elberg 280A (F); 280B (W); 280C (Sp)

281. Public Health Immunology. (3)
Three 1-hour lectures per week. Prerequisite: course 180A—180B or equivalent. Immunologic bases underlying diagnostic procedures, active and passive immunization, problems of vaccine development and auto-immune disorders.
Mr. Tempels (Sp)

284. Advanced Methods in Medical Microbiology. (3)
One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 180A—180B or equivalent and consent of instructor. Theory and practice of current methods and techniques applicable to medical microbiology. Experiments will be conducted in fluorescent antibody techniques, preparative and analytical centrifugation, disc electrophoresis and immuno-electrophoresis.
Mr. Tempels, Mr. Heckly (W)

291S. Advanced Medical Virology. (3)
Two 2-hour lectures per week. Prerequisite: course 182 or consent of instructor. Analysis of viral and host factors that contribute to the production of and recovery from viral diseases of medical importance.
Mr. Hardy, Miss Schmidt, Miss Cremmer (W)

294A. Interdisciplinary Study of Current Health Problems. (3)
One 2-hour lecture per week plus conference period and individual and group study (minimum of nine hours per week). Enrollment is limited to 25 graduate students in public health or related fields. Two-quarter sequence recommended. A study of the application of basic principles and processes of problem solving to current health problems with concurrent analysis of studies appearing in the literature by small interdisciplinary student groups.
Mr. Blumberg, Mr. Blum, Mr. Griffiths, Miss Huenemann, Mrs. Hussein, Mr. Oglesby (F)

294B. Interdisciplinary Study of Current Health Problems—Group Study. (3)
Nine hours of group meetings per week. Prerequisite: course 294A or consent of instructor. Interdisciplinary student groups will apply problem solving methodology in a study of current health problems selected by each group under the guidance of resource faculty and the instructors. Oral and written reports are required.
Mr. Blumberg, Mr. Blum, Mr. Griffiths, Miss Huenemann, Mrs. Hussein, Mr. Oglesby (W)

294U. Dynamics of Health Teams. (2)
One 2-hour lecture per week. Prerequisite: consent of instructor. The course examines the roles and education of various health professionals and their function on health teams. The process of team functioning and the implications of using teams for the delivery of health services and utilization of health manpower are analyzed.
Mrs. Horn, Miss Peek, Mr. Oglesby, Mr. Jackson, Miss Sprowles (W, Sp)

294V. Health Behavior: Individual and Community. (3)
Two 1-hour lectures and one 2-hour discussion per week. An introduction to man, culture and society, with implications for public health: the individual, family, group and community life, dimensions of society and community, social behavior, processes of and approaches to behavioral change.
Mr. Knutson, Mr. Griffiths (F)

294W. Voluntary Health Agency Programs. (2)
One 2-hour lecture, one 4-hour field observation per week. A study of administrative structure and functions of voluntary health agencies. Special emphasis on review and analysis of major programs.
Mr. Weddle (Sp)

294X. Issues in the School Health Program. (3)
Two 1-hour lectures and two 1-hour seminar-discussions per week. Prerequisite: graduate standing in the School of Public Health or the School of Education and consent of instructor. Course may be repeated for credit. This course focuses on in-depth investigation of problems, trends, and issues in school health programs and health of the school age child. It covers the major areas of administration, research, instruction, services, and ecology in school health.
Mr. Eisner, Mr. Foord, Miss Peek, Mrs. Hussein, Mr. Weddle (W, Sp)

294Y. Family Planning. (2)
One 2-hour lecture per week plus conference periods. Analysis of selected world programs and research in family planning.
Mr. Gold, Mr. Gustafson, Mrs. Hussein, Mr. Knutson (F)

294Z. Problems and Programs in Mental Health. (2)
One 3-hour lecture-discussion per week. Consideration of the nature and extent of mental illness and current concepts of prevention and treatment through community programs.
Mr. Hume (W)

295. Seminars. (1—4)
The Staff (F, W, Sp)

296. Special Study. (2—8)
Designed to permit any qualified graduate student to pursue special study under the direction of a faculty member.
The Staff (F, W, Sp)
298. Group Study. (1-8) The Staff (F, W, Sp)

299. Individual Research. (1-8) The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. (and other doctoral degrees). May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

Note: The following sections have been established for courses 197, 198, 199, 295 through 299, 601 and 602. The courses may be repeated for credit, but some sections may not be given every quarter.

A. Health Administration
B. Hospital Administration
C. Community Health Nursing Administration
D. Public Health Social Work
E. Maternal and Child Health

6. Public Policy

(Designed Office, 2607 Hearst Avenue)

Professors:
Judith B. Davis, Ph.D.
C. Bartlett McGuire, M.A.
William A. Niskanen, Ph.D.
Allan P. Sindler, Ph.D.
Percy H. Tannenbaum, Ph.D.
Martin A. Trow, Ph.D.
Aaron Wildavsky, Ph.D. (Dean)

Assistant Professor:
Arnold Meltsner, Ph.D.

Assistant Professors:
Eugene S. Bardach, Ph.D.
Robert P. Biller, Ph.D.

Associate Professors:
David L. Kirp, J.D. (Acting)
Gerald Weber, Ph.D. (Acting)

Senior Lecturer:
Frank H. Trinkl, Ph.D.

For further information about the program of the Graduate School of Public Policy, see page 77 of this catalogue. For more detailed information, brochures are available at the Graduate School of Public Policy at 2607 Hearst Ave., Campus.

Undergraduate Courses

181. Ethical Dilemmas in Public Policy (5)
Four hours of lecture per week. Prerequisite: permission of instructor. Selected empirical, normative, and ethical dilemmas, such as policy intervention based on limited knowledge; ethical constraints on research; conflicting concepts of equality; advocacy and analysis; client-oriented professionalism in bureaucracies. Students will have opportunities to pursue relevant topics of concern.

NOTE: For key to footnote symbols, see page 86.
183. Taxes, Politics and Public Policy. (5)
Four hours of lecture per week. Prerequisite: consent of instructor. An introduction to the politics of taxation at both federal and local levels. This course will examine public organization tactics for getting taxes and revenue, tax reform and public tax preferences.
Mr. Meltzner

184. Analysis of Selected Public Policy Issues. (5)
Two 2-hour lectures per week. Prerequisite: consent of instructor. An introduction to policy analysis through the examination of selected public policy issues such as National Health Insurance, Welfare Reform, and Financing Education. Major emphasis will be on economic analysis; however, political, organizational, legal aspects of problems will be considered.
Mr. Weber (F)

185. The Politics of Advice. (5)
Two 2-hour lectures per week. Prerequisite: permission of instructor. Starting with an overview of policy-making processes in the United States, this course examines: functions of advice, who provides it to whom, the conditions under which it is accepted or rejected and the political and bureaucratic environment of policy advising.
Mr. Meltzner (Sp)

186. Population and Public Policy. (5)
Four hours of lecture per week. A general introduction to current population analysis: population growth, "over-population," population problems of mature and developing economies, minority groups, birth control and public policy, international migration, urban demography, the labor force, aging.
Mrs. Davis (Sp)

Graduate Courses

The following courses are open only to students enrolled in the Graduate School of Public Policy.

200A–200B–200C. Introduction to Policy Analysis. (4–4–4)
Two hours of lecture and three hours of section meeting per week. Prerequisite: consent of instructor. This introductory course will integrate various social science disciplines and apply these perspectives to problems of public policy. Throughout the academic term, students will apply knowledge of politics, economics, sociology, and quantitative methods in the analysis of increasingly complex problems. Credit and grade will be assigned upon completion of the sequence. The Staff (F, W, Sp)

205A–205B–205C. Advanced Policy Analysis. (4–4–4)
Three hours of lecture per week. Prerequisite: open only to majors who have completed the core curriculum. Each student will conduct a thorough analysis on a major policy question. In this research, students will apply the interdisciplinary methods, approaches, and perspectives studied in the core curriculum. Credit and grade will be assigned upon completion of the sequence. The Staff (F, W, Sp)

210A–210B. The Economics of Public Policy Analysis. (3–4; 3–4)
Three or four hours of lecture per week. Prerequisite: consent of instructor. Credit and grade will be awarded upon completion of the sequence. This course examines theories of preference, decision under uncertainty, and production as applied to public policy. Market mechanisms are examined as alternatives to direct administrative devices. Current practice in "systems analysis" and organization design will also be studied.
Mr. McGuire (F, W)

Two 2-hour sessions per week. Prerequisite: consent of instructor. This course will examine the political and organizational factors involved in developing new policies, choosing among alternatives, gaining acceptance, assuring implementation, and coping with unanticipated consequences. Materials will include case studies, theoretical, empirical, and interpretive works from several disciplines. Credit and grade will be assigned upon completion of the sequence.
Mr. Kirp, Mr. Meltzner, Mr. Sindler (F, W, Sp)

240A–240B. Decision Analysis, Modeling and Quantitative Methods in Policy Analysis. (4–4)
Two 2-hour sessions per week. Prerequisite: consent of instructor. An integrated course on the use of modeling in policy analysis. Policy studies employ linear and non-linear, static and sequential, and deterministic and stochastic models. Applications of the various approaches are emphasized. Credit and grade will be awarded upon completion of the full sequence.
Mr. Trinkl (F, W)

244A–244B. Research Methods in Public Policy Analysis. (4–4)
Three hours of lecture per week. Prerequisite: permission of instructor. Examination of various methodological approaches in designing, conducting, and interpreting public policy studies; emphasis on techniques for program evaluation, including quantitative methods (e.g., experimental and quasi-experimental designs) and non-quantitative procedures (e.g., legalistic analysis); uses and abuses of social research in policy formation.
Mr. Trow, Mrs. Davis (F, W)

The following courses are open to qualified graduate students from other schools or departments.

251. Approaches to Public Policy Design. (4)
Successful policy design depends partly on the quality of models we use to interpret the origin and dynamics of social pathologies. This seminar surveys several analytical and historical approaches to producing such models and suggests ways to improve the process.
Mr. Bardach (Sp)

252A–252B. The Strategic Environment of Policy Analysis. (4–4)
(Formerly numbered 220A–220B)
Three hours of lecture per week. Prerequisite: consent of instructor. This course is concerned with three political components: 1) the political context of analysis, 2) functions of advice, and 3) client-analyst roles and interaction. The environment of analysis sets a constraint on likely outcomes and also provides opportunities which the analyst can define. Credit and grade will be assigned upon completion of the sequence.
Mr. Meltzner (W, Sp)

Three hours of seminar and one hour of conference per week. Prerequisite: consent of instructor.
The seminar will consider a range of available, and potential models for evaluation of alternative policies for dealing with social problems and ongoing evaluation of a policy once it is adopted and implemented. Experimental, quasi-experimental, and non-experimental procedures will be included. Credit and grade will be assigned upon completion of the sequence.

Mr. Tannenbaum (F, W)

254. Organizational Strategies and Public Policy (4)

Three hours of lecture per week. Prerequisite: permission of instructor. Analysis of public policy implementation strategies for changing, maintaining, building, shrinking, creating, and dissolving public organizations. Emphasis on diagnosis of public policy exigencies and their connection to alternative organizational response strategies, particularly conditions of uncertainty and change. Mr. Biller (W)

255A–255B. Advanced Quantitative Models in Policy Analysis. (4–4)

Three hours of lecture and one hour of conference per week. Prerequisite: consent of instructor. Examination and assessment of the application of static and dynamic models to allocation, organization, and implementation of policy once it is adopted and implemented. Instructor and student interests will determine specific applications. Students will choose substantive issues for individual research and analysis.

Mr. Trinkl (W, Sp)

256A–256B. Advanced Applications of Economic Analysis to Public Policy. (4–4)

Three hours of lecture per week. Prerequisite: consent of instructor. Examines theoretical issues bordering on economics and politics including: 1) collective choice, private preferences, and public interest, 2) voting schemes, 3) organization of governmental services, decentralization, externality, and information, 4) market allocation of government services, direct obligation, and marginal cost pricing, 5) public goods. Credit and grade will be awarded upon completion of the full sequence.

Mr. McGuire (F, W)

257. Implementation and the Policy Processes. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. The process of implementing any new public policy is often attended by delay, the distortion of goals, and minimal results from maximal effort. This course examines the political and organizational factors producing these problems and considers strategies for counteracting them.

Mr. Bardach (Sp)

258. Introduction to the Theory of Public Choice. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. This course introduces the student to the application of economic models to the behavior of political organizations. Topics include the structure and behavior of committees and elections, political parties, constitutions, representative assemblies, federal structures, and bureaus.

Mr. Niskanen (Sp)

261. Policy in Higher Education, (4)

(Formerly numbered 261A)

Three hours of lecture per week. Prerequisite: consent of instructor. This seminar will explore current problems and issues in the public higher education with special attention to the forces that shape public policy in this area. Topics will include the history and structure of higher education, political context, finance, function, and governance.

Mr. Trow, _____ (W)

*263A–263B–263C. Seminar in Mass Communication Policy. (4–4–4)

Three hours of lecture and one hour of conference per week. Prerequisite: consent of instructor. Examination of selected public policy issues involved in the regulation and operation of the mass media. Particular attention will be directed at policy questions stemming from such recent technological innovations as cable television, videotape cassette systems, communication satellites, etc. Credit and grade will be awarded upon completion of the full sequence.

Mr. Tannenbaum (F, W, Sp)

264A–264B. Issues in Mental Health Policy. (4–4)

Three hours of lecture per week. Prerequisite: consent of instructor. A research seminar examining selected policy problems in mental health. Special emphasis on political, organizational, and fiscal problems. Students are encouraged to do field research.

Mr. Bardach (W)

265A–265B. Population Policy. (4–4)

Three hours of lecture per week. Prerequisite: consent of instructor. 265A is not prerequisite to 265B. The nature and goals of population policy in the history of industrial societies. Population quality and social stratification. The politics of population growth. Socio-economic implications of a static population. Population growth and a national resources-environment policy.

Mrs. Davis (F, W)

266A–266B. Seminar in Human Fertility and Public Policy. (4–4)

Three hours of lecture per week. Prerequisite: consent of instructor. 266A is not prerequisite to 266B. Measurement techniques applied to the determination of levels, trends, and differences in fertility. Implicit and explicit policy influences on fertility. Effects of fertility changes on population growth and structure. Fertility programs here and abroad, voluntarism versus coercion.

Mrs. Davis (F, W)

271A–271B. Law and Policy Analysis. (4–4)

Three hours of lecture per week. Prerequisite: permission of instructor. Examines the interrelationship of law (court decisions, legislation, administrative regulation) and policy making. Case studies, drawn from such diverse fields as public education, welfare, and environmental reform, will illustrate the role of law in translating, implementing, and thwarting policy decisions. Credit and grade to be awarded upon completion of the sequence.

Mr. Kirp (F, W)

*280A–280B–280C. Strategies for Emerging Public Policies. (4–4–4)

Three hours of lecture per week. Prerequisite: consent of instructor. A series of courses will examine different policy issues. Origins of the issues, differing perspectives of the major actors, policy alternatives, and feasibility estimates will be analyzed. Class efforts will include designing implementable policy strategies.

280A: Collective Bargaining in Higher Education. Inquiry into impact of collective bargaining in higher education. Class will focus on drafting model enabling legislation for California. Bargaining experience in other states, and perspectives of California actors, legislators, public executives, college faculty and students, administrators will be analyzed.

Mr. Kirp, Mr. Sindler (W)
292. Directed Advanced Study. (1–12)

Prerequisite: consent of instructor and graduate adviser. Open to qualified graduate students wishing to pursue special study and research under direction of a member of the staff.

299. Preparation for the Master's Essay. (4)

Open only to graduate students working toward the Master degree. Credit and grade awarded upon completion of the Essay.

RELIGIOUS STUDIES

Head Adviser: Mr. J. F. Staal; Area I, Buddhist Studies: Mr. L. Lancaster; Area II, Christian Studies: Mr. G. Caspar; Area III, Islamic Studies: Mr. H. Algar; Area IV, Jewish Studies: Mr. J. Milgrom, Mr. R. A. Webster; Area V, Anthropological and Sociological Studies: to be appointed.

The program in religious studies is designed to permit work in depth in a major religious tradition of the student’s choice, with alternative or complementary provision for work in analytical and anthropological or sociological approaches to religion.

The program requirements are intended to give structure, not create ironclad barriers. With the consent of the committee, courses such as some of the sections of History 104, interdepartmental courses, courses given by visiting faculty, etc., may be substituted. The committee annually reviews courses in other departments to determine if they now qualify or have ceased to qualify for inclusion in the program.

Major Program

Three courses, to be taken by all major students: Anthropology 158; Sociology 146; and one of the following courses: Philosophy 112, 152A, 155A.

Courses in one of the following areas as indicated below:

Area I Buddhist Studies Oriental Languages 170, 171; South Asian 127, 131; and three of the following courses, one of which must have a value of 5 units: Art History 136A, 137; History 184A, 184B, 185A, 187A, 188; Oriental Languages 110A, 110B, 110C (Chinese prerequisite), 142; South Asian 121, 160.


Area III Islamic Studies Near Eastern Studies 180A, 180B; History 182A, 182B; and three of the following courses: History 183A; Environmental Design 176; Near Eastern Studies 102A, 102B, 102C (Arabic prerequisite), 182A, 182B.


NOTE: For key to footnote symbols, see page 86.
Recommended for the Major Classes 25; English 116; German 39A; History 4B, 4C, 19A, 19B, 121, 122, 123, 124, 125, 182A, 182B, 183A, 183B; Interdepartmental Studies 44A, 44B, 44C; Italian 39A; Oriental Languages 38; Philosophy 25B; Scandinavian 175.

Graduate courses which may be open to advanced students with the consent of the instructor: Sociology 264; Classics 245A, 245B; Law 265C; Comparative Literature 255A; English 210A, 210B; German 260; Hebrew 202A, 202B, 202C.

Honors Program

The honors program encourages further penetration in one of the specific areas listed above. An honors candidate is expected to write a thesis of distinction under the supervision of a member of the committee on religious studies. Distinguished work in the area of a particular religious tradition will require reading competence in the language of the principal writings of the tradition—e.g., Sanskrit or Chinese for Buddhist Studies; Hebrew or Greek for Christian Studies (the Early Period); Greek or Latin for Christian Studies (the Middle Ages); Latin, German, or French for Christian Studies (The Reformation); Arabic for Islamic Studies; Hebrew for Jewish Studies. A student interested in honors should begin work in the language appropriate to his chosen area as early as possible and preferably in the freshman year.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

120A–B. The Origins of Christianity. (5)

Three one-hour meetings and one hour of consultation per week. The World of the New Testament; the emergence of the Gospels with special attention to Mark, Early Christianity and the theology of Paul. (W, Sp)

*125. Gnosticism. (5)

Five hours of lecture per week. An investigation of Gnosticism, the far-left religion of antiquity, both in terms of the recent discoveries of gnostic writings in Egypt and in terms of the existentialist implications of gnostic mythology.

*131. Indian Buddhism. (4)

Three hours of lecture per week. Introduction to systems of Buddhist thought in India as preserved in Buddhist scriptures, Pali, and Sanskrit. Readings from philosophical texts, Hinayana and Mahayana scriptures. May be repeated once for credit. Content varies from quarter to quarter.

*132. Buddhism as a Religion and Philosophy. (4)

Three hours of lecture per week. The main tenets of Buddhism which are common to all schools are compared with some of the basic assumptions of the present day.

*135. Buddhism and Jainism. (5)

Three 1-hour lectures per week. Introduction to systems of Buddhist thought in India as preserved in Buddhist scriptures, Pali, and Sanskrit. Readings from philosophical texts, Hinayana and Mahayana scriptures. May be repeated once for credit. Content varies from quarter to quarter.

*192. The Lotus of the Good Law. (5)

Four hours of lecture per week. Critical readings (in English) of those chapters of the Sutra which are most significant for the religious life of the Far East.

198. Directed Group Study for Upper Division Students. (1–5)

Two to five hours per week. To be taken on a passed/not passed basis. Tutorial instruction in areas not covered by regularly scheduled courses.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Two to five hours per week. Enrollment is restricted by regulations listed on page 87. Must be taken on a passed/not passed basis.

Mr. Dauge (F, W, Sp)

Required Courses Offered in Departments

Religion and Anthropology, Anthropology 158 (required for all majors).

Islamic History, History 182A–182B (required for Area III).


Introduction to Buddhism, Oriental Languages 170 (required for Area I).

The Development of Buddhism in the Far East, Oriental Languages 171 (required for Area I).

Sociology of Religion, Sociology 146 (required for all majors).

Brahmanism and Hinduism, South Asian 127 (required for Area I).

Indian Buddhism, South Asian 131 (required for Area I).
RESIDENTIAL PROGRAM
(Residential Program Office, 1 Griffiths Hall)

Professors:
Gene A. Brucker,† Ph.D. (History)
William B. Slottman, Ph.D. (History)
(Director)

Associate Professors:
Gerard Caspary, Ph.D. (History)

The Residential Program in History and Literature is an attempt to create a learning community of students and faculty on the Berkeley campus. It stresses small classes, individual student projects, and faculty-student contact. The Program offers interdisciplinary courses in the history, literature, music, and art of Western society before 1900. Residency is generally required for freshmen but otherwise the Program’s courses are open to all undergraduate students.

For further information students should consult the listings under Interdepartmental Studies in the current CLASSES (Schedule and Directory) or call 642-0787.

Courses

See Interdepartmental Studies for the complete description of this course.

IDS 44A–44B–44C, European History and Literature: Topics in the Greco-Roman, Medieval, and Early Modern Background. (5, 7, 10; 5, 7, 10; 5, 7, 10)
See Interdepartmental Studies for the complete description of this course.

RHE TORIC
(Department Office, 2125 Dwinelle Hall)

Professors:
Edward N. Barnhart, Ph.D.
Robert L. Beloof, Ph.D.
Seymour B. Chatman, Ph.D.
Susan Ervin-Tripp, Ph.D.
Don Geiger, Ph.D.
Leonard Nathan,† Ph.D.
Thomas O. Sloan, Ph.D. (Chairman)
Garff B. Wilson, Ph.D.
Richard Hagopian, M.F.A. (Emeritus)
Gerald E. Marsh, M.A. (Emeritus)

Associate Professors:
William J. Brandt, Ph.D.
Janette L. Richardson, Ph.D.
Todd G. Willy, Ph.D.

Assistant Professors:
Julia Bader, Ph.D.
Thomas Conley, Ph.D.
Arthur J. Quinn, Ph.D.
Clark C. Smith, Ph.D.

Assistant Professors:
Robert S. Leichtner, J.D. (Acting)
Raymond A. Macdonald, J.D., M.A. (Acting)
Daniel Melia, Ph.D. (Acting)
Randall D. Morrison, J.D. (Acting)
Roland F. Wacker, J.D., M.A. (Acting)

Lecturers:
David Schwalm, Ph.D.
Fred S. Stripp, Th.D.
Ward E. Tabler, A.B., L.H.D. (Hon.)

Departmental Major Advisers: Mr. Conley, Mr. Melia, Mr. Schwalm, Mr. Willy.

Graduate Adviser: Mr. Quinn.

NOTE: For key to footnote symbols, see page 86.
The Department of Rhetoric offers the student a program of study that concentrates on developing his sensitivity to a wide variety of discourse. Rhetoric 1A–1B provides the student with tools for close analysis and for writing argument. Rhetoric 2–3–4, Oral Interpretation of Literature, introduces the student to practical training in the relation between critical reading and oral performance. Upper division courses develop methods for analyzing a broad spectrum of human utterance—political, literary, cultural, and theoretical. Graduate courses deal with the history of rhetorical theory and special topics appropriate for advanced study.

**Major Program** The following lower division courses are required of all major students: Rhetoric 1A and 1B, 2, and either 3 or 4. Rhetoric 10 is required of all students who fulfilled the reading and composition requirement outside this department. Forty upper division units from courses numbered 111 through 198 are required in the major; all majors are required to include 111 and 117. A maximum of five units of Directed Group Study (Rhetoric 198) may be allowed toward completion of the major on prior approval of the major adviser.

**Passed or Not Passed** No course taken passed or not passed may be used to satisfy a requirement for the major.

**Honors Program** Students majoring in rhetoric who have an overall grade-point average of 3.0 or better may enroll in the honors course H195A–H195B either for one or two quarters. One of the requirements for graduation with honors, however, is completion of both quarters of the honors course. This course is designed to give students in the major an opportunity to work closely with a professor in a seminar situation on a project of breadth and depth. Two extensive papers are required. For details consult major advisers.

**Major Advisers** The program of each major is carefully planned in conference between student and adviser. For assignment to an adviser consult the department office.

**Graduate Program** The Department of Rhetoric offers programs leading to both the M.A. and Ph.D. degrees. Students are currently admitted to the graduate program in the fall quarter only. The first three to five quarters are spent preparing for the M.A. oral examination, a 1½-hour examination covering the major areas of study within the department. All courses in the 202 and 210 series are required of all first year graduate students. For the M.A. a total of 36 units of course work are required. There are no specific requirements beyond the M.A. for the Ph.D. degree. Individual programs for all graduate students are carefully planned in conference with the graduate adviser.

**Teacher Training** There are opportunities for majors of senior standing to assist professors in teaching certain courses through a special tutorial program. Ample opportunities for direct classroom experience are available to graduate students through the 300 course series. For further details consult the department office or the undergraduate and graduate advisers.

*Letters and Science List:* for regulations governing this list, see the Announcement of the College of Letters and Science.

**Lower Division Courses**

1A–1B. The Craft of Writing. (5–5)

Four and a half hours of meeting per week. Prerequisite: a passing grade in Subject A examination or course. Rhetorical and argumentative analysis through written themes and class discussion. This course satisfies the breadth requirement in reading and composition for the College of Letters and Science. Honors sections will usually be offered each quarter. Sequence beginning each quarter.

The Staff (F, W, Sp)

2. Fundamentals of Oral Interpretation. (5)

Four and a half hours of meeting per week. The use of oral performance as a critical instrument in the rhetorical analysis of literature. The literature is primarily, though not exclusively, lyric poetry.

The Staff (F, W, Sp)
3. Fundamentals of Rhetoric. (5)

Four and a half hours of meeting per week. Pre-requisite: course 2. A continuation of Rhetoric 2. Rhetoric 3 will expand the principles acquired in Rhetoric 2 into narrative and dramatic genres.

The Staff (F, W, Sp)

4. Readers Theatre. (5)

Four and a half hours of meeting per week. Pre-requisite: Majors course 2; Non-majors: consent of instructor. This course is designed primarily for students who need intensive work in the principles and techniques of oral performance. Class time will be devoted primarily to group performances of various literary genres.

The Staff (F, Sp)

5. Readings in Contemporary Poetry. (5)

Four and a half hours of meeting per week. Discussion and readings of poets such as Stafford, Creeley, Wright, and Dickey. No examinations, one paper.

Mr. Nathan (Sp)

10. Argumentative Writing. (5)

Four and a half hours of meeting per week. Intensive practice in the techniques of writing prose argument. Required of those students who wish to complete a major in Rhetoric and who did not take Rhetoric 1A–1B. This course satisfies the advanced writing requirement for the teaching credential.

The Staff (F, W, Sp)

31. The Language of Popular Culture. (5)

Four and a half hours of meeting per week. An introduction to contemporary popular culture through an analysis of its rhetoric. Emphasis on popular non-fiction.

Mr. Quinn

32. The Language of Film. (5)

Four and a half hours of meeting per week. An introduction to film. Emphasis on techniques and strategies of film making, particularly as to how film-makers employ images, symbols, and sequences to achieve their ends. An examination of a number of classic films in lectures and discussion.

Miss Bader, Mr. Chatman

33. The Language of the Novel. (5)

Four and a half hours of meeting per week. An introduction to the rhetorical features of the modern novel, with emphasis upon determining the author-audience relationships which control its form. Attention paid to both popular and literary works.

Mr. Willy (W)

36. The Anatomy of Argument. (5)

Four and a half hours of lecture per week. Principles of analyzing arguments. Emphasis on problems of evidence, inference, induction, deduction, semantic arguments, arguments from authority, and rhetorical terms. Students will be prepared to recognize manipulative elements of arguments of diverse forms, i.e., written, oral, or as experienced in electronic media.

The Staff

45. Public Speaking. (5)

Four and a half hours of lecture per week. Designed for sophomores, but open to students in the upper division. Intensive work, in conjunction with study of significant contemporary political and social issues, in the essentials of public speaking and the forms of public address. Platform theory and practice; principles of oral style.

Mr. Stripp, Mr. Tabler (F, W, Sp)

RHETORIC / 471

Upper Division Courses

105. Debate. (3)

Four and a half hours of meeting per week. Designed for those who wish to participate in inter-collegiate debate. May be repeated for a maximum of 9 units.

Mr. Stripp, Mr. Tabler (F, W, Sp)

106. Oral Interpretation of Poetry and Prose. (5)

Four and a half hours of meeting per week. Pre-requisite: primarily for candidates for teaching credentials whose major is English; others admitted with consent of instructor. Not open to students who have taken course 2A or 2B. Study in rhetorical theory of poetry and prose, with particular reference to the problem of persona in relation to the proper understanding and oral communication of the main literary forms. Principles of effective oral reading; practice in platform performance.

The Staff (F, W, Sp)

108. Psychology of Belief. (5)

Four and a half hours of lecture per week. Introduction to the psychology of racial prejudice, ideological commitment, and religious belief, largely based on psychoanalytical theory, and applied to the argumentative and rhetorical analysis of discourse.

Mr. Barnhart (W)

109. Analysis of Communication Content. (5)

Four and a half hours of lecture per week. Research techniques in communication, with special emphasis on content analysis and audience response, supervised individual and group research.

The Staff (F)

110. Advanced Writing: Argument and Discourse. (5)

Four and a half hours of meeting per week. Pre-requisite: any 1A–1B sequence, upper division standing or permission of instructor. Designed for candidates for the general elementary and/or secondary credential, and other non-majors. Intensive work in writing to persuade, mainly on topics of current concern. Will not fulfill major requirements but satisfies the advanced writing requirement for the teaching credential.

The Staff (F, W, Sp)

Rhetorical Theory

111. Aristotle and Classical Rhetoric. (5)

Four and a half hours of meeting per week. A survey of the development of rhetorical theory up to Aristotle and from Aristotle to Quintilian. Literary and political documents will be considered in addition to the theoretical writings to which most of the attention of the course will be paid.

The Staff (F, Sp)

112. Modern Rhetorical Theory. (5)

Four and a half hours of meeting per week. A close reading of the works of those modern students of language whose point of view can be described as rhetorical—Richards, Burke, Cassirer, and others.

Mr. Conley

113. The Philosophy of Rhetoric. (5)

Four and a half hours of meeting per week. The presuppositions, largely epistemological and psychological, which underly a rhetorical approach to discourse. Considerable attention will be paid to the post-Kantian epistemology and psychology, although the positions developed by the classical rhetoricians themselves will be evaluated. Mr. Brandt, Mr. Willy
115. Rhetoric and Aesthetics. (5)
Four and a half hours of meeting per week. Problems and issues in theory of poetic speech. Special attention to conceptions of speaker, situation, intention, language, meaning, form, poetic persuasion and knowledge. Specific poems for examination.
Mr. Geiger (W)

117. Rhetorical Theory and Practice. (5)
Four and a half hours of meeting per week. An introduction to rhetorical analysis, designed to familiarize the student with the basic concepts and terms of the discipline. Emphasis will be upon argumentation, but other forms of discourse will be examined.
Mr. Brandt and the Staff (F, Sp)

Rhetoric and Literary Forms

121. The Rhetoric of the Novel. (5)
Four and a half hours of meeting per week. An examination of the articulation of selected novels, working from an identification of basic contrastive units to gross structure, directed toward an understanding of the relationship of structure to meaning.

122A-122B-122C. Rhetoric of Drama. (5-5-5)
Four and a half hours of meeting per week. A consideration of the way character is created in drama by repetitive rhetorical patterns and the way themes are defined by the manipulation of such patterns. These courses need not be taken sequentially.
A. Aristophanes. Mr. Conley
B. Shakespeare and the Seventeenth Century. Mr. Brandt
C. Theatre of the Absurd. Miss Bader

123. Narrative Structure in Fiction and Cinema. (5)
Four and a half hours of meeting per week. The nature of narratives, including tales, novels, short stories, historical accounts, etc., as reported in literature and in the cinema. The structures of plot, character, setting, point-of-view, and related matters.
Mr. Chatman (W)

124. Rhetoric of Poetry. (5)
Four and a half hours of meeting per week. A consideration of the relationship between the texture of poetic discourse largely defined by figures of speech and overall poetic structures.
Mr. Brandt

125. The Rhetoric of the Essay. (5)
Four and a half hours of meeting per week. A consideration of the development of the modern essay, from Carlyle to the present, as a new rhetorical genre, developed in response to the breakdown of late eighteenth-century theories of persuasion.
Mr. Willy

126. Rhetoric of Symbolism. (5)
Four and a half hours of meeting per week. Prerequisite: consent of instructor. The functions of language in literature, especially poetry; the literary symbol; the nature and function of figures of speech. Limited to thirty students; rhetoric majors to have preference.
Mr. Beloei

127. Rhetoric and Stylistics. (5)
Four and a half hours of meeting per week. Prerequisite: Speech 20 or consent of instructor. A native command of English or its equivalent is necessary. The concept of style as pattern of individual choices among the array of linguistic features permitting choice; exercises in delineating the styles of famous authors.
Mr. Chatman

129. Rhetorical Stance in Lyric Poetry. (5)
Four and a half hours of meeting per week. Analytic and constructionist implication for interpretation of short poems considered as the utterances of dramatic speakers.
Mr. Geiger

Rhetoric and Politics

141. Issues in Legal Argument. (5)
Four and a half hours of lectures per week. An investigation of appellate opinions and of briefs in cases currently on appeal to the California Supreme Court in order to discover and evaluate "issues" as a key to understanding argument. The course concentrates on means by which issues are manipulated in the process of appeal.
The Staff

142A-142B. Freedom of Speech. (5-5)
Four and a half hours of meeting per week. Prerequisite: 142A or consent of instructor is a prerequisite to 142B. Critical and historical analysis of the main theories and justifications of freedom of expression developed in England and the United States, and of the factors and tests determining its scope and practical exercise. The second quarter involves intensive studies of selected problem areas such as loyalty and security, time, place, and manner, and the political rights of political employees.
Sequence course. The Staff

143A. Rhetoric of Political Discourse: Seventeenth-Century English. (5)
Four and a half hours of meeting per week. An examination of the construction of meaning in speeches and essays by the manipulation of figures and logical devices.
Mr. Brandt

143B. Rhetoric of Political Discourse: Eighteenth-Century English. (5)
Four and a half hours of meeting per week. An assessment of rhetorical strategies in the Georgian Parliament and press; emphasis on conceptions of Eloquence and their relevancy to 18th century political thought.
Mr. Schwalm

143C. Rhetoric of Political Discourse: Eighteenth- and Nineteenth-Century American. (5)
Four and a half hours of meeting per week. Critical analysis of the rhetorical practice in the United States from the late colonial period until the Reconstruction. Special emphasis on political and religious agitation.
Mr. Willy

143D. Rhetoric of Political Discourse: Twentieth-Century American. (5)
Four and a half hours of meeting per week. Writings and speeches of modern spokesmen for major contemporary movements; problems of ideology and ideological conflict, with a special emphasis on the comparison of intellectual perspectives from the realms of politics, social science and culture.
The Staff

144. Legal Language. (5)
Four and a half hours of meeting per week. Prerequisite: course 1A-1B, and a course in rhetorical theory, or consent of instructor. Reading of legal
briefs and opinions to investigate their rhetorical characteristics and how those characteristics function in determining conceptions of justice. Attention is centered on opinions of California appellate courts in both Federal and State Supreme courts in civil and criminal cases.

The Staff

145. Rhetoric of Nineteenth-Century Imperialism. (5)

Five hours of lecture per week. Analysis of the rhetorical patterns in official and public documents relating to English, French, and German imperial expansion policies in the latter half of the 19th century. Special attention to Middle Eastern and African spheres of interest.
Mr. Willy (Sp)

146. Political Rhetoric in Nineteenth-Century Fiction. (5)

Five hours of lecture per week. Investigation of major 19th century European and American works of fiction in which political stances are exploited as dominant themes. Close reading of authorial viewpoints and rhetorical strategies in plays, novels, and poetry of the period.
Mr. Willy (F)

147. Political Rhetoric in Twentieth-Century Fiction. (5)

Five hours of lecture per week. Rhetorical analysis of contemporary world fiction dealing with political ideologies and preconceptions. Particular consideration paid to popular Japanese, German, Russian, American, and French novels.
Mr. Willy (W)

148. Rhetoric of Modern Continental Ideologies. (5)

Five hours of lecture per week. Rhetorical delineation of formal ideological structures as they appear in modern novels, speeches, and political tracts. Emphasis upon readings in Fascism, Communism, Liberalism, and Socialism as the latter emerged between 1890 and 1945.
Mr. Willy (Sp)

Culture and Rhetoric

151A–151B–151C–151D. Ethos and Audience. (5-5-5-5)

Four and a half hours of meeting per week. Consideration of the special problems of an author's or speaker's presentation of himself in relation to the character of his intended audience. Sections devoted to documents of various historical periods.
A. Renaissance. Miss Richardson
B. Eighteenth century. Mr. Schwalm
C. Nineteenth century. Mr. Smith
D. Twentieth century. Miss Bader

152. Language and Society. (5)

Four and a half hours of meeting per week. Pre-requisite: Rhetoric 20 or consent of instructor. The structure of speech in face-to-face interaction, in relation to participants, situation, functions of communication. Speech diversity and types of discourse in large societies.
Mrs. Ervin-Tripp (Sp)

153. Cultural Patterns of Discourse. (5)

Four and a half hours of meeting per week. Pre-requisite: Rhetoric 20 or consent of instructor. Case studies from contemporary societies, literate and nonliterate.

The Staff

154. Rhetoric of Medieval Genres. (5)

Four and a half hours of meeting per week. Examination of the way in which various rhetorical principles and patterns inform such medieval modes of expression as allegory, romance, fabliau, sermon, saints' legend, etc.
Miss Richardson

155. Language Across Cultures. (5)

Four and a half hours of meeting per week. Pre-requisite: Rhetoric 20 or consent of instructor. A native command of English or its equivalent is necessary. Phonological, grammatical and semantic problems in learning English, language learning theory, construction and validation of materials; evaluation of competence; cross-cultural and cross-linguistic comparisons.
Mrs. Ervin-Tripp (W)

156. Language Development. (5)

Four and a half hours of meeting per week. Pre-requisite: Rhetoric 20 or consent of instructor. Theory and research on children's acquisition of their native language including the sound system, grammatical structure, basic semantic categories, and social aspects of usage.
Mrs. Ervin-Tripp (W)

157. The Rhetoric of Crisis. (5)

Four and a half hours of meeting per week. A study of the diplomatic language, formal and informal, generated by opposed interests where some sort of conflict was threatened or was actually the outcome. The rhetoric of selected conflict-situations will be studied in detail.
Mr. Brandon, Mr. Willy

158. Legal Trial and Its Cultural Context. (5)

Four and a half hours of meeting per week. Pre-requisite: course 1A–1B or equivalent. The legal trial, explored historically, structurally, and functionally, will be studied rhetorically as an institutionalized mode of handling confrontations between individuals and social, economic, and political ideologies and attitudes.
The Staff

159. Law and Social Institutions. (5)

Four and a half hours of meeting per week. Pre-requisite: course 1A–1B or equivalent. An examination by rhetorical methodologies of the interaction between courts, and social forces and institutions. Attention is given to specific extralegal historical developments and their roles in changing legal doctrines and practice, and to the relationship between both historic and legal documents.
The Staff

160. Rhetoric and Translation. (5)

Four and a half hours of meeting per week. Pre-requisite: upper division standing, a reading command of a second language or instructor's approval. Studies in the problems of bringing texts from the original into a receiving language with special reference to questions of cultural, temporal, and linguistic differentials, and of the various means available for bridging them. Lectures and class discussions.
The Staff

161A–161B–161C. Rhetorical Dimensions of Declarative Discourse. (5-5-5)

Four and a half hours of meeting per week. Pre-requisite: upper division standing, course 1A–1B; or consent of instructor. Studies in the rhetorical limitations and the discreetness of modern declarative (as distinct from primarily suasive and epideictic) genres
A. Philosophical Discourse. Mr. Quinn
B. Scientific Discourse. Mr. Quinn
C. History. The Staff
162. Rhetoric and the Media. (5)

Four and a half hours of meeting per week. 
Prerequisite: upper division or course 1A–1B or consent of instructor. Analysis of how content of communication is adapted to the particular medium through which it is transmitted. Emphasis on identifying special characters of different media and the rhetorical principles most appropriate to each. Will explore various ways to extend traditional rhetorical theories to the electronic media. 

Rhetoric and Performing Voice

171. The Lyric Mode. (5)

Four and a half hours of meeting per week. 
Prerequisite: course 2A–2B or consent of instructor. Qualities of the various lyric modes developed through oral reading: advanced study of the traditional lyric voices in the major American and English literary periods. 
Mr. Sloan (F)

172. The Narrative and Dialogic Mode. (5)

Four and a half hours of meeting per week. 
Prerequisite: course 2A–2B or consent of instructor. Same as course 171 but with reference to the narrative and dialogic voices as developed in both poetry and prose. 
Mr. Beloof (W)

173. Oral Interpretation of Drama. (5)

Four and a half hours of meeting per week. 
Prerequisite: course 2A–2B or consent of instructor. A critical study of the dramatic mode of literary discourse and of the problems involved in the oral presentation of such discourse by a single performer. The specific material is an intensive study of the theory and form of tragic drama as illustrated by selected plays from the Greek, Shakespearean, and modern periods and by selected critical writings from Aristotle to Arthur Miller. 
Mr. Wilson (W)

175. Group Interpretation of Literature. (5)

Four and a half hours of meeting per week. 
Prerequisite: 173. Achievement of literary meaning through group interpretation of literary texts. 

181. The Practice of Poetry. (3)

Four and a half hours of meeting per week. 
Prerequisite: course 2A or 106, and course 117, or consent of instructor. An approach to composing poetry involving the concept of voice. Students will be expected to read their work aloud and criticism will be in large measure directed to questions of effective tonality in terms of the writer's intentions. 
Mr. Beloof

190. Senior Proseminar. (1–5)

Prerequisite: required for and limited to seniors in the communication and public policy major. Intensive reading, discussion and individual research on topics relating to the field of the major. 
Mr. Barnhart (Sp)

H195A–H195B. Honors Course. (5–5)

Prerequisite: Rhetoric majors, senior standing, and on the honors list. A special program which may be substituted for 10 units of the major requirement with the approval of the major adviser. Sequence course. 
The Staff (Mr. Brandt in charge) (W, Sp)

H196A–H196B. Honors Course, Communications and Public Policy Major. (5–5)

Prerequisite: communication and public policy majors, senior standing, and on the honor list. Special studies in the field of the major with emphasis on sociological aspects. Sequence course. 
Mr. Barnhart (F, W)

198. Directed Group Studies for Upper Division Students. (1–5)

The Staff, Mr. Nathan in charge (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not-passed basis. Additional limitations; overall grade-point average of at least 3.0. Cannot be used to satisfy the major requirement. 
The Staff (F, W, Sp)

Graduate Courses

A prerequisite for all graduate courses is graduate status and approval of the graduate adviser.


Four and a half hours of lecture per week. Problems in the scope, applications, and divergencies of western theory and practices of rhetorical invention, ethical and aesthetic criteria of invention theory. This course is normally required of all graduate students.

A. to 400 A.D. 
Mr. Conley (F)
B. 400–1700. 
Mr. Brandt (W)
C. 1700 to the present. 
Mr. Willy (Sp)

210A–210B. History of Oral Literature and Oral Interpretation. (3–3)

Two hours of lecture per week. Research problems in the distinctive nature of oral literature with emphasis on the oral compositional aspects of the epic tradition; the shifting role of oral communication as literature changes from oral composition, to written composition, to printed transmission. Credit and grade will be awarded upon completion of the full sequence. 
Mr. Sloan and Staff (F, W, Sp)

211. Contemporary Theory of Interpretation. (5)

Four and a half hours of lecture per week. Contemporary approaches to interpreting literary structure and meaning, including assessment of the interpretive function of performance. 
Mr. Geiger

213A–213B. Methodology of Oral Interpretation: Individual Authors. (5–1)

Intensive study of the oral implications in the works of specific authors by means of an extensive examination of their canon. Students must complete both parts of the sequence. Credit and grade will be awarded upon completion of the full sequence. 
Mr. Geiger and the Staff

215. Explication and Oral Interpretation. (5)

Five hours of lecture per week. Studies in the value and limitations of close textual analysis for the interpreter, with emphasis on twentieth century critical apparatus and texts. 
The Staff

217. Poetics and the Lyric Voice. (5)

Five hours of lecture per week. Investigations into the changing notions of "natural" voice—"tone of voice"—in individual works; its general relation to contemporaneous poetic theory. 
Mr. Nathan and Staff
221. Prosody and Oral Communication. (5)
Five hours of lecture per week. Problems in the aesthetic usage of metrics and rhythm, the history of metrics, and the relationship of metrics to oral transmission of poetry.
Mr. Beloff

225. Oral Tradition in Poetry. (5)
Four and a half hours of lectures per week. Advanced studies in the modes of oral composition of poetry, with special emphasis on similarities and differences in different traditions.
Mr. Sloan

231. Rhetoric and Rhetorical Criticism: Ancient Rome. (5)
Five hours of lecture per week. Prerequisite: competence in Latin. Rhetoric in ancient Rome, both as expounded by theorists and as it permeated various forms of Latin discourse. Miss Richardson

232. Rhetoric and Rhetorical Criticism: The Middle Ages. (5)
Five hours of lecture per week. Prerequisite: an elementary knowledge of Latin. Rhetoric in the Middle Ages, both as expounded by medieval rhetoricians and as practiced by medieval writers.
Miss Richardson

234A-234B. Rhetoric and Poetics in the Middle Ages and Renaissance. (5-1)
Examination of the developing connections between rhetorical theory and aesthetics, particularly poetics, in the Middle Ages and Renaissance, with attention to the consequences for poetic practice. Credit and grade will be awarded upon completion of the full sequence.
Mr. Conley

238. Rhetoric and Civilization. (5)
Five hours of lecture per week. Conflicting theories and modes of rhetoric in periods of cultural transition. Mr. Willy

242A-242B. Rhetoric and Perception in the Seventeenth Century. (5-1)
Investigation of modes of thought in the seventeenth century through close analysis of its rhetoric. The major forms of discourse characteristic of the period will be considered. Students must complete both parts of the sequence. Credit and grade will be awarded upon completion of the full sequence.
Mr. Brandt (W, Sp)

246. Studies in Legal Rhetoric. (5)
Four and a half hours of lecture per week. The nature and function of rhetorical analysis as a technique for the examination of legal materials.
The Staff

252. Advanced Stylistics. (5)
Five hours of lecture per week. A linguistic specification of literary style: phonostylistics of "schemes" and meter, stylistic choice in grammar (particularly syntax), in vocabulary (diction, "tropes" and related phenomena), and in discursive structure.
Mr. Chatman (Sp)

253. Style and Discourse. (5)
Four and a half hours of lecture per week. The several definitions of style (ornament, linguistic surface, individual manner, decorum, relation of speaker to audience) and how these fit together with theories of rhetoric. A consideration of the actual features selected by which style reveals itself (semantic, syntactic, etc.). Mr. Chatman (F, W, Sp)

254. Advanced Narrative Analysis. (5)
(Formerly numbered 257)
Four and a half to five hours per week. Modern theories of narrative structure, in the tradition of Continental (Russian Formalist and French Structuralist) thinking, as well as Aristotelian and Neo-Aristotelian schools and independent theorists like James, Lubbeck, and Forster.
Mr. Chatman

255. Advanced Contrastive Language Analysis: English as a Second Language. (5)
Five hours of lecture per week. Phonological, grammatical and semantic contrastive analysis; the diagnosis of bilingual interference; preparation of instructional devices based on contrastive analyses.
Mrs. Ervin-Tripp (F)

Five hours of lecture per week. Advanced study of selected problems of speech comprehension, production, and usage. Topics vary from year to year.
Mrs. Ervin-Tripp (Sp)

266. Values and World View: Cultural Bases of Communication. (5)
Five hours of lecture per week. Structural analysis of cultural patterns of communication; cultural dynamics of speech behavior; criteria of credibility in different cultures; relations of verbal to non-verbal behavior.
The Staff

268. Advanced Studies in the Rhetoric of the Novel. (5)
Four and a half hours of lecture per week. An intensive study of the novel, with attention to its broad structure and component elements and the relationships between author, narrator, work, and audience, directed at the examination of various strategies used as modes of meaning and, ultimately, persuasion.
The Staff

270A-270B. Research Seminars in Rhetorical Theory. (A-1; B-5)
One to five hours of lecture per week. Prerequisite: completion of M.A. Oral Examination in Rhetoric. Intensive study of the theory and practice of a single rhetorician or of a rhetorical movement. Offerings vary from year to year. Students should consult the department's announcements for offering in the current academic year. May be repeated for credit.
The Staff (Mr. Sloan in charge) (F, W, Sp)

295. Special Study. (1-5)
One to five hours of lecture per week. Prerequisite: graduate status and approval of graduate adviser. Open to qualified graduate students who wish to pursue special studies and research under the direction of a member of the staff. May be repeated for credit to a total of ten units. The Staff (F, W, Sp)

299. Directed Research. (1-6)
One to six class hours per week. Prerequisite: Graduate status and approval of graduate adviser. Open to qualified graduate students who wish to pursue special studies and research under the direction of a member of the staff. Primarily for students engaged in preparation of the doctoral thesis.
The Staff (F, W, Sp)

300. Problems in Teaching Rhetoric. (1-5)
Prerequisite: graduate students and others by consent. A: Oral Interpretation; B: Argumentative Composition; C: Speech Sciences; D: Rhetoric. The course may be repeated in different sections. Ac-
cepted in partial satisfaction of the unit requirement
in education for the general secondary credential.
The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1–8)
Individual study for the comprehensive or lan-
guage requirements in consultation with the field
adviser. Units may not be used to meet either unit
or residence requirements for a master's degree.
Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

ROMANCE PHILOLOGY

Professors:
Yakov Malkiel, Ph.D.
Francis J. Carmody, Ph.D. (Emeritus)
Manfred M. G. Sandmann, Ph.D. (Emeritus)
Ronald N. Walpole, Ph.D. (Emeritus)

Graduate Adviser: Mr. Stefanini (F, W, Sp)

Graduate Courses

*200. Linguistic History of the Roman Empire. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. The spread of Latin over the
Western Mediterranean area, and its gradual change
into the Romance dialects, with emphasis on sub-
strata and superstrata.
Mr. Malkiel (F)

*201. Late Latin Language and Literature. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. The internal history of collo-
quial Latin and Late Latin, down to the Carolingian
period, on the basis of original sources.
Mr. Malkiel (F)

202. General Romance Linguistics. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. Problems of methodology in
historical linguistic reconstruction, applied to the
major and minor Romance languages.
Mr. Malkiel, Mr. Craddock (W)

*203A–203B–203C. Old Provencial (4–4–4)
Three hours of lecture per week. Prerequisite:
consent of instructor. An introductory study of Old
Provençal language and literature, with emphasis on
questions of cultural origins and influences.
Mr. Faulhaber (F, W, Sp)

*204. Humanistic Literature in Latin. (2)
Prerequisite: a working knowledge of Latin and
consent of instructor. A study of the growth of Hu-
manism through the reading and interpretation of
selected Latin texts from Alcuin to Erasmus.

*205. Romance Dialect Geography. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. Methods of interpreting lin-
guistic atlases and of using them as a basis for
various types of dialectological studies.
Mr. Malkiel (Sp)

*206. Medieval Latin and Romance Learning. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. Interpretation of original texts
in Latin, Old French, and Old Spanish, and the
cultural problems involved in their translation.

Associate Professors:
Jerry Craddock, Ph.D.
Buggero Stefanini, Dottore in Lettere

Assistant Professor:
Charles B. Faulhaber, Ph.D.

*207. Peninsular Spanish Dialectology. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. Problems and methods in the
study of the Spanish linguistic areas, in diachronic
and synchronic projection.
Mr. Craddock (Sp)

*208. Romance Etymology. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. Assumptions and techniques
in the study of Romance etymology.
Mr. Malkiel (F)

*209. The Ancient Languages of the Northern
Mediterranean. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. Reconstruction of archaic Medici-
terranean cultures through the analysis of linguistic
substrata, with special attention to Romance-speaking
areas.
Mr. Stefanini (Sp)

211. Highlights in the History of Romance
Linguistics. (4)
Three hours of lecture per week. Prerequisite:
consent of instructor. The major schools and scholars that
dominated the scene over a century and a half
(1800–1950) and the vital problems raised by them.
Mr. Malkiel (F)

*212. Seminar in Albanian Language, Literature,
and Folklore. (2)
Two 1-hour lectures. General survey and indi-
vidual research projects in the field of Albanian,
with special reference to Albania's links with Latin
and Romance culture.

299. Special Advanced Study. (1–4)
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major
field adviser, intended to provide an opportunity
for qualified students to prepare themselves for the
various examinations required of candidates for the
Ph.D. May not be used for unit or residence re-
quirements for the doctoral degree. Must be taken on
a satisfactory/unsatisfactory basis.
The Staff (Mr. Stefanini in charge) (F, W, Sp)

NOTE: For key to footnote symbols, see page 86.
Related Courses in Other Departments

The Age of Chaucer (English 155).
The Medieval Mind (English 220).
Historical Grammar (French 201A–201B–201C).
French Syntax (French 203A–203B).
Reading and Interpretation of Typical Old French Text (French 206A–206B).
Gothic (German 265).
Italian Literature of the Thirteenth and Fourteenth Centuries (Italian 110A–110B).
Italian Syntax and Lexicon (Italian 200).
Historical Grammar (Italian 201A–201B).
Early Italian Texts (Italian 202).

History of the Italian Language (Italian 205).
Elementary Phonology and Grammar (Linguistics 100).
Phonetics and Phonemes (Linguistics 130).
Introduction to Indo-European Comparative Grammar (Linguistics 150).
Romance Historical Phonology, Inflection, Derivation (Linguistics 235, 236, 237).
Introduction to Spanish Linguistics (Spanish 100).
Early Spanish Literature (Spanish 200A–200B–200C).
The Ballad (Spanish 208A–208B–208C).
Old Spanish (Spanish 212A–212B).
History of the Spanish Language since the Middle Ages (Spanish 217).

SCANDINAVIAN

(Department Office, 1305 Dwinelle Hall)

Professor:
Eric O. Johannesson, Ph.D.

Associate Professors:
James L. Larson,† Ph.D.
Lars C. Lönnroth, Ph.D.

Børge Gedsø Madsen, Ph.D.
Gregory P. Nybo, Ph.D.

Assistant Professor:
John F. Lindow, Ph.D. (Acting)

The Department of Scandinavian offers undergraduate majors in three Scandinavian languages, Danish, Norwegian, and Swedish, and courses in English in Scandinavian literature, ancient and modern. A graduate program offering work leading to the M.A. and Ph.D. degree is also available.

The Major

Lower Division  4 courses from the following course sequences: Scandinavian 1A–1B; 3A–3B; 4A–4B; 11A–11B; 13A–13B; 14A–14B; or the equivalents.

Upper Division Courses  10 upper division courses, including at least two of the following sequences: Scandinavian 101A–101B, 103A–103B, 104A–104B, 141A–141B, 143A–143B, 144A–144B. A course in composition, Scandinavian 151, 153, or 154, is also required.

Honors Program  Students must complete with distinction the courses required for the major as well as three quarters of course H195. A thesis is also required.

Graduate Degrees

For information regarding admission to the graduate program in Scandinavian and the specific requirements for the M.A. and Ph.D. degree, interested students should consult the graduate adviser.

A. The M.A. in Scandinavian  General requirements: 36 units of courses in Scandinavian, including courses in Old Icelandic, in History of the language, and in Advanced Composition. A comprehensive examination will test the student’s knowledge.
of two Scandinavian literatures with special emphasis on the literature in his major language. A program with linguistic emphasis is also available.

**B. Ph.D. in Scandinavian** After the master's degree there are no specific course requirements; each student, instead, plans a program that will best prepare him for the qualifying examinations and for the writing of his dissertation. There are two curricula leading to the Ph.D. degree in Scandinavian, one in the field of history and criticism of Scandinavian literature, the other in the field of Scandinavian languages and linguistics.

*Letters and Science List:* for regulations governing this list, see the Announcement of the College of Letters and Science.

**Lower Division Courses**

1A–1B. Elementary Swedish. (5–5)

Five classroom hours and at least a 1-hour language laboratory per week.

1A. Elementary grammar, conversation.
Mr. Lindow (F)

1B. Elementary grammar, conversation, easy prose reading.
Mr. Lindow (W)

3A–3B. Elementary Norwegian. (5–5)

Five classroom hours and at least a 1-hour language laboratory per week.

3A. Elementary grammar, conversation.
Mr. Nybo (F)

3B. Elementary grammar, conversation, easy prose reading.
Mr. Nybo (W)

4A–4B. Elementary Danish. (5–5)

Five classroom hours and at least a 1-hour language laboratory per week.

4A. Elementary grammar, conversation.
Mr. Madsen (F)

4B. Elementary grammar, conversation, easy prose reading.
Mr. Madsen (W)

5. Intensive Elementary Swedish. (10)

Ten hours of lecture and two hours of laboratory per week. Elementary grammar, conversation, composition, reading. This course is equivalent to Scandinavian 1A and 1B.

Mr. Lindow 11A (Sp); 11B (F)

11A–11B. Intermediate Swedish. (5–5)

Five classroom hours per week. Prerequisite: course 1A–1B or the equivalent. Intermediate grammar, extensive reading, conversation, composition.

Mr. Lindow 11A (Sp); 11B (F)

13A–13B. Intermediate Norwegian. (5–5)

Five class hours per week. Prerequisite: course 3A–3B or the equivalent. Intermediate grammar, extensive reading, conversation, composition.

13A, (Sp); 13B, (F), Mr. Nybo

14A–14B. Intermediate Danish. (5–5)

Five class hours per week. Prerequisite: course 4A–4B or the equivalent. Intermediate grammar, extensive reading, conversation, composition.

14A (Sp); 14B (F), Mr. Madsen

21. Conversational Swedish. (4)

Three hours of lecture and one hour of laboratory per week. Prerequisite: consent of instructor. Practice of conversation in connection with reading of selected Swedish texts. Recommended for prospective majors.

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51. Cultural and Intellectual Trends in Modern Sweden. (4)

Three classroom hours per week. Discussion of topics illustrating cultural and intellectual developments in Sweden during this century, in conjunction with the reading of selected texts. May be repeated for credit by permission of the instructor.

Mr. Lönroth (Sp)

**Upper Division Courses**

**Language and Literature Courses**

101A–101B. Advanced Swedish. (4–4)

Three classroom hours per week. Prerequisite: course 11A–11B or the equivalent. Grammar review, reading, conversation, composition.

101A (W); 101B (Sp)

103A–103B. Advanced Norwegian. (4–4)

Three classroom hours per week. Prerequisite: course 13A–13B or the equivalent. Grammar review, reading, conversation, composition.

103A (W); 103B (Sp)

104A–104B. Advanced Danish. (4–4)

Three classroom hours per week. Prerequisite: course 14A–14B or the equivalent. Grammar review, reading, conversation, composition.

104A (W); 104B (Sp)

141A–141B. Introduction to Swedish Literature. (4–4)

Three classroom hours per week. Prerequisite: 20 units of lower division courses in Swedish or the equivalent. Reading and analysis of representative Swedish works.

141A. From 1700 to 1870.

141B. From Strindberg to the present.

Mr. Johannesson (F)

143A–143B. Introduction to Norwegian Literature. (4–4)

Three classroom hours per week. Prerequisite: 20 units of lower division courses in Norwegian or the equivalent. Reading and analysis of representative Norwegian works.

143A. From 1800 to 1890.

143B. From Hamsun to the present.

143A (F); 143B (W), Mr. Nybo

144A–144B. Introduction to Danish Literature. (4–4)

Three classroom hours per week. Prerequisite: 20 units of lower division courses in Danish or the equivalent. Reading and analysis of representative Danish works.

144A. From Holberg to 1870.

144B. From Brandes to the present.

144A (F), 144B (W), Mr. Madsen
Courses in Scandinavian Literature

Courses listed below require no knowledge of a Scandinavian language. They are now open to students with at least a junior standing and, with consent of instructor, to properly qualified students with sophomore standing.

*106. History of Scandinavian Drama up to 1900. (4)
Three 1-hour lectures per week. Reading of Danish, Norwegian, and Swedish plays in translation; discussions; lectures on the development of the drama. Mr. Madsen (F)

107. The Plays of Ibsen. (4)
Three 1-hour lectures per week. Reading and discussions of Ibsen's major plays. Mr. Nybo (F)

108. Strindberg. (4)
Three 1-hour lectures per week. Reading and discussion of Strindberg's major works with emphasis on his dramas and their significance. Mr. Madsen (W)

109. Scandinavian Drama of the Twentieth Century. (4)
Three 1-hour lectures per week. Reading of modern Scandinavian dramas in translation; discussions. Mr. Madsen (Sp)

120A–120B. The Novel in Scandinavia. (4–4)
Three 1-hour lectures per week. Course 120A is not prerequisite to 120B. Reading and discussion of great Scandinavian novels; lectures on the development of the novel. Mr. Johannesson, 120A (W); Mr. Nybo, 120B (Sp)

123. The Viking Age. (4)
Three 1-hour lectures per week. A survey of early Scandinavian culture and civilization from the first Viking raids to the end of Norse saga-writing. Reading of selected texts in English translation and discussion of problems connected with the nature of the sources and archaeological evidence. Mr. Lönnroth (F)

125. Old Icelandic Literature. (4)
Three 1-hour lectures per week. Reading and discussion of some of the Icelandic sagas and representative selections from the Eddas and the Scaldic songs. Mr. Lönnroth (W)

160. Scandinavian Mythology. (4)
Three 1-hour lectures per week. Critical survey of mythology in ancient Scandinavia. Lectures and readings of selected material in English translation. Mr. Lindow (Sp)

165. Scandinavian Folklore. (4)
Three 1-hour lectures per week. A survey of Scandinavian folklore, with primary emphasis on oral narrative traditions (legends, folktales, and ballads). Proverbs, riddles, folk belief, customs, and other folkloristic material, including folk music, will also be considered. Mr. Lindow (F)

*171. Contemporary Swedish Literature. (4)
Three classroom hours per week. Reading and discussion of representative Swedish works in translation from World War II to the present. Mr. Larson (W, Sp)

Graduate Courses

201. History of the Swedish Language. (4)
Three 1-hour lectures per week. Prerequisite: an A.B. degree with an undergraduate major in Scandinavian. Phonology, historical grammar, texts. Mr. Lindow (Sp)

202. Old Icelandic. (4)
Three 1-hour lectures per week. Descriptive and historical phonology and grammar, texts. Some attention is given to Old Norwegian. Mr. Lindow (F)

*203. History of the Norwegian Language. (4)
Three 1-hour lectures per week. Prerequisite: an A.B. degree with an undergraduate major in Scandinavian. Phonology, historical grammar, texts. Mr. Lindow (F)

*205. Runology. (4)
Three 1-hour lectures per week. Prerequisite: course 202 or the equivalent. Interpretation and discussion of runic inscriptions in the Germanic, Danish, and Swedish-Norwegian futharks (200 B.C.–1200 A.D.).
206. Readings of Old Icelandic Texts. (4)
Three 1-hour lectures per week. Prerequisite: course 202 or the equivalent. One Old Icelandic saga and one or two poems of the Edda will normally be read in this course. May be repeated with consent of instructor. Mr. Lönroth (W)

208. The Poems of the Poetic Edda. (4)
Three 1-hour lectures per week. Reading of some more important poems with emphasis on mythological songs. Mr. Lönroth (W)

*215. Scandinavian Dialects. (4)
Three 1-hour lectures per week. A survey of the Scandinavian dialects with special reference to their relation to the standard languages of the different countries. (F)

*250. Seminar in Scandinavian Linguistics. (4)
One 2-hour lecture per week. Conference work on chosen or assigned topics; at least one shorter paper a quarter is normally required. (F)

**Literature Courses**

*200. Proseminar in Bibliography and Literary Methods. (4)
Three 1-hour lectures per week. Training in the use of bibliographical materials for the study of Scandinavian languages and literatures; analysis and interpretation of selected texts with emphasis on literary method and criticism. Mr. Nybo (F)

210. Graduate Readings. (4)
Graduate lecture course covering broad areas and directing students in wide reading. Offerings vary from year to year. May be repeated for credit with the permission of the Graduate Adviser and the Instructor.

Swedish Literature. Mr. Johannesson
Danish Literature. Mr. Madsen
Norwegian Literature. Mr. Nybo
Old Icelandic and Medieval Literature. Mr. Lönroth

Swedish Language. Mr. Lindow
Norwegian Language. Mr. Nybo
Danish Language. Mr. Madsen
Icelandic. Mr. Lindow (F, W, Sp)

*220. The Icelandic Saga. (4)
Three 1-hour lectures per week. Prerequisite: courses 202 and 206 or the equivalent. Reading and analysis of representative works with emphasis on problems of origin and on the saga as narrative art. Mr. Lönroth (Sp)

*225. The Scandinavian Ballad. (4)
Three 1-hour lectures per week. A comparative and historical study of the mediaeval ballad in Scandinavia, its later derivates, its relation to ballads of other European countries. Some attention will also be paid to modern folksongs, broadsides, and the troubadour tradition from C. M. Bellman to the present. Mr. Lönroth (W)

*230. Eighteenth-Century Scandinavian Literature. (4)
Three 1-hour lectures per week. Reading and analysis of representative works. Mr. Larson (F)

*231. Romanticism in Scandinavia. (4)
Three 1-hour lectures per week. Reading and analysis of representative works. Mr. Madsen (Sp)

*241. Modern Swedish Literature. (4)
Three 1-hour lectures per week. Reading and analysis of representative works. Mr. Johannesson (F)

*243. Modern Norwegian Literature. (4)
Three 1-hour lectures per week. Reading and analysis of representative works. Mr. Nybo (W)

251. Seminar in Scandinavian Literature. (4)
One 3-hour lecture per week. The Staff (F, W, Sp)

*265. Seminar in Scandinavian Folklore and Mythology. (4)
One 3-hour class per week. Prerequisite: knowledge of Old Icelandic or of a modern Scandinavian language. Investigation of selected problems in Scandinavian Folklore and Mythology. Mr. Lindow (Sp)

298. Special Study. (2-6)
Designated for students engaged in exploration of a restricted field, involving the writing of a report. May not be substituted for available seminars or graduate courses. The Staff (Mr. Nybo in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1-8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

**SCIENCE**

Science courses (in contradistinction to courses in the individual sciences) are described under Interdisciplinary and General Studies, Division of (DIGS).

**SCIENCE AND MATHEMATICS EDUCATION**

(Group Office, 347 Birge Hall)

Professors:
Max Alpert, Ph.D. (Zoology)

Walter J. Freeman, Ph.D. (Physiology)
John E. Hearst, Ph.D. (Chemistry)

NOTE: For key to footnote symbols, see page 86.
Description of the Program

The Group in Science and Mathematics Education offers a graduate program designed to allow students to combine advanced training in one of the natural sciences with the pursuit of central interests in the area of education. A student enrolled in the program will be expected to attain in his chosen scientific discipline a degree of competence comparable to that of a departmental Ph.D. candidate in that discipline. His thesis research will consist of some project dealing with curricular innovation, with the exploitation of new educational techniques, or with the development of more effective teaching methods. Upon satisfactory completion of his studies and thesis work, the student will obtain the degree of Ph.D. in science (or mathematics) education.

Admission Requirements

Requirement for admission to the program is ordinarily a distinguished course record and a master's degree in a particular scientific discipline. A student without such a degree may express his intention of joining the program while enrolling in the Berkeley science department of his field. His application for formal admission to the program will then be considered after he obtains his master's degree from that department.

More detailed information about the program and its requirements can be obtained from the group office.
Lecturers:
Lóránt G. Czigány, Ph.D.
Serge Kassatkin, M.A.

Ema Leskovar, Diplomirani Filozof
Olga Sorokin, Ph.D.

Departmental Major Advisers: Mrs. Grossman, Mrs. Coote.
Departmental Graduate Advisers: Mr. Hughes, Mr. Whitfield.

The department offers courses in several Slavic languages and literatures and in Slavic linguistics, both for those pursuing the department's own degree programs and for interested students from other departments. A large number of its literature courses require no knowledge of any foreign language.

The undergraduate major program usually emphasizes Russian, but honor students may choose Czech, Polish, or Serbo-Croatian as their special field of study. For all students the major program includes an introduction to the cultural history and the literatures of other Slavic peoples and requires at least an elementary knowledge of Russian.

Under the auspices of the department, courses in non-Slavic languages and literatures of Eastern Europe are given, especially in Baltic linguistics and Hungarian language and literature.

The Major

Lower Division  Emphasis on Russian: courses 1, 2, 3, 4, 5, 6 or their equivalents; course sequence 45A–45B–45C. Emphasis on a Slavic language other than Russian: courses 1, 2, 3 and 16 units of the other Slavic language; course sequence 45A–45B–45C.

Upper Division  45 units, including 15 units in the major language and, for students majoring in Russian, course sequence 128A–128B, course 187 or 188, 5 additional units in Russian literature, and one of the following course sequences: 150A–150B, 160A–160B, or 170A–170B. Students majoring in another Slavic language and literature shall take course sequence 129A–129B, in addition to the 10-unit survey sequence.

Honors Program  Students with an overall grade-point average of 3.0 or better may apply for admission to the honors program. This program will include course H195 (an honors proseminar), in which a thesis will be written, and 10 units, in addition to those required for the major, in upper division language courses. For majors in Russian these are courses 104A–104B or, in special cases and with the permission of the department, courses 125A–125B. A member of the department must agree to direct the thesis. Applications for the program should be submitted through the major adviser.

Preparation for Graduate Study  Candidates for higher degrees must have completed the undergraduate major program in Slavic languages and literatures as required by the department, or must present evidence that they have received equivalent training. Both the M.A. and Ph.D. programs require work in two Slavic languages or literatures, of which one must be Russian. Preparation in other European literatures (especially French, German, English), in comparative literature, in languages (especially French, German, Italian), and in Russian intellectual history is valuable for candidates in literature. For candidates in linguistics, preparation in French, German, Latin or Greek and in general and comparative linguistics is desirable.

Graduate Programs

M.A. and Ph.D. programs are offered in Russian, Polish, Czech, and Serbo-Croatian, each with either linguistic or literary emphasis.

The M.A. requirements include: reading knowledge of French or German; 36 units of upper division and graduate courses approved by the Department, including
210A–210B: at least 16 units of a second modern Slavic language; and a final comprehensive examination, partly written and partly oral. Courses 104A–B–C (which may be waived by examination) and 125A are required of majors in Russian.

Ph.D. candidates must have an M.A. from this department or show evidence of equivalent training. A reading knowledge of both French and German is required. Through course work and individual study as approved by the graduate adviser the student prepares for the general qualifying examinations, both oral and written.

Not all the courses listed below may actually be offered in 1973–74; further, the quarter in which a particular course may be given and its instructor may be changed. Students should consult Classes (Schedule and Directory) issued each quarter for more precise information, and the Departmental bulletin board for the specific topics of Slavic 134N, 280, and 290.

Letters and Science List: for regulations governing this list, see the Announcement of the College of Letters and Science.

Lower Division Courses

The first unit of secondary school credit in a language is considered to be equivalent to the first quarter course in college; each successive unit of credit in the same language is equal to one additional course in a sequence of four quarter courses in college.

1. Elementary Russian, Beginners’ Course. (5)
   Five 1-hour meetings and two 1-hour laboratories per week. Mr. Kassatkin in charge (F, W, Sp)

2. Elementary Russian. (5)
   Five 1-hour meetings and two 1-hour laboratories per week. Prerequisite: course 1.
   The Staff (Mr. Kassatkin in charge) (F, W, Sp)

3. Elementary Russian. (4)
   Five 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 2.
   Mr. Kassatkin in charge (F, Sp)

4. Intermediate Russian. (4)
   Five 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 3.
   The Staff (Mr. Kassatkin in charge) (F)

5. Intermediate Russian. (4)
   Four 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 4.
   Mr. Kassatkin in charge (W)

6. Intermediate Russian. (4)
   Four 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 5.
   Mr. Kassatkin in charge (Sp)

9. Russian Language Workshop. (4–9)
   Prerequisite: course 1. Individualized instruction covering the material of courses 2, 3, 4, 5, 6. Intended primarily for students whose programs prevent them from taking one, or two, of those courses when regularly scheduled. May be repeated for credit up to a total of nine units. Unit credit to be assigned at the end of the quarter, depending on achievement. Mr. Kassatkin in charge (F, W, Sp)

12A–12B–12C. Elementary Bulgarian. (4–1–4)
   Three 1-hour meetings per week.
   Sequence beginning (F).

21A–21B–21C. Intensive Russian. (8–8–8)
   Ten 1-hour meetings and two 1-hour laboratories per week. This sequence covers the same ground as courses 1 through 6 and qualifies for admission to 103A.
   Sequence beginning (F) Mr. Kassatkin in charge

   Ten 1-hour meetings per week.

24A–24B. Intermediate Polish. (4–4)
   Four 1-hour meetings per week. Prerequisite: course 23.
   Sequence beginning (W).

   Ten 1-hour meetings per week. Mrs. Leskova (F)

26A–26B. Intermediate Serbo-Croatian. (4–4)
   Four 1-hour meetings per week. Prerequisite: course 25.
   Sequence beginning (W), Mrs. Leskova

   Ten 1-hour meetings per week.
   Mr. Schamschula (F)

30A–30B. Intermediate Czech. (4–4)
   Four 1-hour meetings per week. Prerequisite: course 29.
   Sequence beginning (W), Mr. Schamschula

39. Great Writers of Russian Literature. (4)
   Four 1-hour meetings per week. No knowledge of Russian is required.
   Mr. Grossman (F)

40. Specialized Russian Reading. (4)
   Three 1-hour meetings per week. Prerequisite: course 4 or consent of instructor.
   Mrs. Grossman in charge (F, Sp)

45A–45B–45C. Survey of Russian Literature and Intellectual Trends. (4–4–4)
   Three 1-hour meetings per week. Students in the major program are advised to take this course in sequence.
   Sequence beginning (F)

45A. From the eleventh century to 1842.
   Mrs. Hughes

45B. From 1845 through the nineteenth century.
   Mrs. Grossman

45C. The twentieth century.
   Mr. Karlinsky
Upper Division Courses

103A–103B–103C. Advanced Russian. (5–5–5)
Three 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 6 or course 21C. Sequence beginning (F), Mr. Kassatkin in charge.

104A–104B–104C. Russian Composition and Style. (5–5–5)
Three 1-hour meetings and one individual consultation per week. Prerequisite: course 103C.
Sequence beginning (F) Mrs. Sorokin

108A–108B. Polish Reading, Grammar, and Composition. (5–5)
Four 1-hour meetings per week. Prerequisite: course 24B. Sequence beginning (F) 

112A–112B. Serbo-Croatian Reading, Grammar, and Composition. (5–5)
Four 1-hour meetings per week. Prerequisite: course 26B. Sequence beginning (F), Mrs. Coote

116A–116B. Czech Reading, Grammar, and Composition. (5–5)
Four 1-hour meetings per week. Prerequisite: course 30B. Sequence beginning (F), Mr. Schamschula

125A–125B. Introduction to Descriptive Russian Grammar. (5–5)
Three 1-hour meetings and one 1-hour discussion section per week. Prerequisite or corequisite: course 103A (to 125A), course 103B (to 125B). Phonology, morphology, and syntax of standard literary Russian. Recommended for prospective teachers. Though it is not a prerequisite, students are urged to take Linguistics 20 before taking this course.
Sequence beginning (W)

128A–128B. Readings in Russian Literature. (5–5)
Three 1-hour meetings per week. Prerequisite or corequisite: course 103B (to 128A), course 103C (to 128B). Required for majors in Russian.
Sequence beginning (W), Mr. Hughes

Individual or group conferences. Prerequisite or corequisite: courses 105B or 112B or 116B.
Sequence beginning (W), The Staff

Lecture Courses on Slavic Literatures

Except where otherwise indicated, these courses are given in English and require no knowledge of any other language. Each course will include one hour of discussion per week in addition to the scheduled three hours of lecture.

*130. Topics in Twentieth Century Russian Literature. (5)
Three 1-hour meetings per week. Variable subject matter. Course may be repeated with the consent of the instructor without duplication of credit.
The Staff (Sp)

133A–133B–133C. The Russian Novel and its Relations to West European Literatures. (5–5–5)
Two 1½-hour meetings per week. Prerequisite to 133B, 133A or 45A or permission of the instructor; to 133C: 133B or 45B or permission of the instructor.
Mrs. Grossman
133A. To 1845 (F)
133B. 1845 to 1865 (W)
133C. 1865 to 1885 (Sp)

134A. Dostoevsky. (5)
Three 1-hour meetings per week. Mr. Milosz (F)

134B. Tolstoy. (5)
Three 1-hour meetings per week. Mr. Karlinsky (W)

134C. Chekhov. (5)
Three 1-hour meetings per week. Mr. Karlinsky (F)

134D. Turgenev. (5)
Three 1-hour meetings per week. Mr. McLean (F)

134F. Pushkin. (5)
Three 1-hour meetings per week. Prerequisite: reading knowledge of Russian required.
Mr. McLean (W)

134G. Gogol. (5)
Three 1-hour meetings per week. Mr. Karlinsky (Sp)

134N. Monographic Studies in Russian Literature. (5)
Three 1-hour meetings per week. Variable subject matter. Course may be repeated with the consent of the instructor without duplication of credit.
The Staff

*135. Russian Drama from the Seventeenth Century to the Twentieth. (5)
Three 1-hour meetings per week.

*138. Nineteenth-Century Russian Literary Criticism. (5)
Two 1½-hour lectures and one hour of discussion per week. Prerequisite: course 103B or equivalent.

*139. Twentieth-Century Russian Literary Criticism. (5)
Three 1-hour meetings per week.

150A–150B. Survey of Polish Literature and Intellectual Trends. (5–5)
Three 1-hour meetings per week. Sequence beginning (W), Mr. Milosz
150A. To 1848. 150B. Since 1848.

*155. Polish Romanticism. (5)
Three 1-hour meetings per week. Mr. Milosz (F)

*156. The Polish Theater. (5)
Three 1-hour meetings per week. Mr. Milosz (F)

159. Contemporary Polish Poetry and Fiction. (5)
Three 1-hour meetings per week. Mr. Milosz (Sp)

160A–160B. Survey of Czech and Slovak Literature. (5–5)
Three 1-hour meetings per week. Sequence beginning (W), Mr. Schamschula
170A–170B. Survey of Serbian and Croatian Literature. (5–5)
Three 1-hour meetings per week. Sequence beginning (W), Mrs. Coote

187A–187B. Russian Poetry. (5–5)
Three 1-hour lectures and one 1-hour discussion section per week. Prerequisite: course 103B or consent of instructor. Lecture course given in Russian. Survey of techniques of Russian versification and history of Russian Poetry. 187A: eighteenth century to 1890; 187B: 1890 to the present. Sequence beginning (W), Mrs. Hughes

188. Russian Prose. (5)
Three 1-hour lectures per week. Prerequisite: course 103C or consent of instructor. Lecture course given in Russian. Reading, analysis, and interpretation of representative authors from the nineteenth century to the present. All readings in the original. Course may be repeated without duplication of credit. Mrs. Sorokin (F, W, Sp)

H195. Honors Proseminar. (5)
Two 2-hour meetings for discussion each week, or individual meetings with the instructor. Advanced literary study for senior honor students, culminating in the writing of a thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Additional limitation: overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis.
Graduate Courses

210A–210B. Old Church Slavic. (3–3)
Two 1½-hour meetings per week. Sequence beginning (W), Mr. Whitfield

220. Comparative Slavic Linguistics. (4)
Two 1½-hour meetings per week. Prerequisite: courses 210A–210B.

226. Historical Russian Grammar. (4)
Three 1-hour meetings per week. Prerequisite: courses 210A–210B.

*229. Russian Oral Tradition. (4)
Three hours of lecture per week. Prerequisite: much of the reading is in nonstandard Russian, and requires a good command of the language. Major emphasis will be placed on the epics (byliny), but other forms of orally transmitted literature will also be discussed.

230. Old Russian Literature. (4)
Three hours of lecture per week. The content varies, the Kievan and Moscovite periods usually presented in alternate years. The course may be repeated without duplication of credit. Mr. McLean (W)

One 2-hour meeting per week. Advanced studies in the several fields of Slavic literatures and linguistics. Course content varies. Course may be repeated without duplication of credit. The Staff (F, W, Sp)

281. Proseminar: Aims and Methods of Literary and Linguistic Scholarship. (4)
Two 1½-hour meetings per week. Course designed particularly for new graduate students in the department. Mr. Hughes in charge (F)

290. Seminar. (4–4)
One 2-hour meeting per week. Advanced study in Slavic languages and literatures. Topics will vary from year to year and will be announced at the beginning of each quarter. Two-quarter sequence required for completion in Seminar 290. Credit and grade to be awarded at close of sequence.
The Staff (F, W, Sp)

298. Special Study for Graduate Students. (2–9)
Preliminary exploration of a restricted field involving research and a written report.
The Staff (F, W, Sp)

299. Directed Research. (2–9)
Normally reserved for students directly engaged upon the doctoral dissertation.
The Staff (F, W, Sp)

16–26–36. Russian for Graduate Students. (No credit)
Three 1-hour meetings per week. Preparation for graduate reading examinations. Sequence beginning (F)

116–126. Spoken Russian for Graduate Students. (No credit)
Three 1-hour meetings per week. Prerequisite: course 103A–103B–103C or its equivalent. Preparation for the Departmental precandidacy examination in spoken Russian. Open only to candidates for graduate degrees in the Department of Slavic Languages and Literatures.
The Staff (W, Sp)

601. Individual Study for Master’s Students. (1–8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (F, W, Sp)

Hungarian Language and Literature Courses

Hungarian 27. Elementary Hungarian. (5)
Five 1-hour meetings per week. Mr. Czigány (F)

Hungarian 28A–28B. Intermediate Hungarian. (5–5)
Five 1-hour meetings per week. Prerequisite: course 27. Sequence beginning (W), Mr. Czigány

Hungarian 118A–118B–118C. Hungarian Reading, Grammar, and Composition. (5–5–5)
Four 1-hour meetings per week. Prerequisite: course 28B. Sequence beginning (F), Mr. Czigány
Three 1-hour meetings per week. No knowledge of Hungarian is necessary. 185A, to 1849; 185B, 1850 to 1908; 185C, 1909 to present.
Sequence beginning (F), Mr. Czigány

Hungarian 190. The Romantic Movement in Hungary. (5)
Three 1-hour meetings per week. Prerequisite: course 185A–185B–185C or consent of instructor. Knowledge of Hungarian is essential.
Mr. Czigány (Sp)

Hungarian 221. Studies in Finno-Ugrian Linguistics. (5)
Three 1-hour meetings per week. No knowledge of Hungarian or any other Finno-Ugrian language is necessary. An introduction to Finno-Ugrian linguistics, designed to meet the requirements of graduate students of linguistics. With consent of the instructor, course may be repeated for credit.
Mr. Czigány (W)

Hungarian 280. Studies in Hungarian Literature. (4)
One 2-hour meeting per week. Prerequisite: course 185A–185B–185C or consent of instructor. Advanced studies in Hungarian literature. Course may be repeated for credit. Mr. Czigány (F, W, Sp)

Lithuanian

Lithuanian 270. Structure of Modern Lithuanian. (4)
Three hours of lecture per week. (Sp)

Social Sciences courses and the Social Sciences Field Major are described under Interdisciplinary and General Studies, Division of (DIGS).

Social Welfare

(Department Office, 120 Haviland Hall)

Professors:
Milton Chernin, Ph.D. (Chairman)
Davis McEntire, Ph.D.
Kermit T. Wiltsie, D.S.W.
Martin Wolins,† D.S.W.
Ruth Cooper, D.S.W. (Emeritus)
Walter Friedlander, Ph.D. (Emeritus)
Ernest Greenwood, Ph.D. (Emeritus)
Maurine McKeany, Ph.D. (Emeritus)
Margaret S. Schubert, Ph.D. (Emeritus)
Gertrude Wilson, M.A. (Emeritus)

Associate Professors:
Ralph M. Kramer, D.S.W.
James R. W. Leiby, Ph.D.
Henry Miller, D.S.W.
Harry Specht,† Ph.D.

Assistant Professors:
Lawrence H. Boyd, Jr., Ph.D.
Neil Gilbert, Ph.D.
Joseph A. Kuypers, Ph.D.
Leonard S. Miller, Ph.D.
Robert Pruger, D.S.W.
S. Lynne Roberts,† Ph.D.
Steven Segal, Ph.D.

Assistant Professors:
Miguel Montiel, M.S.W. (Acting)
Roberta Turner, M.S.W., M.A. (Acting)

Lecturers:
Andrew Curry, M.S.S.A.

Justine Fixel, M.S.W.
Eileen Gambrill, Ph.D.
Robert C. Jackson, M.S.W., M.P.H.
Joseph Lifschutz, M.D.
William Smelser, Ph.D.
Judith Wallerstein, M.S.W.

Lecturer—Field Work Consultants:
Mildred Alexander, M.S.
Mary O’Day, M.S.W.
Ida Oswald, M.S.W.
Genevieve Oxley, M.S.
Joseph Solis, M.S.W.

Field Work Consultants:
Franklin Bauer, M.A.
Edgar Clarke, A.B., B.D.
Bertha Ferguson, M.A.
Doris Smith, M.S.W.
Dorothy Turner, M.S.W.
Robert Wasser, M.S.W.
Barbara Weiss, M.S.W.

Field Work Consultant—Field Work Supervisor:
Margaret Butcher, M.A.

Field Work Supervisors:
Mary Jeffress, M.S.W.
Mary Miles, M.S.W.

NOTE: For key to footnote symbols, see page 86.
Undergraduate Group Major

The group major in social welfare, leading to the degree of Bachelor of Arts in the College of Letters and Science, offers a social welfare sequence of general interest to liberal arts students. For students whose career interests are in this field, it provides preparation for graduate professional education in social work, and it also serves as preparation for entry into beginning social service positions directly upon graduation with the bachelor's degree.

Major Requirements

Lower Division Psychology 1, Sociology 1, and Statistics 2. Recommended: Anthropology 3, Economics 2, Political Science 1.

Upper Division Social Welfare 102A–102B (5–5), Social Welfare 110A–110B (5–5), and five courses chosen from the following list, with three of the courses taken in one department and two selected from the other departments: Anthropology 140, 144, 149, 152; Economics 103A, 103B, 130, 185, 186A, 186B; Political Science 108, 181, 182, 183; Psychology 140, 150, 152, 160; Sociology 120, 140, 142, 157, 160.

Honors Program Eligible social welfare majors, upon recommendation of their advisors, may enroll in an honors program. A candidate for honors must complete an honors seminar in social welfare and social work problems (Social Welfare 195A–195B–195C). A senior essay is part of the work of the final quarter of the seminar. The essay which will be of a creative and integrative nature, will be the culmination of an individual library research project on a topic of special interest to the student. It will meet criteria established to assure breadth and depth and will be produced with reference to a timetable for completion. Some time in the senior seminar is devoted to the planning and writing of the essay.

Graduate Programs

For information about graduate study in the School of Social Welfare, see page 78 of this catalogue. For more detailed information see the separate ANNOUNCEMENT OF THE SCHOOL OF SOCIAL WELFARE, available from the School Office, 120 Haviland Hall.

Upper Division Courses

100. The Field of Social Welfare. (5)

Two 2-hour sessions per week. Survey of social welfare problems, programs, and issues. Designed to acquaint nonmajors with the field of social welfare. Not open to students who have completed or are taking course 110A–110B–110C.

Mr. Chernin (W, Sp)

102A–102B. Social Work as a Profession. (5–5)

Two 1½-hour sessions and three hours in community per week. Prerequisite: senior standing; nonmajors must have course 100 or 110A (may be concurrent) and consent of instructor.

Sequence beginning (F) and (W)

102A. Introduction to social work theory and practice methods including social casework, social group work, and community organization.

102B. Analysis of case and laboratory material illustrating the methods of social work; factors influencing practice in various special purpose agencies and in small and large communities. Credit and grade will be assigned upon completion of the full sequence. —— (F, W, Sp)


Two 1½-hour sessions and one hour consultation per week. 110A prerequisite to 110B; 110A and 110B prerequisite to 110C.

110A. Social Welfare as an Institution. The background and development of the social services in relation to economic, political, and social change; analysis of the organization and delivery of social services in an industrial society.

Mr. Gilbert, Mr. Leiby (W)

110B. Social Welfare Policies and Programs. Analysis of social welfare policies and programs including public assistance, social insurances, urban renewal, antipoverty program, and emerging policies for income maintenance.

Mr. Gilbert, Mr. Leiby (W)

110C. Seminar in Social Policy. Examination of the philosophy, organization and purpose of selected social welfare programs.

Mr. Leiby (Sp)


(3–3–3)

(Formerly numbered H197A–H197B–H197C)

Weekly hours to be arranged. Problems in social welfare...
welfare and social work. Preparation of a senior essay. Credit and grade will be assigned upon completion of the full sequence.

Sequence beginning (F) Mr. Gilbert (F, W, Sp)

197. Field Study in Social Welfare. (1–5)
Supervised experience relevant to specific aspects of social welfare in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required.
The Staff (Mr. Chernin in charge) (F, W, Sp)

198. Group Study for Advanced Undergraduates. (1–5)
The Staff (Mr. Chernin in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (Mr. Chernin in charge) (F, W, Sp)

Graduate Courses
All graduate classroom courses in social welfare are open to qualified students from other departments, with the consent of the instructor.

200A–200B. Development of the Person. (3–3)
Two 1½-hour sessions per week. Physical, psychological, and social development and adaptations of the person, as related to social welfare.
Sequence beginning (F). The Staff (F, W)

201A–201B. Social Organization and Social Welfare. (2–3, 2–3)
One 1½-hour session per week for 2 units; an additional 1½ hours every other week for students who elect an additional unit. Structure and dynamics of communities, organizations, groups and families, as related to social welfare. Credit and grade will be assigned upon completion of the sequence.
Sequence beginning (W). Mr. Wolins in charge (W, Sp)

203. Development of the Social Deviant. (2)
One 1½-hour session per week. Prerequisite: course 200A–200B or consent of instructor. Deviant behavior and welfare implications of minority status, educational and occupational incapacity, delinquency, sexual deviancy, and identity problems of the nonconforming members of society. (Sp)

210A–210B. Psychodynamics and Psychopathology. (2–2)
One 1½-hour session per week. Prerequisite: course 200A–200B or consent of instructor. Psychiatric symptomatology and psychopathology and their implications for social welfare.
Sequence beginning (W), The Staff (W, Sp)

211. Seminars in Human Development and Pathology. (2)
One 1½-hour session per week. Prerequisite: course 200A–200B or consent of instructor. The social welfare implications of selected problems in human development and adaptation in situations involving physical illness, psychopathology, or stressful social conditions. Seminar topics will be announced annually.
The Staff (F, W, Sp)

212. Seminars in Social Organization and Social Welfare. (2)
One 1½-hour session per week. Prerequisite: course 201A–201B or consent of instructor. Advanced study of selected problems in social organization and social welfare. Seminar topics will be announced annually.
The Staff (Sp)

One 1½-hour session per week.
220A. Income Maintenance. Analysis of major issues in the social provision of income for individuals and families through public assistance, social insurance, family and children's allowance, work and training, income supplementation, and other income maintenance programs. (F)
220B. Service Programs. Analysis of major issues with reference to socially provided services in the fields of family and child welfare, corrections, public health including mental health, rehabilitation, and recreation. (W)
220C. The Social Impact of Social Welfare Policies. Prerequisite: course 220A or 220B or consent of instructor. Examination of issues involved in the relation of the state to voluntary social services, intergovernmental relations, scope and control of administrative powers, and in the impact of alternative policy decisions. (W)

221. Law and Social Welfare. (2)
One 1½-hour session per week. Legal information for social workers with emphasis on family law. (Sp)

230. Social Welfare Programs and Policies. (2)
One 1½-hour session per week. Prerequisite: course 220A and either course 220B or 220C or consent of instructor. Intensive study of particular program areas such as child welfare, corrections, family welfare, health, medical care, mental health, mental retardation, poverty, rehabilitation, school social work, etc. Topics will be announced annually.
The Staff (F, W, Sp)

232. Comparative Welfare Institutions and Practice. (2 or 3)
One 2- or 3-hour session per week. Comparative analysis of welfare policies and provisions in selected countries in cultural and ideological context. Countries or regions to be dealt with will be announced in advance each time the course is offered.
Mr. McEntire (W)

234. The "Benevolent Asylum" and Social Welfare. (2)
One 1½-hour session and one consultation hour per week. Theory and data on asylums in the U.S., England, Austria, Poland, Israel, Yugoslavia, and others. Primarily directed towards theory and research, but clinical and administrative implications will also be discussed.
Mr. Wolins (Sp)

Two seminar hours and one consultation hour per week. Primarily for doctoral students. Sequence beginning (F). 239A–239B, theory of organization and administration with applications to social welfare; 239C, selected problems of social welfare policy.
Mr. McEntire (F, W)
240A—240B—240C. Social Work Methods with Individuals and Groups. (2—2—2)
One 1 1/2-hour session per week. Basic principles of social work practice with individuals, families, and small groups. The Staff (F, W, Sp)

One 1 1/2-hour session per week. Basic principles of social work practice with individuals, groups, and communities of special population groups such as aged or minority groups. The Staff (F, W, Sp)

242A—242B—242C. Introduction to Community Organization, Social Planning, and Neighborhood Organization. (2—2—2)
One 1 1/2-hour session per week.
242A. An overview of practice, historical development of the field, issues and problems, and various modes of practice utilized by professionals.
242B. Introduction to social planning.
242C. Introduction to neighborhood organization. The Staff (F, W)

249A—249B—249C. Theory and Practice of Social Work. (2—2—2)
Two seminar hours per week. Prerequisite: admission to the predoctoral program or consent of instructor. Analysis of the historical, philosophical, and theoretical bases of social work practice with individuals, groups, organizations, and communities. (F, W, Sp)

250. Advanced Social Casework. (2)
One 1 1/2-hour session per week. Prerequisite: course 240A—240B—240C or consent of instructor. Generic and specific components of social casework in different fields of practice, including corrections, family and child welfare, medical, psychiatric, public welfare, and school social work. The Staff (F)

251. Specialized Methods of Social Work Practice. (2)
One 1 1/2-hour session per week. Prerequisite: consent of instructor. A study of various methods of social work practice with individuals, families, groups and communities in relation to social problems. Topics will be announced annually. The Staff (F, W, Sp)

252A—252B. Advanced Social Group Work. (2—2)
One 1 1/2-hour session per week. Prerequisite: course 241A—241B—241C or consent of instructor. Advanced analysis of social group work theory and practice; application in a variety of settings. Sequence beginning (F). (F, W)

253A—253B—253C. Advanced Community Organization and Social Planning. (2—2—2)
One 1 1/2-hour session per week. Prerequisite: course 242A—242B—242C or consent of instructor.
253A. Theories of Planning. Social planning, planning in government, advocacy planning, techniques.
253B. Theories of Organization. Working with community action groups, methods, skills, goals, and problem identification.
253C. Community Organization Practice. Presentation by students of original thinking on subject. The Staff (F, W, Sp)

254A—254B. Social Welfare Administration. (2—2)
One 1 1/2-hour session per week. Prerequisite: course 242A—242B or consent of instructor. Administrative process and problems in social welfare organizations. Sequence beginning (F).
Mr. Pruger, Mr. McEntire (W, S)

Two 1 1/2-hour sessions per week. Sequence beginning (F).
Mr. Jackson (F, W, Sp)

256A—256B. Media and Methods in Social Work. (2—2)
One 1 1/2-hour session per week. Uses the School's educational media laboratory, especially videorecording and playback, to improve professional functioning and to teach utilization of new media in social work practice. The relation of medium to message, and ethical, legal, philosophical, artistic issues are discussed and demonstrated. Mrs. Oswald (W, Sp)

258. Methods of Supervision in Social Work. (2)
One 1 1/2-hour session per week. Prerequisite: second-year standing in the M.S.W. program or consent of instructor. (Sp)

Two seminar hours and one consultation hour per week. Primarily for doctoral students.
Sequence beginning (W)
259A, analysis of selected theories of social work practice; 259B, analysis of selected social problems in the light of theory in social work and the social and behavioral sciences; 259C, theories of change and their implications for social work practice. (F, W, Sp)

279A—279B—279C. Seminars in History and Philosophies of Social Welfare. (3—3—3)
Two seminar hours and one consultation hour per week. Primarily for doctoral students.
Sequence beginning (W)
279B, survey of historical thinking about the development of the social services; 279B, selected problems in historical research; 279C, study of political and ethical theories that bear on the development of the social services. Credit and grade for the A and B portion of the sequence will be assigned upon completion of the B portion.
Mr. Leiby (W, Sp)

280. Social Welfare Research Fields and Techniques. (2)
One 1 1/2-hour session per week. The logic, methods and techniques of research in social welfare. The Staff (Sp)

281A—281B. Research Techniques in Social Welfare. (2—2)
One 1 1/2-hour session per week consisting of lecture and/or laboratory. Prerequisite: course 280. The theory and application of a variety of social research techniques usable in social welfare investigations. Sequence beginning (F). Credit and grade will be assigned upon completion of the sequence in even numbered sections and upon completion of each quarter's work in odd numbered sections. The Staff (F, W)
286. Policy Analysis and Research in Social Welfare. (3)

Two seminar hours and individual meetings with faculty. Prerequisite: consent of instructor. Review of the policy making process in social welfare. Research requirements and the utilization of existing knowledge for policy formation. The role of scholarship and research in policy making.

289A-289B-289C. Research Methods and Techniques in Social Welfare. (4-4-4-4)

289A. Introduction to probability theory, the logic of social research, and basic statistics. Mr. Boyd (F)
289B. Continuation and expansion of the logic of social research. Topics include: rationale and procedure of research design, hypothesis testing, measurement and data analysis. Mr. Miller (W)
289C. Introduction to the general linear model and its application to social welfare problems. Mr. Segal (Sp)
289D. Workshop in applied research and statistics with special reference to social welfare. Mr. Miller (F)

296. Individual Study for Graduate Students. (1-9)

Designed to permit any qualified graduate student to pursue special study in a subject of his own choosing under the direction of a faculty member. The Staff (Mr. Chernin in charge) (F, W, Sp)

298. Group Study for Graduate Students. (1-9)

Mr. Chernin in charge (F, W, Sp)

299. Individual Research for Graduate Students. (1-9)

Designed to permit any qualified graduate student to pursue research in a subject of his own choosing under the direction of a faculty member. The Staff (Mr. Chernin in charge) (F, W, Sp)

Professional Courses

401. Field Instruction. (2-14)

Four units of credit per quarter for two days in the field; variable units for block placement. First-year requirement: 12 units spread over three quarters. Second year: 14 to 18 units spread over one, two or three quarters. Supervised practice in social agencies. Graded on a passed/not passed basis. The Staff (F, W, Sp)

402. Laboratory in Social Work Practice and Social Agencies. (1-2)

One-half or one full day per week. Introduces the student to the range of professional roles and services in social welfare through a series of visits, interviews, observations, and participation in meetings. Designed to correspond to student's program concentration. Graded on a passed/not passed basis. Miss Smith, Mrs. Weiss (F, W, Sp)

602. Individual Study for Doctoral Students. 1-8

Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the D.S.W. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Mr. Chernin in charge) (F, W, Sp)

IDS 175. A Nontechnical Introduction to Operations Research. (4)

See Interdepartmental Studies for the complete description of this course.

SOCIOLOGY

(Starting Office, 410 Barrows Hall)

Professors:

Robert N. Bellah, Ph.D. (Ford Professor of Sociology and Comparative Studies)
Kenneth E. Bock, Ph.D.
John A. Clausen, Ph.D.
Kingsley Davis, Ph.D. (Ford Professor of Sociology and Comparative Studies)
Wolfram Eulerhard, Ph.D.
Charles Y. Glock, Ph.D.

William Kornhauser, Ph.D.
David Matza, Ph.D.
H. Franz Schurmann, Ph.D.
Gertrude Jaeger Selznick,† Ph.D.
Philip Selznick,† Ph.D.
Neil J. Smelser,† Ph.D. (University Professor)
Arthur L. Stinchcombe,† Ph.D.
Guy E. Swanson, Ph.D.
Harold L. Wilensky,† Ph.D.

NOTE: For key to footnote symbols, see page 86.
Herbert Blumer, Ph.D. (Emeritus)
Margaret T. Hodgen, Ph.D. (Emeritus)
Leo Lowenthal, Ph.D. (Emeritus)
Alene R. Hochschild, Ph.D.
Mazi O. Ojiaku, Ph.D.
Jeffery M. Paige, Ph.D.

Lecturers:
Reinhard Bendix, Ph.D.
Claude S. Fischer, Ph.D.
David Nasatir, Ph.D.
Martin A. Trow, Ph.D.
Alan B. Wilson, Ph.D.

The Major

The program for a major in sociology leads to a B.A. degree. Admission to the major requires prior successful completion of Sociology 1 or 20, and an interview with a faculty adviser who will help work out an appropriate program of study. For admission to the major, see the undergraduate secretary in 410 Barrows Hall.

The student majoring in sociology is required to take a total of 45 units in nine upper division courses, allocated as follows:

3. At least one course in the core area of organizations and institutions: choice from 118, 119, 120, 124, 129, 130, 131A–131B, 132, 141, 142, 146.
4. Five or six elective upper division sociology courses (five only if the student took 105A–105B). Up to two of these may, with prior written approval from the adviser, be elected from the category of Sociology 191, 197, 198, or from related courses in other departments.

Students who plan to go on to graduate study in sociology are strongly urged to take both 157 and 158, and to take 105A–105B. They are also urged to take a course in statistics.

Honors Program H194A–H194B–H194C. Majors who enter their senior year with a B average are invited to join the department honors program.

The Graduate Major

Facilities for graduate study and research, leading to the M.A. and Ph.D. degrees, include courses, seminars, and research training under faculty supervision in the areas of comparative institutions, demography, deviance, educational sociology, industrial sociology, methodology, political sociology, race relations, social change, social psychology, social stratification, sociology of culture, of health and medicine, of law, of religion, and urban sociology.

Candidates for admission must apply by January 5, except those applying for a fellowship who must apply by December 1. No action will be taken on an application until the department has received all required materials. In addition to the Graduate Division application, the applicant must complete the department's own special forms and submit evidence of creative capacity as exhibited in written work and as judged by instructors who are familiar with his performance and promise. Applicants who are graduates of an American college or university must take either the Graduate Record Examination (apply to Educational Testing Service either at 1947 Center St., Berkeley, California 94704, or at Box 955, Princeton, New Jersey 08540) or the Miller Analogies Test. The portion of the GRE dealing with a sub-
tantive area may be in any field the applicant chooses, not necessarily in sociology. The undergraduate major need not have been in sociology. The character and quality of the individual's prior education and experience is more important than the actual field of study.

**M.A. Degree Requirements** Coursework (36 Required Graduate Units)

One course or seminar in sociological theory is required, and one course or seminar in sociological methods. A maximum of 12 units may be counted from work taken in: upper division sociology courses, Sociology 299, or in upper division or graduate courses in other departments. No units in course 601 will be counted toward the required 36 graduate units.

**Deadlines for Completion** During his first five quarters of residence the student must complete (a) the theory and method requirements, including a paper in each of these areas; (b) at least three additional papers on sociological subjects written for instructors other than those for whom the theory and methods papers were written. The three additional papers may or may not be written as assignments in sociology courses; if not, however, the paper must be submitted for appraisal to an instructor in the department. (c) 36 units as above.

There is no foreign language requirement for the M.A. degree.

**Ph.D. Degree Requirements** A master's degree is required. Students who have taken the M.A. at another university must meet the basic course requirements for M.A. students at Berkeley by passing the courses or passing the examinations.

Required: Beyond any work taken for the M.A., (1) a course or seminar or equivalent satisfaction of approved level of knowledge in quantitative methods, and (2) two more seminars.

Before the qualifying examination, the student must have completed all required courses. A foreign language or knowledge of advanced methodology may be required by a student's Qualifying Examination Committee if deemed necessary for the dissertation research. The graduate secretary, in 422 Barrows, has a written statement of procedures to be followed for the qualifying examination.

Before formal Advancement to Candidacy for the Ph.D. degree, the student must have completed the two-seminar requirement. He must also have written and received approval by his proposed committee of a dissertation prospectus.

Within a period of no more than five years from the date of his formal Advancement to Candidacy, the student must complete and file his dissertation. Under special circumstances, the department may recommend to the Graduate Division a one-year extension of Candidacy if the extension has been approved by the dissertation committee chairman and by the graduate adviser.

**Letters and Science List:** For regulations governing this list, see the Announcement of the College of Letters and Science.

**Lower Division Courses**

1. **Introduction to Sociology: Selected Themes. (4)**

   Course to be offered in either of two patterns: 1) two lecture hours and two discussion section hours per week, or 2) three lecture hours and one tutorial hour per week. Prerequisite: not open to students who have taken course 10. The instructor will choose a theme to be explored in depth and treated as a vehicle for introducing the student to the sociological perspective. Mr. Edwards (P); Mr. Clausen (W); Mr. (Sp)


   Two 1½-hour lecture meetings plus one 1-hour section meeting per week. Introduction to sociological analysis using demographic data and concepts.

**Upper Division Courses**

*100. Social Evolution. (5)**

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Major views of social development; cultural cycles, progress, social and cultural evolution.

*102. Major Social Issues. (5)**

Three lecture hours and two consultation hours per week. Prerequisite: does not give credit toward the major in sociology. A selective introduction to the analysis of social issues and policies, drawing upon such issues as race relations, crime, deviance, industrial conflict, old age, etc., at the discretion of the instructor.

*103. Power and Conflict. (5)**

Three lecture hours and two consultation hours per week. Prerequisite: does not give credit toward
104. Evaluation of Evidence. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division course in sociology, or consent of the instructor. Directed more to the acquisition of the skills of intelligent "consumption" of social science research than to the making of social researchers. Relation of theory and concepts, experimental models, interpreting correlations, reading tables, logical grounds of statistical inference, etc.

105A–105B. Introduction to Sociological Methods. (5–5)

Two lecture hours, two laboratory hours, and one consultation hour per week. Prerequisite: one lower division sociology course, or consent of the instructor. A two-quarter sequence course introducing the methods of sociological inquiry, with attention to both qualitative and quantitative studies. Problems of research design, measurement, and data collection, processing, and analysis, will be considered. Credit and grade will be given only upon completion of the full sequence. Mr. Nasr (F); Mr. Kornhauser (Sp)

107. Deviance and Social Control. (5)

Three lecture hours and two consultation hours per week. Prerequisite: restricted to majors in sociology and to those non-majors who have completed two upper division sociology courses. A consideration of forms, causes and controls of deviant behavior. Mr. Duster (F)

110A. Ethnic and Racial Relations: Theoretical Perspectives. (5)

Three lecture hours and two consultation hours per week. Prerequisite: credit will not be given to students who have completed Sociology 110. Some of the important theories and concepts in the field will be examined. Problem areas will include the emergence of ethnic and racial minorities through such historical processes as colonialism, slavery, immigration; Racism, its elements, dynamics, functions; Ethnocentrism, ethnicity and related concepts.

110B. Peoples of Color: Continuities, Conflicts, and Consequences. (5)

Three lecture hours and two consultation hours per week. Prerequisite: course 110A recommended but not required. Focus on experience of major third world groups within the United States: Native-Americans, Afro-Americans, Chicanos, Puerto Ricans, Asian Americans. Topics include historical emergence of subject cultures; dynamics underlying present-day social position of the various groups; contemporary trends and future possibilities in relations between peoples of color and the dominant society. Mr. Edwards (Sp)

110C. Selected Topics in Ethnic and Racial Relations. (5)

Three lecture hours and two consultation hours per week. Prerequisite: course 110A or course 110B recommended but not required. There will be variation in focus of attention, depending on the instructor in charge. Possibilities include an intensive concentration on one ethnic group, consideration in depth of specific theoretical issues, or an examination of race relations from an international comparative approach.

111. African Social Thought. (5)

Three hours of lecture and two consultation hours per week. Analysis of selected ideologies of outstanding African thinkers from precolonial times to the present. Special emphasis on content of ideas of the thinkers, major social problems facing them as builders of contemporary African society; how their respective social thought relates to the foundation of new institutions in the continent. Mr. Ojaku (F)

112. Social Change in Africa. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division course in sociology or consent of the instructor. Analysis of the vast and complex changes that have been sweeping over the African continent and the emergence of new social, cultural, and political institutions that have emerged consequent on westernism. The role of urban life, political parties and nationalism in modern Africa. Mr. Ojaku (W)

113. The Sociology of the Possible. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division and two upper division sociology courses, or permission of the instructor. Analysis of social thought about possible social arrangements from Plato through the writers of modern social science fiction and planners of the future. Utopias, anti-utopias and proposed and possible social innovations will be analyzed through the application of sociological theory.

117. American Society: A Comparative Analysis. (5)

Three lecture hours and two consultation hours per week. Prerequisite: restricted to majors in sociology and to those non-majors who have completed two upper division sociology courses. Various aspects of American values and behavior patterns over time; sources of differences from other developed nations. Mr. Matza (W); Mr. Kornhauser (Sp)

118. Introductory Political Sociology. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Political processes in organized groups, the social bases of power. The role of social classes, occupational groups, religious groups, and the influence of cultural values. Mr. Paige (W); Mr. Kornhauser (Sp)

119. Law and Society. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Selected legal rules, principles, and institutions treated from a sociological perspective. Influence of culture and social organization on law; role of law in social change; social aspects of the administration of justice; social knowledge and the law. Mr. Selznick (W)

120. Organizations and Institutions. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Administrative organizations and voluntary associations; major social institutions in industry, government, religion, and education.

121. Prospero or Caliban: The Sociology of European Colonialism in Africa. (5)

Three hours of lecture and two tutorial hours per week. Prerequisite: one lower division Sociology course, or consent of the instructor. Sociological
analysis of African society at the time of European scramble; nature of imperialism by mid-19th century; pattern and style of colonial policy and practice; African colonial experience and reaction; social, cultural, psychological consequences of colonialism on the African people.

Mr. Ojaku (Sp)

123. Population Theories. (5)

Three lecture hours and two consultation hours per week. Prerequisite: course 20 or consent of instructor. A critical review of theories of population growth, structure, and distribution, from before Malthus to the present, analyzed in relation both to the history of social thought and to social, economic, and demographic trends.

124. Sociology of Education. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. The role of formal education in modern societies. Educational systems in relation to the religious, cultural, economic, and political forces shaping their character.

-(W); Miss Heyns (Sp)

125. Industrial and Occupational Sociology. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. The labor force; social control within and of occupations and professions (professionalization, professional associations vs. labor unions, codes of ethics, legal controls); social structure of the work-place, work experience of the participants, relation of both to community and society.

Mr. Blauner (Sp)

130. Sociology of the Family. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Systematic and comparative analysis of family structure and change: marriage, reproduction, child-rearing, marital dissolution.

Miss Hochschild (F)

131A. The Black Family: Its Historical Development in America. (5)

Three lecture hours and two tutorial hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Not open to students who have completed courses 191Q or 191R. The development of Black families and their relationship to the social contexts in America prior to the 20th century. Attention will be given to west African roots.

131B. Sociological Development of Black Families in America. (5)

Three hours of lecture and two tutorial hours per week. Prerequisite: one lower division Sociology course, or consent of the instructor. Not open to students who have completed course 191S. Course 131A is recommended but not required for admission to 131B. Variations in family responses and role development to elements of the social context of 20th-century America.

132. Social Stratification. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Recent trends in occupational stratification; social classes in local communities and the nation as related to interest organizations.

Miss Heyns (W)

134. Sociology of War and Conflict. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Violent and peaceful procedures in the pursuit of national objectives; analysis of attempts to specify the causes of war.

Mr. Matza (W); Mr. Fischer (Sp)

135. Social Change in Underdeveloped Countries. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. The problem of progress; factors influencing social change, especially in the modern West and Asia.

140. Social Change. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Major sources of change in societies; prediction of future changes.

Mr. Swanson (W)

141. Social Organization of Modern Western Societies. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Comparison of selected social institutions; their relation to ideas and social change.

Mr. Eberhard (F)

146. Sociology of Religion. (5)

Three lecture hours and two consultation hours per week. A systematic survey including sociological theory and organizational structure of religion, the character of religious authority and leadership, the individual's religion, and the interplay of religion with other spheres of social life.

Mr. Glock (Sp)

148. Elementary Collective Behavior. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. Social contagion and crowd behavior, psychic epidemics, popular arts and interests, fashions, mass behavior, formation and manipulation of public opinion.

Mr. Blumer (Sp)

149. Social Movements and Public Action. (5)

Three lecture hours and two consultation hours per week. Prerequisite: restricted to majors in sociology and to those non-majors who have completed two upper division sociology courses. Social movements, the formation and play of public opinion, and the behavior of interest groups.

150. Human Migration. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. History of international migration and analysis of its types, causes, and consequences. Study of internal migration in the United States and in selected foreign countries. Statistical, social and demographic problems connected with migration.
151. Sociology of Women. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Historical and comparative analysis of women’s varying roles, statuses, and life opportunities. Consideration of the feminist movement, past and present, with special emphasis on struggles over conflicting definitions of woman’s “nature” and potential. ——— (F, W)

157. History of Sociological Theory. (5)
Three lecture hours and two tutorial hours per week. Prerequisite: one lower division Sociology course, or consent of the instructor. History of social thought as a source of present-day problems and hypotheses. ——— (F); Mr. Nonet (W); ——— (Sp)

158. Contemporary Sociological Theories. (5)
Three lecture hours and two tutorial hours per week. Prerequisite: course 157. Major theoretical perspectives and schools in sociology.

160. Urban Sociology and Ecology. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. The nature, causes, and consequences of world urbanization; metropolis; location and types of cities; social and demographic characteristics of urban populations.

162. Urban Structure and the Individual. (5) *
Three lecture hours and two tutorial hours per week. Prerequisite: one lower division sociology course or consent of instructor. The sociology of personal and group reactions to urban life. Mr. Fischer (W)

164. Folklore and Society. (5)
(Formerly numbered 191F) Three lecture hours and two tutorial hours per week. Prerequisite: one lower division course, or background in folklore, or consent of instructor. Analysis of form, content, and value systems in oral literature and folk customs of non-Western, specifically Asian, societies by the use of sociological methods. The role of folklore in modernizing and modern societies. Mr. Eberhard (W)

165. Japanese Society. (5)
Three lectures and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. The nature of traditional Japanese society and its modern transformation. The place of values, world view and religion will be especially emphasized.

166. Agricultural Oriental Societies. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. Main characteristics of medieval China, Japan, India as compared with the West. Research methods. Mr. Eberhard (Sp)

167. Modern Social Structure in the Near East. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. Social organization of contemporary Near East. Contact of nomads with settled groups. Processes of modernization in both groups.

174. Sociology of Literature. (5)
Three lecture hours and two consultation hours per week. The relation of literature to the social order and to systems of social control. Analysis of the social role of the writer.

176. Interpersonal Behavior in Small Groups. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. An examination of sociological theories and research on behavior in small groups. Topics such as status relations, communication, coalitions and interpersonal conflict are examined in light of field and laboratory research.

178. Social Interaction and Personal Organization. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. A critical analysis of dominant theories and schemes of research in social psychology. Mr. Blumer (F); Mr. Paige (Sp)

179. Personality and Social Structure. (5)
Three hours of lecture and two consultation hours per week. Prerequisite: A course in introductory sociology. An analysis of the establishment and growth of personality, and of varieties of personality, as a consequence of social experience and an evaluation of social-psychological and sociological explanations of these developments. Mr. Swanson (F)

180. The Group Studying Itself. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of instructor. Enrollment will be limited to 15 students admitted by consent of the instructor. Not open to students who have taken Sociology 191P. Seminar in field methods of small group observation. Emphasis placed on the great variety and diversity of conceptual schemes the observer may choose among in giving order to observational data.

184. Social Structure of Communist Societies. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of instructor. Various aspects of the class system, economic life, nationality groups, the family, education, demographic factors; comparison of communist social structure with American. Mr. Schurmann (Sp)

190. Seminar on Advanced Topics. (5)
Two seminar hours plus four tutorial hours per week. Prerequisite: admission by consent of the instructor. Advanced study in sociology, with specific topics to be announced at the beginning of each quarter. Mrs. Selznick (W); Mr. Nonet (Sp)

§191S. Sport as a Social Institution. (5)
Three hours of lecture and two hours of tutorial per week. Prerequisite: one lower division sociology course or consent of instructor. Analysis of sport as social institution, its structure and functions: male-female role contrasts, race and sport; economics of sport; the roles of coach, athlete, fan—their interrelationships and complexities; current turmoil in sport and the ideological struggle which has developed. Mr. Edwards (W)

Two lecture-seminar hours and four consultation hours per week. Prerequisite: open only to seniors in sociology who are seeking an A.B. degree with honors. Intensive study of individual topic to provide background for honors thesis. Group and individual conferences. Credit and grade will be assigned only upon completion of the full sequence.

Mr. Bock (F, W, Sp)

197. Field Study in Sociology. (1–5)

One to five meeting and consultation hours per week. Prerequisite: one lower division course in sociology, or consent of the instructor. Supervised experience relevant to specific aspects of sociology in off-campus organizations. Regular individual meetings with faculty sponsor and written reports required.

The Staff (F, W, Sp)

198. Directed Group Study for Undergraduates. (1–5)

One to five meeting and consultation hours per week. Prerequisite: consent of the instructor. Group studies of selected topics which vary from year to year.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Hours per week: 1–5 in individual consultation. Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.

The Staff (F, W, Sp)

Graduate Courses

201A–201B. Methods of Sociological Research. (4–4)

Two lecture hours and two consultation hours per week. Prerequisite: course 105 or equivalent. A two-quarter sequence course treating sociological methods, emphasizing the logic of social inquiry, problems of research design and execution, and qualitative and quantitative analysis. Laboratory work will be offered in problems of design, data collection, and analysis. Credit and grade will be given only upon completion of the full sequence.

Mr. Glock (F, W)

202. Seminars in Research Methods. (4)

Two seminar hours and two consultation hours per week. Prerequisite: consent of instructor.

Mr. Blauner (W); Mr. Paige, Mr. Glock (Sp)

203A–203B–203C. Research Methods Seminar Sequence. (1–1–4)

Two hours of seminar meetings biweekly throughout the year and two tutorial hours biweekly throughout the year. Prerequisite: 203A prerequisite to 203B, 203A–203B prerequisite to 203C. An alternative format for methods seminars, satisfying the same requirements as comparable 202 seminars. Format similar to staff-meeting-seminar of research assistants planning, discussing, or analyzing a major research activity in which the faculty member is currently engaged. Credit and grade will be assigned only upon completion of the full sequence.

206. Socialization and Personality. (4)

Two lecture hours and two consultation hours per week. Goals and process of socialization; the self; organized social roles as mediated through the norms and patterned interactions of family, peer group and school.

Mr. Clausen (F)

207. Analysis of Social Action. (4)

Two lecture hours and two consultation hours per week. Advanced social psychology, particularly from the viewpoint of George H. Mead; the nature of the social situation, social roles, the self, socialization, the social act.

Mr. Blumer (W)

208. Social Interaction and Organization. (4)

Three lecture hours and two consultation hours per week. Prerequisite: graduate standing in sociology or psychology.

Mr. Swanson (Sp)

*209A–209B. Advanced Interpersonal Behavior. (4–4)

Two hours of lecture or seminar plus two tutorial hours per week. Prerequisite: course 209A is recommended but not prerequisite to 209B. Students may take the lecture course 209A or the seminar 209B, or they may take 209A–209B in sequence, with credit and grade assigned upon completion of the full sequence. Intensive study of selected topics in interpersonal behavior and small group processes: evolution of power and prestige orders, balance and exchange processes, interpersonal conflict, and social influence processes.

*210A–210B. Racial and Ethnic Minorities. (4–4)

Two hours of lecture or seminar and two hours of tutorial per week. Prerequisite: course 210A is recommended but not prerequisite to 210B. Students may take the lecture course 210A or the seminar 210B, or they may take 210A–210B in sequence, with credit and grade assigned upon completion of the full sequence. Describes and analyzes the nature of minorities and their relations with dominant members of society. Stresses processes of subjugation, accommodation, and mobilization. Different kinds of minorities compared to convey the range of differences as well as similarities.

212. Deviance and Social Control. (4)

Two lecture hours and two consultation hours per week. Deviance and social system analysis; ethnography of deviant communities.

Mr. Duster (F)

*214A–214B. Advanced Quantitative Methods. (4–4)

Two lecture hours and two laboratory hours per week. Prerequisite: Statistics 130A or 131 or equivalent. Course 214 or equivalent prerequisite for 214B. Credit may be earned in 214A alone, or students may take 214A–214B in sequence with credit and grade assigned upon completion of the sequence. Multi-variate statistics and linear models and their application in sociology: multiple regression, structural equations, measurement error, cross tabulation statistics, factor analysis, and analysis of variance. Laboratories will apply techniques to the analysis of a body of quantitative sociological data.

*217. History of Social Thought. (4)

Two lecture hours and two consultation hours per week.

*218A–218B. Seminars in the History of Social Thought. (4–4)

Two seminar hours and two tutorial hours per week. Prerequisite: course 217 or course 227 or equivalent. Credit and grade will be assigned only upon completion of the full sequence.
219. Sociology of Law. (4)
Two lecture hours and two consultation hours per week. Functions of law in society; social sources of legal change; social conditions affecting the administration of justice; role of social science in jurisprudence.

222. Sociology of Education. (4)
Two lecture hours and two consultation hours per week. The study of educational systems and processes, with special emphasis on the relations of education to other social institutions.
Miss Heyns (Sp)

224. Social Change. (4)
Two lecture hours and two consultation hours per week. Stresses the rise and spread of industrialism to underdeveloped countries. Mr. Ojaku (W)

227A–227B. Basic Issues in Sociological Theory. (4-4)
Two hours of lecture plus two tutorial hours per week. Prerequisite: admission by consent of the instructor. Credit and grade will be assigned upon completion of the full sequence. Representatives of major theoretical traditions in sociology will be examined intensively and critically, and an effort will be made to identify the recurrent substantive and methodological issues that arise in sociological theorizing.
Mr. Selznick (W, Sp)

228. Seminars in Sociological Theory. (4)
Two seminar hours and two consultation hours per week. Prerequisite: course 227 or equivalent.
Mr. Bock (F); Mr. Nonet, Mrs. Selznick, Mr. Bullah (W)

229. Sociology of Work. (4)
Two seminar hours and two consultation hours per week. Course 229 may be taken in one quarter or in two. When course 229 is followed by one quarter of Sociology 290 with the same instructor, it may be considered a sequence course; credit and grade will then be assigned upon completion of the full sequence. The organization of work and varieties of work experience. Topics: occupational roles and career patterns; the interplay of machine, man, colleague group, and complex organization; worker participation in management; social aspects of industrial conflict; labor, industry, and society.

230. Population. (4)
Two lecture hours and two consultation hours per week. Prerequisite: a course in population or consent of instructor. Problems in the theory of population; institutional and motivational aspects of demographic behavior.
Mr. Davis (F)

231. Sociology of Marriage, Family, and Kinship. (4)
Two lecture hours and two consultation hours per week. Family structure and behavior, including kinship, marriage, divorce, reproduction, and parental relations; interrelations between family and stratification, economy, law, religion.

232. Social Stratification. (4)
Two lecture hours and two consultation hours per week. Theoretical and methodological problems in the field, with special emphasis on comparative materials.
Miss Heyns (W)

241. Organizations and Institutions. (4)
Two lecture hours and two consultation hours per week.
Mr. Nonet (F)

242A–242B. Comparative Social Structure. (4-4)
Two lecture or seminar hours and two tutorial hours per week. Prerequisite: course 242A is recommended but not prerequisite to 242B. Students may take the lecture course 242A or the seminar 242B, or they may take 242A–242B in sequence with credit and grade assigned upon completion of the full sequence.
Mr. Eberhard (F)

246. Sociology of Religion. (4)
Two lecture hours and two consultation hours per week. Prerequisite: course 146, or consent of instructor.

248. Collective Behavior. (4)
Two lecture hours and two consultation hours per week. Studies in mass behavior, social movements, and political action.

254. Sociology of Health and Medicine. (4)
Two lecture hours and two consultation hours per week. A general orientation to sociological theory and research bearing upon the phenomena of health and disease and the organization and functioning of societal efforts to cope with disease.

255. Sociology of Mental Health. (4)
Two lecture hours and two consultation hours per week. Social and cultural aspects of mental illness: etiology, symptomatology, and duration; social and organizational responses.

260A–260B. Political Sociology. (4–4)
Two lecture hours and two tutorial hours per week. Prerequisite: course 260A is recommended but not prerequisite to 260B. Students may take the lecture course 260A or the seminar 260B, or they may take 260A–260B in sequence with credit and grade assigned upon completion of the full sequence. Contributions of sociology to theory and research in politics. Analysis of structure and ideology of organized groups.
Mr. Kornhauser (F, W)

261. Sociology of Comparative Politics. (4)
Two lecture hours and two tutorial hours per week. A survey of sociological theory and research on comparative political organization with particular emphasis on the relationship between economy and polity. Agrarian societies and the origin of the state, capitalism and revolutionary political change, imperialism and underdevelopment.
Mr. Paige (W)

262. Urbanization. (4)
Two lecture hours and two consultation hours per week. Urbanization in the world and in particular countries. Causes and consequences of organization, theory of city location; patterns of city growth, problems of measurement.
Mr. Fischer (W)

263. Modern Society: Structural Uniformity and Cultural Diversity. (4)
Two lecture hours and two consultation hours per week. Prerequisite: may be taken either as a one-quarter course or as a two-quarter sequence with course 290 with the same instructor. Social and cultural impact of continued economic growth in rich countries. Critical examination of major images of modern society—"urban," "industrial," "mass," "pluralist," "totalitarian." Special attention to variations in class structure, minority groups, the welfare state, popular culture, role of intellectuals.
265. American Society. (4)

Two lecture hours and two tutorial hours per week. American institutions beginning during the Second World War and subsequent development of domestic and international arrangements. Emphasis on relationships among labor, the economy, international affairs. Background on the period before World War II, especially the depression years, for the understanding of the post-war era.

Mr. Matza (Sp)

290. Seminar. (4)

Two seminar hours and two consultation hours per week. Advanced study in modern sociology. The specific topics will be announced at the beginning of each quarter.

Mr. Blauner, Mr. Fischer, Mr. Swanson, Mr. Lowenthal (F); Mr. Bock, Mr. Davis, Miss Hochschild, Mr. Swanson, Mr. Lowenthal (W); Mr. Eberhard, Mr. Ojiaku (Sp)

SOILS AND PLANT NUTRITION

(Department Office, 108 Hilgard Hall)

Professors:

Kenneth L. Babcock, Ph.D. (Chairman)
Paul R. Day, Ph.D.
Louis Jacobson, Ph.D.
A. Douglas McLaren, Ph.D.
James P. Bennett, Ph.D. (Emeritus)
Geoffrey B. Bodman, Ph.D. (Emeritus)
Theodore C. Broyer, B.S. (Emeritus)
R. Earl Storie, B.S. (Emeritus)

Associate Professor:

Lawrence J. Waldron, Ph.D.

Assistant Professors:

Harvey E. Doner, Ph.D.
Paul L. Gersper, Ph.D.
Norman Terry, Ph.D.

Undergraduate Major Adviser: Mr. Doner.

Graduate Adviser for Soil Science: Mr. Waldron.

Graduate Adviser for Plant Physiology: Mr. Jacobson.

The Department of Soils and Plant Nutrition in the College of Agricultural Sciences offers a major in soils and plant nutrition under the Agricultural Sciences Curriculum (see page 67). The requirements for the major involve both biological and physical sciences. Flexibility is provided by the inclusion of a substantial number of electives to be selected in consultation with the undergraduate adviser. The program may be broadly selected so as to include a wide variety of subjects relating to the improvement of production methods for food and fiber as well as the evaluation of the resources of the agricultural industry. Alternatively, the student may undertake more specialized work, including preparation for graduate study in either soil science or plant physiology.

NOTE: For key to footnote symbols, see page 66.
Undergraduate Major Requirements

*Humanities and Social Sciences*, 18 units as follows: English, rhetoric, or comparative literature (8); restricted electives (anthropology, art, classics, decorative art, dramatic art, economics, foreign languages, geography, history, music, philosophy, political science, psychology, sociology, or additional English or rhetoric) (10).

*Physical Sciences and Mathematics*, 32 units as follows: chemistry (12); geology (4); physics (12); analytic geometry and calculus (4).

*Biological and Agricultural Sciences*, 18 units as follows: biology (12); plant ecology or world agriculture (3); plant pathology (3).

*Major Field*, 36 units as follows: plant nutrition (6); soil characteristics (4); development and morphology of soils (4); soil as a medium for plant growth (5); soil microbiology (4); additional courses in soil science (13).

*Additional courses*, 76 units.

*Total units*, 180.

Certain courses may be required in satisfaction of the above. The undergraduate adviser will provide this information and any other details about the major.

Graduate Programs

The Department of Soils and Plant Nutrition offers work leading to the M.S. and Ph.D. degrees in soil science or plant physiology. Typical areas of specialization include soil chemistry, soil physics, soil microbiology, soil genesis and morphology, soil fertility, plant or soil biochemistry, plant nutrition, plant physiology, plant-soil relationships, and water relations of plants and/or soils. In addition, degrees are available in agricultural chemistry, biophysics, comparative biochemistry, microbiology, and other group programs in which individual faculty members participate.

Candidates for advanced degrees in *Soil Science* are required to show competence in mathematics (calculus), in the physical, biological, and earth sciences, and in soil science and plant nutrition. The M.S. degree may be obtained either by the thesis plan or by comprehensive examination. Applicants for the Ph.D. degree must satisfy the foreign language requirement before taking the oral qualifying examination. At least four units of graduate seminar credit are required.

Candidates for advanced degrees in *Plant Physiology* are required to secure a strong background in mathematics (including calculus and biometry), botany, chemistry, physics, and biochemistry in addition to prescribed courses in genetics, plant nutrition, and soil science. After admission to candidacy, a student may obtain the M.S. degree by means of a thesis based on individual research, or by means of a comprehensive examination. Ph.D. candidates must satisfy a foreign language requirement before taking the oral qualifying examination. Appropriate graduate seminars are prescribed during doctorate study.

For further details, consult the appropriate graduate adviser.

Soil Science

Lower Division Courses

10. The Soil and Its Significance to Man. (3)

Three 1-hour lectures per week. Prerequisite: Chemistry 1A or high school chemistry. Cannot be used for credit in the soil science major. For students who desire a general knowledge of soils.

Mr. Gersper (Sp)

10L. The Soil and Its Significance to Man—Laboratory. (1)

One 3-hour meeting per week: laboratory, demonstrations, and field trips. Prerequisite: course 10 (may be taken concurrently). Mr. Williams (Sp)

Upper Division Courses

100. Soil Characteristics. (4)

Three 1-hour lectures per week; one 3-hour laboratory per week; one field trip. Prerequisite: Chem-
101. Development and Morphology of Soils. (4)

Three 1-hour lectures and 1-hour discussion per week. Prerequisite: Geology 10, Chemistry 1A. Recommended: course 100. Climate, vegetation, geology, topography, and time as factors in development and chemistry of great world soil groups. Mr. Gersper (Sp)

101F. Development and Morphology of Soils. (1)

Field trips. Prerequisite: course 101 should be taken concurrently. Saturday excursions in connection with course 101. Mr. Arkley (Sp)

102. Soil Physics. (5)

Three 1-hour lectures per week; two 3-hour laboratories per week. Prerequisite: course 100, Mathematics 16A. Analysis of important physical processes occurring in soil and of the soil physical properties affecting them. Mr. Waldron (W)

103. Soils of California and the Western United States. (4)

Three 1-hour lectures per week; one hour discussion per week; two field trips to be arranged. Prerequisite: Geology 5A, or 10; Chemistry 1A. Characterization and geography of agricultural, grazing, and forest-soils of the Western United States, with emphasis on soils of arid regions; their identification, classification, and use rating. Mr. Arkley (W)

105. Summer Field Course. (8)

Six weeks, daily. Prerequisite: course 100, 101, or 103, and consent of instructor. Field study of soils, with emphasis on their characteristics, morphology, and genesis. Field exercises in classifying and mapping soils, and preparation of soil survey reports. Practice in identifying and evaluating soils for agricultural, range, forest, and other use. Mr. Arkley, Mr. Begg (Extrasession)

110. The Soil as a Medium for Plant Growth. (5)

Five 1-hour lectures per week. Prerequisite: Chemistry 1A–1B, Chemistry SA or Chemistry 1C. Chemistry of plant, soil, and microbial interrelationships under acid, alkaline, and saline regimes; nutritional factors in productivity, reclamation, and conservation. Mr. Babcock (F)

111. Soil Microbiology and Soil Biochemistry. (4)

Two 1-hour lectures per week; laboratory, six hours per week. Prerequisite: Biology 1A–1B. Activities of microorganisms related to soil organic matter, soil properties, and the rhizosphere. Mr. Huismans (Sp)

112. Soil Chemistry. (3)

Three 1-hour lectures per week. Prerequisite: course 110. Physicochemical properties influencing the availability of elements in soils to plants. Mr. Doner (W)

113. Soil Chemistry Laboratory. (3)

Three 3-hour laboratories per week. Prerequisite: course 112. Liquid, solid, and gaseous phases of soils; cation exchange; solubility, buffering, salinity, reaction; chemistry of macronutrients and micronutrients. Mr. Doner (W)

116. Soil Management. (3)

Two 1½-hour lectures and demonstrations per week. Prerequisite: senior standing in soil science. Estimation of soil fertility by soil and tissue analysis and plant growth methods; use of fertilizers; soil physical properties related to management problems. Mr. Ulrich, Mr. Arkley (Sp)

120. Soil and Water Conservation. (3)

Lectures, 2 hours per week; discussion, one hour per week. Analysis of contemporary and perennial problems: soil pollution by pesticides, heavy metals, radioactive materials; disposal and recycling of wastes on the soil; the loss of agricultural land to urban use; soil erosion and nutrient depletion water yield; soil salinization. Mr. Waldron (F)

198. Directed Group Study, (1–5)

Selected topics in soil science for advanced undergraduates. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

203. Soil Resources Evaluation. (3)

One 2-hour lecture per week; field work. Prerequisite: training in any of the following fields: soil science, forestry, range management, irrigation, land economics, geography. Survey data interpretations for appropriate land uses; cultivation, grazing, timber, watershed, and multiple use; tax and economic appraisals. Mr. Arkley (W)

211. Advanced Soil Biochemistry and Soil Biology. (2)

Two 1-hour lectures and discussions per week. Prerequisite: course 111 or equivalent. Offered in even-numbered years. Microbial activity at surfaces and in the rhizosphere; mineral nutrition of soil microorganisms and the fate of agricultural chemicals in soil. Origin, nature, and properties of soil organic matter. Mr. Huismans (F)

212. Advanced Soil Chemistry. (4)

Two 1-hour and one 2-hour lectures per week. Prerequisite: course 110; Chemistry 109. Applications of thermodynamics to soil systems. Mr. Babcock (W)

213. Podochemistry and Mineralogy of Soils. (3)

Three 1-hour lectures per week. Prerequisite: graduate standing in soil science or consent of instructor. Crystal structure and colloid chemistry of soil clay minerals; application of principles of mineralogy and chemistry to a quantitative evaluation of soil formation. Mr. Barshaq (W)

213L. Podochemistry and Mineralogy of Soils. (2–5)

Laboratory, six to fifteen hours per week. Prerequisite: course 211 or 213, may be taken concurrently. Chemical and mineralogical analyses for evaluating soil profile formation and chemistry of soil organic matter. Laboratory exercises adapted to individual interest of the student. Mr. Barshaq (W)

220. Soil Physics. (5)

Three 1-hour lectures per week; two hours discussion group per week. Prerequisite: course 102; Mathematics 1A–1B–1C. Statics and dynamics of soil water, with development of general principles,
applicable to saturated and unsaturated soils, both isotropic and anisotropic, with examples from hydrology, irrigation practice, and drainage.

Mr. Day (Sp)

235. Seminar. (2)
One 1½-hour meeting per week. Prerequisite: graduate standing in soil science, plant physiology, or related subjects.
The Staff (F)

298. Special Study for Graduate Students. (1–6)
The Staff

299. Research in Soil Science. (1–12)
Prerequisite: graduate standing and consent of instructor.
The Staff (F, W, S)

601. Individual Study for Master’s Students. (1–8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff, Mr. Waldron in charge (F, W, S)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff, Mr. Waldron in charge (F, W, S)

IDS 10A–10B–10C. Man and His Environment—Crises and Conflicts. (5–5–5)
See Interdepartmental Studies for complete description of this course.

Staff Seminar in Soil Science. (No credit)
The Staff (F, W, S)

Plant Nutrition

Upper Division Courses

115. The Nutrition of Green Plants. (3)
Three 1-hour lectures per week. Prerequisite: Biology 1A–1B. Evolution of modern concepts of plant nutrition, including functional aspects of inorganic nutrients, photosynthesis, nitrogen metabolism.
Mr. Terry (W)

117. The Nutrition of Green Plants—Laboratory. (3)
Three 3-hour laboratories per week. Prerequisite: course 115 (taken concurrently if possible). Laboratory and greenhouse experiments in plant nutrition to accompany course 115.
Mr. Jacobson (F)

120. Plant Biochemistry. (3)
Three 1-hour lectures per week. Prerequisite: Biochemistry 102 or equivalent. Biochemistry of plant processes.
Mr. Terry (W)

198. Directed Group Study. (1–5)
Selected topics in plant nutrition for advanced undergraduates.
The Staff (F, W, S)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulation listed on page 87. Must be taken on a passed or not passed basis.
The Staff (F, W, S)

Graduate Courses

206. Seminar in Plant Physiology. (2)
One 1½-hour meeting per week. Prerequisite: qualified graduate students with consent of staff member in charge. Problems of plant physiology in the field of botany, food science, forestry, plant nutrition, and soil science.
Mr. Babcock, Mr. Gold, Mr. Jacobson, Mr. Stone, Mr. Stout, Mr. Ulrich, Mr. Williams (W, S)

298. Special Study for Graduate Students. (1–6)
The Staff (F, W, S)

299. Research in Plant Nutrition. (1–12)
Prerequisite: graduate standing and consent of the instructor.
The Staff (F, W, S)

601. Individual Study for Master’s Students. (1–8)
Individual study for the comprehensive or language requirements in consultation with the field adviser. Units may not be used to meet either unit or residence requirements for a master’s degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff, Mr. Jacobson in charge (F, W, S)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff, Mr. Jacobson in charge (F, W, S)

IDS 10A–10B–10C. Man and His Environment—Crises and Conflicts. (5–5–5)
See Interdepartmental Studies for a complete description of this course.

Staff Seminar in Plant Nutrition. (No credit)
The Staff (F, W, S)

SOUTH AND SOUTHEAST ASIAN LANGUAGES AND LITERATURES

(Department Office, 246 Dwinelle Hall)

Professors:
P. S. Jainsi, Ph.D.
J. F. Staal, Ph.D. (Chairman)

Associate Professors:
Bruce R. Pray, Ph.D.
Barend A. van Nooten, Ph.D.

NOTE: For key to footnote symbols, see page 86.
Departmental Major Advisers: Hindi-Urdu, Indian Civilization: Bruce Pray; Sanskrit: Robert Goldman.
Graduate Advisers: Hindi-Urdu: Bruce Pray; Sanskrit: Robert Goldman.

A complete program of graduate and undergraduate instruction and graduate research in the languages, literatures, and civilization of South and Southeast Asia from the most ancient period to the present is offered.

Instruction centers around intensive training in major languages and literatures of the area and provides such training in Hindi, Indonesian, Nepali, Sanskrit (along with Buddhist Sanskrit, Pali, and Prakrit), Tamil, and Urdu. Within the context of language studies specialized training is offered in several area-related disciplines including: literature, philosophy, linguistics, mythology, religion, archaeology, and area civilization. In addition students are able and encouraged to avail themselves of area-relevant courses offered in other departments, including History, Art History, Music, Anthropology, Linguistics, etc.

The program as a whole maintains a balance between ancient and modern studies and between linguistic and cultural disciplines. As a result programs of study can be devised to fit the needs of students with interests varying from Indo-Aryan comparative grammar and Modern Hindi fiction to Buddhism, Yoga, and South Asian archaeology. Studies in Buddhism can be pursued at the graduate level by way of the Group in Buddhist Studies.

The Major

Majors are offered in three separate areas: Hindi-Urdu, Indian Civilization, and Sanskrit. Requirements for each major are as follows:

Hindi-Urdu: (1) Hindi 1A–1B–1C (should be taken as early as possible, preferably in the freshman year); (2) 37 upper division language units and 8 upper division lecture units. The course distribution is to be chosen in consultation with the major adviser. Portions of the requirement may, with permission, be fulfilled by relevant courses in other departments.

Indian Civilization: (1) South Asian 15A–15B–15C; (2) 15 units of Sanskrit or 13 upper division units of a modern Indo-Aryan or Dravidian language; (3) 24 units from the following list: Anthropology 188A, Art History 136A–136B, History 187A–187B, Interdepartmental Studies 155, Linguistics 165, Music 128L, 128M, South Asian 121, 122, 123, 124, 125, 130, 132, 140, 175.

Sanskrit: (1) South Asian 15A–15B–15C, Linguistics 20; (2) a minimum of 30 units of Sanskrit; (3) a minimum of 12 units to be selected by the student, in consultation with the adviser, from the following list: Anthropology 188A, Art History 136A–136B, History 187A–187B, Interdepartmental Studies 155, Linguistics 165, South Asian 121, 122, 123, 140, 175.

Honors Program All majors will have an honors program. Candidates must maintain an overall 3.0 grade-point average and complete an honors thesis.

Graduate Study

Programs of graduate study and research leading to the M.A. degree are offered in the areas of Hindi and Urdu, Sanskrit, and South Asian civilization. Programs leading to the Ph.D. degree are offered in Modern Indo-Aryan: Hindi and Urdu, and Sanskrit.
Degrees All students admitted to programs leading to a graduate degree will be expected to have, in addition to a B.A. or its equivalent, some formal academic background in South or Southeast Asian languages and area studies. Students should in general be prepared to have undergone training equivalent to that required of departmental majors in the various areas. M.A. candidates with insufficient preparation may be required to make up deficiencies without credit toward the M.A. unit requirement.

The M.A. degree is generally offered under Plan II (see page 36) which requires the student to take courses totaling at least 36 upper division and graduate units, of which at least 18 must be graduate. The distribution of courses is determined in consultation with the graduate adviser, following the special requirements for each degree. In special cases, the program may be carried out under Plan I for which a Master's thesis is submitted.

Except in unusual circumstances, a student is expected to complete his M.A. program in six quarters. Further information about University degree regulations can be found in this catalogue.

As part of the M.A. requirement, the student must pass a reading examination in a language which the student and his adviser decide is relevant to the student's major interest. Examples are Dutch, French, German, Japanese, and Russian. The language required for admission to the M.A. program cannot be offered for this reading requirement.

Before being admitted to the comprehensive examination, the student is required to submit to his graduate adviser two acceptable scholarly papers, prepared either independently or in connection with graduate courses.

The student must pass a written examination to consist of a general section and two areas of specialization toward which the student has directed his reading and coursework. The foreign language requirement and the two scholarly papers must be completed before the student can be admitted to this examination.

Programs leading to the Ph.D. degree will be offered in Sanskrit and Modern Indo-Aryan: Hindi and Urdu. The general prerequisites for admission to a Ph.D. program are the requirements for the M.A. degree in the appropriate field. A student without such an M.A. degree would normally be advised to apply for admission to the M.A. program, even though his eventual goal is the Ph.D. degree. At the conclusion of the M.A. program, he will be informed as to whether he is eligible for admission to the Ph.D. program. If a student already has an M.A. degree from another university, he will be expected to make up the deficiencies in his preparation and to fulfill the requirements for the M.A. degree in this department, except for the comprehensive examination.

The Ph.D. degree is offered according to Plan B. Beyond the course requirements for the M.A. the student will complete a course in Indo-Aryan or Indo-European comparative grammar. He is expected to plan a program that will best prepare him for his qualifying examinations and the writing of the dissertation. The General Catalogue should be consulted for further information and regulations.

The student must demonstrate a reading knowledge of two languages relevant to his major field of interest. These languages will normally be selected from the following list: Dutch, French, German, Japanese, and Russian. Under special circumstances a student may offer another language with the approval of his adviser. The foreign language requirement is normally met by passing a reading examination in each language. This requirement must be met before the student can take his qualifying examinations.

Before being admitted to candidacy for the Ph.D., the student must demonstrate his competence in the language or languages in his program, and must pass a written and oral qualifying examination in his three fields of specialization. One of these
fields may be in an area of study outside the department. Fields within the department are Hindi literature, Dravidian linguistics, Vedic, Prakrit, the Sanskrit grammarians; fields outside the department are Indian history and Indian art. Fields such as Indian philosophy and Buddhism can be studied both within and outside the department. Early in his Ph.D. program, the student should consult with his graduate adviser and then submit a "statement of field," indicating how he will prepare himself through reading and coursework for the qualifying examinations. The examinations will be administered by a committee appointed by the Graduate Council.

After admission to candidacy, the student will complete the Ph.D. dissertation according to Plan B. The dissertation will conform to procedures and regulations set by the Graduate Division and the Graduate Council; no additional requirements will be adopted by this degree program.

South Asian

Undergraduate Courses Not Requiring Knowledge of Area Languages

Lower Division Course

*15A-*15B-*15C. Introduction to Indian Civilization, (5-5-5)
Three 1-hour lectures and one scheduled 1-hour discussion and one cultural presentation per week. A study of major cultural and social developments in early, medieval, and modern India, intended for students with little previous background in Indian studies. Sequence beginning (F). Students may be admitted for later quarters with consent of instructor.

(F, W, Sp)

Upper Division Courses

*121. Early Indian Literature, (4)
Three hours of lecture per week. A study of early Indian literature, primarily using translations from classical Sanskrit literature: epics, drama, and lyric poetry.
Mr. van Nooten (F)

122. Medieval Indian Devotional Literature, (4)
(Formerly South Asian 121B)
Three hours of lecture per week. A study of medieval Indian literary and cultural traditions, through readings in English translation, primarily of devotional poetry.
(F)

*123. The Indian Story, (4)
Three 1-hour meetings per week. The short story in classical, medieval and modern India, studied through English translations. Stress will be placed on the way in which this literature reveals aspects of Indian life and thought.
(F)

124. Modern Indian Literature, (4)
Three hours of lecture per week. Lectures and discussion of 19th and 20th century Indian literature, based on readings in English or in English translation. Stress is placed upon the interpretation of contemporary Indian society and culture through this literature.
(Sp)

125. Tamil Literature in Translation, (3)
Three 1-hour lectures per week. Prerequisite: no previous knowledge of Tamil will be presupposed or required. The flavor, aesthetic goals, and structure of classical Tamil literature. An analysis in depth of a few representative works with special emphasis on the nature-love poetry of the earlier period of Saivite religious poetry.
Mr. Hart (Sp)

*126. Folk Religions of India, (4)
Three hours of lecture per week. Lectures and discussions of rituals and beliefs of obscure religious cults of India, past and present. Survey of folk religions of Shakti, yakṣa, shiva (mahadeva) yogis of Goraknath Pantha, serpent worship, tree symbol worship, local deities of north Indian villages based on readings in English.

127. Brahmanism and Hinduism, (4)
Three hours of lecture per week. Readings in selections from the Hindu scriptures—the Vedas, the Brāhmaṇas, the Upānīṣads, the Epics (the Gītā, and the sūtras of the traditional systems of Indian philosophy.
Mr. Jaini (F)

129. Sufism in India, (4)
The development of Sufi thought and practice in India and its expression in the literatures of India.
Mr. Pray (W)

*130. Structure of Modern Indo-Aryan Languages, (4)
Three hours of lecture per week. Prerequisite: at least one course in linguistics and consent of instructor. Linguistic analysis of the phonology, morphology, and syntax of Hindi-Urdu with comparative data from other modern Indo-Aryan languages. Those features which are characteristic of modern Indo-Aryan languages will be subject to particular study.
Mr. Pray (Sp)

131. Indian Buddhism, (4)
Three hours of lecture per week. Prerequisite: course 127. General introduction to the systems of Buddhist thought in India. Selected readings from in the Hinayāna and Mahāyāna scriptures in translation. Brief survey of the historical development of the Buddhist sangha and its impact on the peoples of South and Southeast Asia.
Mr. Jaini (W)

*132. Origin and Development of Hindi and Urdu, (4)
(Formerly South Asian 122)
Three 1-hour lectures per week. Prerequisite: at least one course in linguistics and two years of Hindi-Urdu or consent of instructor. The linguistic development of modern Hindi and Urdu in relation to Old and Middle Indo-Aryan and to other modern Indo-Aryan languages. Texts representative of earlier stages of Hindi and Urdu, such as medieval Hindi, Braj Bhasha, and Dakhani Urdu, will be studied and analyzed.
Mr. Pray (W)

*134. Linguistic Patterns of Nepal, (4)
Three hours of lecture per week. Survey of the major languages of Nepal: their structures and
genetic classifications. Special attention will be devoted to the historical development of Nepali, and possible points of convergence between Nepali and Newari.

*135. Civilizations and Peoples of Nepal. (4)
Three hours of lecture per week. Survey of caste and tribal communities of Nepal, with emphasis on the interaction between Hindu and Buddhist civilizations, and the formation and characteristics of the Newar and Gorkha kingdoms of the Kathmandu Valley.

140. Hindu Mythology. (4)
Three 1-hour lectures per week. Literary and religious aspects of Hindu myths. Reading of selected mythological texts in translation.

Mr. Goldman (Sp)

*160. Jainism and Other Heterodox Systems. (4)
Three hours of lecture per week. Prerequisite: course 131 and/or consent of instructor. Selected readings from the Jain scriptures and commentaries culminating in the 12th century A.D. Rise of other Heterodoxies, particularly in the Viraśaivas in the South and the Nāṭhas and Siddhas in the North. General introduction to the various aspects of the non-vedic religious movements of ancient and medieval India.

Mr. Jaini (Sp)

*175. Classical Indian Civilization. (4)
Three 1-hour lectures per week. Cultural, religious, and philosophical traditions: the Vedas, classical Hinduism, scholarly literature (primarily using translations from Sanskrit).

Mr. Staal

193A–193B. South Asian Archaeology (down to 3rd century B.C.), (4–4)
(Formerly numbered Near Eastern Studies 193A–193B)
Three hours of lecture per week. A survey of archaeological discoveries in South Asia (India, Afghanistan, Pakistan) from Stone Age times to the beginning of historical times in the 3rd century B.C. Emphasis will be placed on the factors leading to the rise of the Indus (Harappan) civilization and the question of contacts between South Asia and the Near East.

A: Stone Age, the Neolithic and beginnings of agriculture, and rise of civilization.

B: The Indus civilization, post-Harappan “dark age” and Aryan problems.

Mr. Dales (W, Sp)

198. Directed Group Study for Upper Division Students. (1–4)
Tutorial instruction in areas not covered by regularly scheduled courses.

(F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Must be taken on a passed/not passed basis. Enrollment is restricted by regulations shown on page 87.

(F, W, Sp)

Graduate Courses

210. Linguistics in India. (4)
Three 1-hour meetings per week. Prerequisite: some familiarity with linguistics and/or the elements of an Indian language, or consent of instructor. The linguistic description and analysis of Sanskrit as created and developed by the Sanskrit grammarians.

Mr. Staal (Sp)

*212. Indian Philosophical Texts. (4)
Three 1-hour meetings per week. Reading of Sanskrit texts on Indian Philosophy (e.g., Sankara or other Vedanta & Mimamsa) for students with some knowledge of Sanskrit.

Mr. Staal (W)

Three hours of lecture per week. Prerequisite: one year of Sanskrit and/or consent of instructor. A survey of the origins and development of the Abhidharma texts and commentaries in Pali and Sanskrit.

A: Selected readings from the Visuddhimagga and the Abhidharmakosa. C: Advanced readings in Buddhist texts leading to a comparative study of the Hinayana and Mahayana schools of Buddhism.

Mr. Jaini (F, W, Sp)

Hours variable. Prerequisite: consent of instructor. A, South and Southeast Asian Studies; B, Dravidian, C, Hindi-Urdu; D, Malay-Indonesian; E, Nepali; F, Sanskrit. Students may enroll in more than one section of 290, but the total number of units of Special Study in any one quarter may not exceed 12.

The Staff (F, W, Sp)

293. Seminar in South Asian Archaeology. (4)
(Formerly numbered Near Eastern Studies 293)
Three hours of seminar per week. Prerequisite: consent of instructor. Discussions and research into a major aspect or problem of South Asian Archaeology. Subject to be selected through consultation of students and instructor.

Mr. Dales (W)

298. Seminar. (3)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor as content varies from quarter to quarter.

(F, W, Sp)

601. Individual Studies for Master Students. (1–8)
Individual Study for the comprehensive or language requirements in consultation with the graduate adviser. Units may not be used to meet either unit or residence requirements for the Master's degree. Must be taken on a satisfactory/unsatisfactory basis.

(F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

IDS 155. Philosophies of India. (4)
See Interdepartmental Studies for the complete description of this course.

IDS 212. Advanced Seminar in Buddhist Studies. (4)
See Interdepartmental Studies for the complete description of this course.
Dravidian

Lower Division Course

1A-1B-1C, Elementary Tamil. (4-4-5)
Five 1-hour recitation sessions and two 1-hour lectures per week.
Sequence beginning (F), (F, W, Sp)

Upper Division Courses

*100A–100B–100C, Studies in Dravidian Languages. (4-4-4)
Four 1-hour meetings per week. Prerequisite: course 1A–1B–1C or equivalent. May be repeated for additional credit.
Sequence beginning (F), (F, W, Sp)

Three 1-hour meetings per week. Prerequisite: course 1A–1B–1C, or consent of instructor. Introduction to Tamil literary dialect, with emphasis on its points of divergence from colloquial Tamil as taught in course 1A–1B–1C. Reading material will become progressively more “literary.” (F, W, Sp)

*102A–102B, Seminar in Comparative Dravidian Linguistics. (3–3)
Two 1½-hour meetings per week. To receive credit, both quarters must be completed. Prerequisite: some familiarity with linguistics and/or an Indian language, or consent of instructor. Reconstruction of the structures characteristic of the prototype of Dravidian languages and comparison of these structures with those of modern Indo-Aryan languages. A summary of the state of scholarship in the languages and detailed analysis of selected problems of phonology and syntax. In the second quarter, students present and discuss papers dealing with various aspects of a single problem in the comparative study of these languages. (W, Sp)

*150, Reading Course in Tamil Saivism. (4)
Four hours per week. Prerequisite: no previous knowledge of Tamil will be presupposed or required. Language skills needed for reading and integrating the texts on Saivite religion and philosophy which are written in classical Tamil. Representative selections from both the early devotional and the late doctrinal literature will be read, analyzed, and discussed. A glossary to facilitate further reading will be provided. (Sp)

Graduate Course

298, Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor.
The Staff (F, W, Sp)

Hindi-Urdu

Lower Division Course

1A–1B–1C, Elementary Hindi-Urdu. (5–5–5)
Five 1-hour sessions and two 1-hour laboratories per week. Sequence beginning (F).
Mrs. Jain (F, W, Sp)

Upper Division Courses

100A–100B–100C, Intermediate Hindi-Urdu. (5–4–4)
Five 1-hour meetings per week. Prerequisite: course 1A–1B–1C or equivalent.
Sequence beginning (F), Mr. Bryant (F, W, Sp)

102A–102B–102C, Readings in Hindi Expository Prose. (4–4–4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. Study of nonliterary writings. May be repeated for additional credit.
Mr. Pray, Mr. Bryant (F, W)

*103, Advanced Hindi Composition. (4)
(Formerly 103A)
Three hours per week. Prerequisite: course 100A–100B–100C or equivalent. Training and practice in the use of formal and informal styles of Hindi composition for writing essays, letters, and other forms of prose. May be repeated for additional credit when subject matter differs and with consent of instructor.
(F)

*104, Advanced Hindi Comprehension. (4)
(Formerly 103B)
Three hours per week. Prerequisite: course 100A–100B–100C or equivalent. Training and practice in the comprehension of standard regional and dialectical forms of Hindi. May be repeated for additional credit when subject matter differs and with consent of instructor.
Mr. Pray (W)

*105, Advanced Hindi Conversation. (4)
(Formerly 103C)
Three hours per week. Prerequisite: course 100A–100B–100C or equivalent. Training and practice in conversation and in patterns of advanced spoken Hindi. May be repeated for additional credit when subject matter differs and with consent of instructor.
Mr. Pray (Sp)

111A–111B–111C, Readings in Urdu. (4–4–4)
Three hours per week. Prerequisite: course 100A–100B–100C or equivalent, and knowledge of Urdu script. Readings in selected Urdu texts with continuing emphasis on developing skills in speaking, understanding, and writing Urdu.
Mr. Pray (F, W)

112, Urdu Poetry. (4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. Reading and analysis of a representative selection of Urdu poetry. Knowledge of the Urdu script is helpful but not required, as all material will be available in both Urdu and Devanagari scripts.
Mr. Pray (F)

149A–149B–149C, Studies in South Asian Languages. (2–4, 2–4, 2–4)
Two to four meetings per week. Prerequisite: consent of instructor. Directed study in South Asian languages other than Hindi-Urdu.
The Staff (F, W, Sp)

H198, Senior Honors. (2)
Prerequisite: limited to senior honors candidates. Directed study centering upon preparation of an honors thesis.
The Staff (F, W, Sp)
199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

201A–201B. Studies in Modern Hindi Literature. (4-4)
(Formerly 201A–201B–201C)
Three hours per week. Prerequisite: course 100A–100B–100C or equivalent. Qualified undergraduates may be admitted with consent of instructor. The study of modern Hindi literature, primarily of fiction and drama. One quarter usually stresses training, practice, and analysis of translation, one quarter usually stresses critical analysis of literature. May be repeated for additional credit. A is not a prerequisite to B.

(Formerly 201C and 202)
Three hours per week. Prerequisite: course 100A–100B–100C or equivalent. Qualified undergraduates may be admitted with consent of instructor. Reading and analysis of modern and/or medieval Hindi poetry, emphasizing poetic theory, literary conventions, and linguistic variations. (Sp)

*204 A–*204 B–*204 C. Studies in Urdu Literature. (4–4–4)
Three hours per week. Prerequisite: course 111A–111B–111C or equivalent. Qualified undergraduates may be admitted with consent of instructor. Readings in Urdu prose and poetry of all periods. Class discussion and papers will be primarily in Urdu. May be repeated for additional credit. Mr. Pray (Sp)

298. Seminar. (2)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of instructor. The Staff (F, W, Sp)

Malay/Indonesian

Lower Division Course

1A–1B–1C. Elementary Indonesian. (4–4–5)
Five 1-hour recitation sessions per week. Sequence beginning (F), Mrs. Sumukti (F, W, Sp)

Upper Division Course

100A–100B–100C. Intermediate Indonesian. (5–4–4)
Five 1-hour recitation sessions per week. Prerequisite: courses 1A, 1B, 1C or equivalent. Sequence beginning (F), Mr. Braekel (F, W, Sp)

Graduate Course

298. Group Study. (1–5)
Students may receive credit for more than one seminar in the same quarter. May be repeated for additional credit with consent of the instructor. The Staff (F, W, Sp)

Nepali

*1A–*1B–*1C. Introductory Nepali. (5–5–5)
Five hours of lecture per week. Conversational Nepali and Devanagiri script, with gradual introduction of culturally relevant readings. (F, W, Sp)

Sanskrit

Upper Division Courses

100A–100B–100C. Elementary Sanskrit. (5–5–5)
Four and one-half hours per week. Elements of Sanskrit grammar and first practice in reading Sanskrit texts. Attention will be paid to spoken Sanskrit. Mr. Goldman (F, W, Sp)

101. Epic Sanskrit. (5)
Four and one-half hours per week. Prerequisite: course 100C or equivalent. Readings from the Sanskrit Epics and Purana. This course may be repeated for credit as materials will vary from year to year. Mr. Paranjpe (F)

102. Classical Sanskrit Poetry. (5)
Four and one-half hours of lecture per week. Prerequisite: course 100C or equivalent. Introduction to the Kāśyapa style. Selected readings in classical Indian poetry and drama. Selections will vary from year to year, therefore the course may be repeated for credit with consent of instructor. Mr. Paranjpe (W)

103. Readings in the Sāstras. (5)
Four and one-half hours of lecture per week. Prerequisite: course 100C or equivalent. Introduction to Sanskrit scientific, scholarly, and commentarial texts. Selection of materials will vary in accordance with needs and interests of students. May be repeated for credit when subject matter differs. (Sp)

*104. Introduction to the Veda. (5)
Four and one-half hours of lecture per week. Prerequisite: course 100C or consent of instructor. Introduction to the grammar of the Vedic language. Readings of selected passages from Rg Veda, other sāṁhitā, brāhmaṇa, and upaniṣad texts. May be repeated for credit as materials will vary from year to year. Mr. van Nooten (Sp)

105. Pali. (5)
Four and one-half hours of lecture per week. Prerequisite: course 100C or consent of the instructor. Introduction to the grammar of the Pali texts. Selected readings of Buddhist texts. Readings will vary from year to year. The course may be repeated for credit with consent of instructor. Mr. Goldman (F)

106. Buddhist Sanskrit. (5)
(Formerly numbered 102)
Four and one-half hours of lecture per week. Prerequisite: course 100C or consent of instructor. Introduction to grammar of Buddhist Sanskrit and readings of Buddhist Sanskrit texts. Mr. van Nooten (Sp)

*107. Linguistic Theories of the Hindus. (4)
(Formerly numbered 103)
Three hours of lecture per week. A brief and general survey of Indian grammar from its inception in the Vedas until the semantic speculations of the Middle Ages, followed by a more intensive study of part of Panini’s grammar, to show its structured rules and sensibility. Mr. van Nooten
199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted to regulations listed on page 87. Must be taken on a passed/not passed basis.

The Staff (F, W, Sp)

Graduate Courses

200. Readings in Sanskrit. (5)

Four and one-half hours per week. Advanced reading of Buddhist and middle-Indic texts. Such texts are read as are suited to the student's needs. This course may be repeated for credit with consent of the instructor.

Mr. Goldman (W)

*201. Sanskrit Religious Texts. (5)

Four and one-half hours per week. Critical reading of an Upanisad or a similar text at an advanced level.

*202. The Bhagavad-Gita. (5)

Four and one-half hours per week. Introduction to text, concepts, and ideas of the Bhagavad-gita.

Mr. Goldman (F)

203. Advanced Sanskrit. (5)

Four and one-half hours per week. Readings of advanced Sanskrit texts with linguistic emphasis. The texts to be read will vary from quarter to quarter. The course may be repeated with consent of the instructor.

Mr. van Nooten (Sp)

*250. Seminar in Sanskrit Grammar. (5)

Four and one-half hours per week. Study of the phonological structure of Sanskrit.

Mr. Paranjpe (W)

SPANISH AND PORTUGUESE

(Department Office, 4321 Dwinelle Hall)

Professors:

G. Arnold Chapman, Ph.D. (Chairman)
Luis Monguió, Licenciado en Derecho, LL.D.
Edwin S. Morby, Ph.D.
Louis A. Murillo, Ph.D.
John H. R. Polt, Ph.D.
Dorothy C. Shadi, Ph.D.
Lesley B. Simpson, Ph.D. (Emeritus)
Robert K. Spaulding, Ph.D. (Emeritus)

Associate Professors:

Arthur L. Askins, Ph.D.
Jerry B. Craddock, Ph.D.
Benjamin M. Woodbridge, Jr., Ph.D.

Assistant Professors:

Charles B. Faulhaber, Ph.D.
John K. Walsh, Ph.D.

Departmental Major Advisors: Mr. Faulhaber, Mr. Murillo, Mr. Walsh.

The sequence of undergraduate and graduate programs of the Department of Spanish and Portuguese is designed to lead from the acquisition of competence in written and spoken Spanish or Portuguese, through an acquaintance with the structure and history of one or both of these languages and a critical understanding of the development and achievements of their literatures in the Old World and in the New, to training in advanced study and independent research. The department's policy is to maintain a balanced strength between language and literature and between Peninsular and Hispanic-American facets of a unified field.

The Major in Spanish

Lower Division Courses 1, 2, 3, 4, 5, and 25 (or their equivalents). One year of high school Latin, or, to be completed before the senior year, either Latin 1 or Latin 1S. Students transferring from other institutions with advanced standing and intending to major in the department must present evidence (by examination or otherwise) that their preparation includes the equivalent of Spanish 25.

Upper Division 44 units of upper division work in the department, including the core courses Spanish 100, 104A–104B, 107A–107B–107C; and five specialized courses (i.e., upper division courses other than core courses) taken under the following conditions: Spanish 100 to be completed before enrollment in any specialized course; Spanish 104A–104B or Spanish 107A–107B–107C to be completed before enrollment in any specialized course in Spanish-American or Spanish literature, respectively; and Spanish 116, 117, 141, 142, or more than one quarter each of 192 and 193 not to be in-

NOTE: For key to footnote symbols, see page 86.
cluded as one of the five. One upper division course in Portuguese literature may be substituted for one of the five specialized courses. Although the Department does not offer a major in Portuguese, an A.B. with emphasis in Portuguese can be obtained in Comparative Literature. Recommended: further study in Western European and Latin American history, languages, and literatures.

Honors Program To be admitted to the honors program in Spanish, students shall have completed at least three quarters of work on this campus with a general and a departmental average of at least 3.0, and have the approval of the major adviser in consultation with other members of the department.

Students admitted to the honors program shall complete, prior to the beginning of the senior year, courses 100, 104A–104B, and 107A–107B–107C, or give evidence, by special examination, of equivalent preparation. Students passing an examination in lieu of any of the required courses will be deemed to have satisfied the corresponding requirement for the major, though without obtaining unit credit.

Students shall qualify for honors at graduation by completing with a grade of at least B the special honors course or a three-quarter graduate course. The special honors course (H198A–H198B) shall be offered each quarter. This course shall consist of independent study and the writing of a thesis under the direction of an appropriate member of the department.

Certificate of Completion, Teacher-Training Curriculum Teaching major must include an A.B. degree with a major in Spanish equivalent to the undergraduate major in Spanish at the University of California, Berkeley, plus Spanish 116, 117, and 125. Teaching minor must include (as part of the required 30 units) 16 upper division units, composed of Spanish 100, 116, 117, and 125.

Graduate Study

Preparation for Graduate Study Students who may wish to pursue work toward advanced degrees in Spanish should note that a broader foundation in Latin than that required in the baccalaureate major is a prerequisite for such work. A minimum of one year of college Latin (or equivalent) is therefore strongly recommended.

Students (other than Berkeley A.B. Spanish majors) applying for admission to graduate work in the Department of Spanish and Portuguese should have an undergraduate preparation reasonably approximating that of the undergraduate major in Spanish at Berkeley.

The Graduate Programs The requirements for an M.A. degree in Spanish are: an A.B. degree with a major in Spanish equivalent to the undergraduate major in Spanish at the University of California, Berkeley (see above); an elementary knowledge of Latin; a reading knowledge of another language; 36 units of post-baccalaureate work in the Department of Spanish and Portuguese at Berkeley, of which at least 24 units must be in strictly graduate level (200 series) courses, including Spanish 212A–212B and 217; and the passing of a comprehensive written and oral examination. The examination covers Spanish philology and all periods and genres of Spanish and Spanish-American literature.

The doctoral program in Romance languages and literature with emphasis on Hispanic literature requires an A.B. degree with a major in Spanish approximately equivalent to the undergraduate major at Berkeley. No specific courses are required, but the student in consultation with a graduate adviser will lay out a program designed to prepare him for qualifying examinations preceding advancement to candidacy. As early as possible, he must demonstrate a reading knowledge of Latin, Italian, and French, by a reading examination in one of these languages, and by either written examination or appropriate course work in the others. A reading knowledge of German
is recommended. The precise nature of the qualifying examinations will depend on
the student’s choice of two alternative plans of preparation, both of which require a
detailed knowledge of Spanish and Spanish-American literature and familiarity with
Romance philology, with emphasis on Spanish. Plan I further requires a knowledge of
a second Romance literature as a collateral, and of prescribed masterpieces in the
third. Plan II requires a command of one broad, integrated field (period, movement,
or genre) in both Italian and French literatures. Students whose principal interest is
philological should see the statement under Romance Philology.

For further details on the requirements for the M.A. degree in Spanish and the
Ph.D. degree in Romance languages and literature see the Graduate Division section
of this catalogue, and consult the Graduate Adviser in Spanish, 4321 Dwinelle Hall.

Letters and Science List: for regulations
governing this list, see the ANNOUNCEMENT
OF THE COLLEGE OF LETTERS AND SCIENCE.

Spanish

Lower Division Courses

Evaluation of Credit Previously Earned. The
first year of secondary school credit in
Spanish is considered to be equivalent to the
first quarter course; each successive year of
credit is equal to one additional course (4–5
units) in a sequence of four quarter courses in
college.

1. Elementary Spanish (Beginner’s Course). (4)
   Five 1-hour class meetings per week. (F, W, Sp)

2. Elementary Spanish (Continuation of 1). (4)
   Five 1-hour class meetings per week. Prerequisite:
course 1 or equivalent. (F, W, Sp)

3. Elementary Spanish (Continuation of 2). (5)
   Five 1-hour class meetings per week. Prerequisite:
course 2 or equivalent. (F, W, Sp)

4. Intermediate Spanish (Continuation of 3). (5)
   Five 1-hour class meetings per week. Prerequisite:
course 3 or equivalent. (F, W, Sp)

5. Intermediate Spanish (Continuation of 4). (5)
   Five 1-hour class meetings per week. Prerequisite:
course 4 or equivalent. (F, W, Sp)

8A. Spoken Spanish. (4)
   Five 1-hour class meetings per week. Prerequi-
site: course 3 or equivalent. May be taken in con-
junction with course 4, 5, or 25. Course designed
to increase vocabulary and to improve grammar and
pronunciation by means of oral expression. (F, W, Sp)

8B. Spoken Spanish. (4)
   Five 1-hour class meetings per week. Prerequi-
site: course 8A (formerly Spanish 8) or equivalent. A
   continuation of Spanish 8A (formerly Spanish 8).
   May be taken in conjunction with course 4, 5, or 25.
   Course designed to increase vocabulary and to im-
   prove grammar and pronunciation by means of oral
   expression. (F, W, Sp)

Spanish 12A. Beginning Spanish. Intensive
   Course. (8)
   Ten 1-hour class meetings per week. Two hours
   per week obligatory laboratory attendance. An in-
tensive course in beginning Spanish, equivalent to
Spanish 1 and Spanish 2. (F)

Spanish 12B. Intermediate Spanish. Intensive
   Course. (10)
   Ten 1-hour class meetings per week. Two hours
   per week obligatory laboratory attendance. An in-
tensive course in intermediate Spanish, equivalent
to Spanish 3 and Spanish 4. (W)

Spanish 12C. Advanced Spanish. Intensive
   Course. (10)
   Ten 1-hour class meetings per week. An intensive
course in advanced Spanish, equivalent to Spanish
5 and Spanish 25. (Sp)

25. Advanced Spanish. (5)
   Four 1-hour class meetings per week. Prerequisite:
course 5 or equivalent. (F, W, Sp)

Lower Division Courses in English Translation

*39. Spanish and Spanish-American Literature in
   English Translation. (4)
   Three class hours per week. Open to students in
all departments of the University. No knowledge of
Spanish necessary.

39A. Spain: Medieval Period, Renaissance, and
   Golden Age.
39B. Spain: Neo-Classical Period to Present Day.
39C. Spanish America: To the End of the Nine-
   teenth Century.
39D. Spanish America: Modernism and the Con-
   temporary Period.

Upper Division Courses

Prerequisite to all upper division courses:
Spanish 25 or the equivalent, unless otherwise
stated.

100. Introduction to Spanish Linguistics. (4)
   Three class hours per week. Mr. Walsh (F, Sp)

*103. Nineteenth-Century Spanish Fiction. (4)
   Three class hours per week. Mr. Pott
104A-104B. Survey of Spanish-American Literature. (4-4)
Three class hours per week. Sequence beginning (F).
Mr. Chapman, Mr. Monguió

105. Modern Peninsular Drama: From the
Romantic Movement to the Present. (4)
Three class hours per week.
Mrs. Shadi

(4-4-4)
Three class hours per week. Sequence beginning (F).
Mr. Walsh, Mr. Morby

108. Introduction to the Ballad. (4)
Three class hours per week.
Mr. Askins (Sp)

109. Spanish Drama of the Sixteenth and
Seventeenth Centuries. (4)
Three class hours per week.
Mr. Morby (F)

110. The Generation of '98. (4)
Three class hours per week.
Mr. Murillo (F)

111A-111B. Cervantes. (4-4)
Three class hours per week. Sequence beginning (F)
Mr. Murillo

112. Studies in Spanish Culture. (4)
Three class hours per week.
Mr. Murillo (W)

113. Studies in Latin-American Culture. (4)
Three class hours per week.

*114. The Contemporary Spanish-American
Novel. (4)
Three class hours per week.
Mr. Chapman

115. A Survey of Spanish Lyric Poetry. (4)
Three class hours per week.
Mrs. Shadi (Sp)

116. Advanced Grammar. (4)
Three class hours per week.
Mr. Faulhaber (F, W)

117. Advanced Composition. (4)
Three class hours per week, Prerequisite: course
116.
Mr. Morby, Mr. Faulhaber (W, Sp)

125. Spanish Phonetics. (4)
Three class hours per week.
Mr. Walsh, Mr. Craddock (W, Sp)

126. Medieval Spanish Literature, (4)
Three class hours per week.
Mrs. Shadi (W)

127. Eighteenth-Century Spanish Literature. (4)
Three class hours per week.
Mr. Polt

*128. Contemporary Spanish Literature. (4)
Three class hours per week.

*129. The Spanish-American Essay. (4)
Three class hours per week.

130. Twentieth-Century Spanish-American Poetry. (4)
Three class hours per week.
Mr. Monguió (Sp)

171. Advanced Spanish for Bilingual Students. (4)
Three class hours and one laboratory hour per week. Prerequisite: permission of instructor. A unified study of phonetics, grammar, lexicon, and composition. Primarily for students whose native language is Spanish.
Mr. Murillo (Sp)

192. Senior Course in Hispanic Literature. (4)
Three class hours per week. Course may be repeated for credit when topic changes. Enrollment limited to students majoring in Spanish who have completed 135 units of university-level work, including 20 units of upper division Spanish and Spanish-American literature. Topic for Winter 1974: Cervantes, Upanamu, and Borges, topic for Spring 1974: Gongora. Mr. Murillo (W); Mr. Morby (Sp)

193. Advanced Course in Hispanic Linguistics. (4)
Three class hours per week. Prerequisite: Spanish 100 or consent of instructor. Course may be repeated for credit when topic changes, but not more than four units may be included in the major.
Mr. Craddock (F)

H198A-H198B. Spanish Honors Course. (4-4)
Honors thesis. The Staff (F, W, Sp)

199. Supervised Independent Study and Research.
(2-4)
Enrollment is restricted by regulations listed on page 57. Restricted to senior honor students with an adequate preparation for the subject proposed for special study, and by previous arrangement with members of the departmental staff. Must be taken on a passed or not passed basis.
The Staff (F, W, Sp)

Upper Division Courses in English Translation

141. Cervantes' Don Quixote. (4)
Three class hours per week. Prerequisite: permission of the instructor. A critical introduction to Cervantes' masterpiece, including its literary antecedents and importance as a prototypical novel in modern European literature. Course given in English.
Mr. Murillo (Sp)

142. The Spanish American Novel in English
Translation. (4)
Three class hours per week. Prerequisite: upper-
division or graduate status. Discussion of the Spanish
American novel from its beginnings; reading and discussion of selected twentieth-century novels as translated.
Mr. Chapman (W)

Graduate Courses
(Concerning conditions for admission to graduate courses, see page 27.)
In the requirements for the master's degree this department follows Plan II. (See page 36.)

200A-200B. Introduction to Medieval Hispanic
Literature. (3-3)
One 2-hour meeting per week. Sequence beginning (F)
Mr. Craddock

*201A-201B. History of Hispanic Poetry.
(3-3-3)
One 2-hour meeting per week. Course may be re-
peated for credit when topic changes. Topic: Cande- tionero poetry. (Fall 1972 and winter 1973 only.) dence beginning (F), Mrs. Shadi

*226A–*226B–*226C. Critical and Stylistic Studies of a Single Author or Genre. (3–3–3) Each 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for 1973: Calderón. Mr. Morby (F)

228A–228B–228C. The Literature of a Single Indian American Country. (3–3–3) Each 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for 1973–74: Mexico. Sequence beginning (F), Mr. Chapman

299. Special Advanced Study. (2–6) Restricted to candidates for higher degrees with an adequate preparation for the subject proposed for special study, and by previous arrangement with members of the departmental staff.

The Staff (Graduate Advisers in charge) (F, W, Sp)

601. Individual Study for Master's Students. (1–8) Individual study in consultation with the graduate adviser, to provide an opportunity for student to prepare for the comprehensive examination. May be taken only after completion of all unit and language requirements, and only in the quarter in which the examination will be attempted. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Graduate Advisers in charge) (F, W, Sp)

602. Individual Study for Doctoral Students. (1–8) Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare for the qualifying examination required of candidates for the Ph.D. and to be taken in the quarter immediately preceding that examination. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Graduate Advisers in charge) (F, W, Sp)

1G–2G. Beginning Spanish for Graduate Students. (No credit) Three 1-hour meetings per week. Preparation for the graduate reading examinations. Sequence beginning (W)

Portuguese

Lower Division Courses

Evaluation of Credit Previously Received. The first year of secondary school credit in Portuguese is considered to be equivalent to the first quarter course; each successive year of credit is equal to one additional course (4–5 units) in a sequence of four quarter courses in college.

1. Elementary Portuguese (Beginner's Course). (4) Five 1-hour class meetings per week. (F)

2. Elementary Portuguese (Continuation of 1). (4) Five 1-hour class meetings per week. Prerequisite: course 1 or equivalent. (W)

3. Intermediate Portuguese (Continuation of 2). (5) Five 1-hour class meetings per week. Prerequisite: course 2 or equivalent. (Sp)
4. Intermediate Portuguese (Continuation of 3). (5)
Five 1-hour class meetings per week. Prerequisite: course 3 or equivalent. Reading, translation, and oral interpretation of modern texts. Mr. Woodbridge (F)

Lower Division Courses in English Translation

*39C–39D. Brazilian Literature in English. Translation. (4–4)
Three class hours per week. Open to students in all departments of the University. No knowledge of Portuguese necessary. Sequence beginning (F)

Upper Division Courses

Prerequisite to all upper division courses: 18 units or equivalent of Portuguese or another Romance language. With the approval of the graduate adviser, upper division and graduate credits in Portuguese literature may be applied toward the M.A. degree in Spanish.

101. Portuguese for Advanced Students. (3)
Three class hours per week. Prerequisite: 18 units in another Romance language. An intensive course for students with no previous study of Portuguese. Mr. Woodbridge (W)

*120. Gil Vicente and Camões. (4)
Three class hours per week. Major works in Spanish as well as in Portuguese.

*122A–122B–122C. Portuguese Literature. (4–4–4)
Three class hours per week. Prerequisite: 18 units or equivalent or Portuguese or another Romance language. Studies in the literature of Portuguese may be repeated for credit when topic changes. The Middle Ages and the 16th century. Mr. Woodbridge (W)

123. Brazilian Literature. (4)
Three class hours per week. Mr. Woodbridge (Sp)

150. Problems of Portuguese Linguistics. (4)
Three class hours per week. Prerequisite: consent of instructor. Analysis of selected problems of the Portuguese language, in an effort to contrast it with Spanish and with other varieties of Romance speech. — (W)

198. Special Study for Undergraduates. (2–4)
Prerequisite: consent of instructor. Special tutorial or seminar on selected topics.
Mr. Askins, Mr. Woodbridge (F, W, Sp)

199. Supervised Independent Study and Research. (2–4)
Enrollment is restricted by regulations listed on page 87. Restricted to senior honor students with an adequate preparation for the subject proposed for special study, and by previous arrangement with members of the departmental staff. Must be taken on a passed or not passed basis.
Mr. Askins, Mr. Woodbridge (F, W, Sp)

Graduate Courses

(Concerning conditions for admission to graduate courses, see page 27.)

*200. Early Portuguese Literature. (3)
One 2-hour meeting per week. Analytical history of Portuguese literature to the Renaissance.

*201. The Brazilian Novel. (3)
One 2-hour meeting per week.

226. Critical and Stylistic Studies of a Single Author or Genre. (3)
One 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for Spring 1974: Antero de Quental. Mr. Woodbridge (Sp)

299. Special Advanced Study. (2–6)
Restricted to candidates for higher degrees with an adequate preparation for the subject proposed for special study, and by previous arrangement with members of the departmental staff.
Mr. Askins, Mr. Woodbridge (F, W, Sp)

STATISTICS

(Department Office, 367 Evans Hall)

Professors:
Edward W. Barankin, Ph.D.
Richard E. Barlow, Ph.D.
Peter J. Bickel, Ph.D.
David Blackwell, Ph.D., D.Sc.(hon.)
Albert H. Bowker, Ph.D.
David R. Brillinger, Ph.D. (Miller Professor)
Lester E. Dubins, Ph.D.
Jacob Feldman, Ph.D.
David A. Freedman, Ph.D.
Joseph L. Hodges, Jr., Ph.D.
George M. Kuznets, Ph.D.
Lucien LeCam, Ph.D.
Erich L. Lehmann, Ph.D. (Chairman)
Michel Loève, Docteur ès Sciences

Roy Radner, Ph.D.
Henry Scheffé , Ph.D.
Elizabeth L. Scott, Ph.D.
Aram J. Thomasian, Ph.D.
Jerzy Neyman, Ph.D., D.Sc.(hon.), L.L.D.
(hon), Ph.D.(hon) (Emeritus)

Associate Professors:
Rudolph J. Beran, Ph.D.
Kjell A. Doksum, Ph.D.
Jean-François Mertens, Docteur ès Sciences
Pressley W. Millar, Ph.D.

Assistant Professors:
Charles E. Antoniak, Ph.D.
Louis A. Jaeckel, Ph.D.

NOTE: For key to footnote symbols, see page 86.
The Department of Statistics offers the undergraduate a thorough introduction to the theory of probability and of statistics, their extensions in several directions such as stochastic processes and sampling surveys, and some of their applications in general and in special fields such as social science and engineering.

The undergraduate courses are divided into several basic cycles according to their emphasis and mathematical background. One cycle, emphasizing theory but including some application in the laboratories, includes courses 20 and 100A–B–C (or 200A–B–C–L–M–N). Statistics 100 requires two years of calculus (Statistics 200 requires more); the first half is devoted to probability and the second half to statistics. A second cycle, requiring four quarters of calculus and emphasizing interpretation and concepts, is based on 134A–134B, 147 (the first two quarters are devoted to probability, the remainder to statistics) or 134A–134B and 141 or 142 (stochastic processes). Another cycle emphasizing interpretations and concepts, which requires one year of calculus, consists of 133 followed by 135A–135B (one quarter of probability and two of statistics). A fourth cycle, emphasizing concepts and applications and requiring one quarter of calculus only in its third quarter, is the sequence 130A–130B–130C; the probability material is developed as needed for the statistics. A cycle intended primarily for social scientists, requiring less mathematics, involves 2, 131 with 131L, 132 with 132L.

A student may not receive full credit for partially parallel sequences of courses.

The interests of the members of the staff are too varied to be reflected completed in the courses given each year. The courses numbered from 152 to 169 cover a wide range; attention is also drawn to 191, given to recent developments.

The Major

Lower Division Courses Required: Mathematics 1A–1B–1C and 51A–51B–51C, or preferably the corresponding honors courses. Recommended: Statistics 1A–1B or 20 is helpful preparation for the upper division courses. Familiarity with computer programming (e.g., Computer Science 2 or 100; Engineering 1 or 101) is very useful in applied statistical work.

Upper Division Courses Statistics 100A–100B–100C; Mathematics 112 or 113C. At least four courses from Statistics 141, 142, 160, 161, 162, 166 (with 166L), 168, 169, 181A. In addition, either two courses from Mathematics 104A, 104B, 105, 113A, 125A, 128A, 135 and 185; or at least three advanced nonoverlapping courses from a substantive field. The courses selected for the 40 or more upper division units required for the major must be approved in advance by the major adviser.

Honors Program Honor students may apply for enrollment in the honors program. The program will include course H197, reading in a special topic and writing a thesis.

Individual Major or Double Major Attention of the student is drawn to the possibility of an individual major in statistics combined with a science, social science or philosophy, etc., according to his interests. Superior students are encouraged to consider a double major, combining statistics with mathematics or with a field of application.

Engineering Mathematical Statistics The College of Engineering with the cooperation of the Department of Statistics offers a curriculum in engineering mathematical statistics leading to the degree of Bachelor of Science. Major Adviser: Mr. Scheffé (see section on Program of Study in Engineering Science, page 199).
Preparation for Graduate Study  Those interested in the graduate statistics major should include in the undergraduate courses a strong foundation in mathematics as well as probability and statistics. For advanced degrees of the theoretical type, Mathematics 104B, 105, 113B and 185 are needed. For advanced degrees of the applied type, at least a year of upper division probability and statistics (or course 200A–200B–200C with 200L–200M–200N). It is also recommended that all students acquire some familiarity with French, German, or Russian.

The Graduate Major

Higher degrees may be of the theoretical or of the applied type. The program for the theoretical type of M.A. will usually include 205A–205B and 210A–210B–210C; the program for the applied type of M.A. will usually include 230A–230B, 236A–236B, 240 and at least one of 232, 238, 242, 248. All students will prepare either a master's oral or a master's thesis.

There are no fixed course requirements for the Ph.D. degrees at Berkeley. However, the student is asked to prepare an extensive list of detailed questions for his qualifying examination. He also prepares a special one-hour lecture on a topic selected by his graduate adviser and not included in course work.

For further details on the requirements for the M.A., consult the graduate adviser, Mr. Jaeckel (Fall), Mr. Schellf (Winter, Spring) and for the Ph.D. with emphasis on theoretical probability, Mr. Millar, with emphasis on theoretical statistics, Mr. Beran, with emphasis on applied probability and statistics, Miss Scott.

Biostatistics A program in biostatistics, leading to the M.A. or Ph.D. degree, is offered jointly with the School of Public Health. The emphasis may be toward theory or toward the substantive field. For information, consult Miss Scott.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

1A. Introduction to Probability. (3)
Three 1-hour lectures per week. Prerequisite: high school algebra. Students who have completed a course in probability will receive only partial credit. Elementary concepts of probability; random variables; expectation and variance; binomial and hyper-geometric distribution; normal and Poisson approximations.
Mr. Frischtk (F); Mr. Mertens (W); Mr. Lehmann (Sp)

1B. Introduction to Statistical Inference. (3)
Three 1-hour lectures per week. Prerequisite: course 1A. Students who have completed a course in statistics will receive only partial credit. Elementary concepts of statistical inference. Estimation with applications to the estimation of means, differences, variance. Determination of sample size, choice of estimate and problems of design. Testing hypotheses; simple examples of tests; the concept of power.
Mr. Mertens (Sp)

2. Introduction to Statistics. (5)
Three 1-hour lectures and three 1-hour laboratories per week. Prerequisite: high school algebra. Elementary treatment of basic ideas in probability and statistical inference. Models; conditional probability; measures of location, spread, and association; binomial distribution, normal approximation. Sampling; point estimation; some standard significance tests; power.
Mr. Pisani, Mr. Purves, Mr. Freedman (F); Mr. Pisani, Mr. Kaplan, Mr. Purves (W); Mr. Pisani, Mr. D'Abrera, Mr. Hudson (Sp)

20. Introduction to Probability and Statistics. (4)
Three 1-hour lecture and one 1-hour discussion per week. Prerequisite: one quarter of calculus. Students who have completed a course in probability or statistics will receive only partial credit.) For students with mathematical background who wish to acquire basic concepts. Relative frequencies, discrete probability, random variables, expectation. Testing hypotheses. Estimation. Illustrations from various fields. Mr. Hudson (F); Mr. D'Abrera (W); Mr. Straf (Sp)

Upper Division Courses

100A. Introduction to the Theory of Probability and Statistics. (4)
Mr. Bickel (F); Mr. Frischtk (W); Mr. Millar (Sp)

100B–100C. Introduction to the Theory of Probability and Statistics. (5–5)
Three 1-hour lectures and one 2-hour laboratory per week. (Continuation of 100A.) Statistical inference, including point and interval estimation and tests of hypotheses. Probability densities including the normal, t, x², and F. 100B, Mr. Bickel (W); 100C, Mr. Bickel (Sp)

130A–130B–130C. Statistical Inference. (4–4-4)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite for 130C: one quarter of calculus. Students who have taken any part of Statistics 100, 131, 132, 133, 134, 135 may receive only two units for 130A. Meant for users of statistics. Basic concepts and principal tools of probability theory,
131. Statistical Inference for Social Scientists. (4)

Three hours of lecture and 1-hour discussion per week. Prerequisite: a mathematics course such as Mathematics 190. May not be taken for credit by students having completed Statistics 130A. Ideas of estimation and hypothesis testing basic to social science applications. Linear estimation and normal regression theory.

Mr. Kuznets, Mr. Jaeckel (F); Mr. Beran (Sp)

132. Second Course in Statistical Inference for Social Scientists. (4)

Three 1-hour lectures per week. Prerequisite: course 131. May not be taken for credit by students having completed 130B. Further study of topics in probability and statistics relevant to social science applications.

Mr. Kuznets, Mr. Jaeckel in charge (F); Mr. Beran in charge (Sp)

132L. Second Laboratory Course in Statistical Inference for Social Scientists. (1)

One 2-hour laboratory per week. May be taken only in conjunction with Statistics 131.

Mr. Kuznets, Mr. Jaeckel in charge (F); Mr. Beran in charge (Sp)

133. Elementary Probability Theory. (4)

Three hours of lecture and two hours of laboratory or one hour discussion section per week. Prerequisite: one year of calculus. May not be taken for more than one unit by students having completed 100A or 134A. An introduction to the concepts of probability theory in both the discrete and continuous cases. Emphasis is on interpretation rather than proofs. Random variables, probability distributions, transformations of random variables, expectation, variance, correlation, law of large numbers, central limit theorem.

Mr. D’Abrera (F); Mr. Thomasian (Sp)


Three hours of lecture per week. Courses 134A–134B provide a modern foundation for probability applications in other departments, and for subsequent probability or statistics courses.

Prerequisite: one year of calculus. Introduction to probability emphasizing concepts, facts, interpretation, and illustrative examples. Theory, and examples, primarily in the discrete case but easily generalizable. Conditional probability, independence, binomial, Poisson, random variables, induced distribution, expectation, law of large numbers.

Mr. Kaplan, Mr. Mertens, Mr. Millar, Mr. Straff (F); Mr. Barankin, Mr. Frischtak, Mr. LeCam (W); Mr. Kaplan, Mr. Bickel, Mr. Freedman (Sp)

134B. Prerequisite: Course 134A or 100A. Continuous densities and their transformations, multivariate normal densities, distribution functions, probability measures, conditional expectation, central limit theorem.

Mr. Barankin (F); Mr. Millar, Mr. Mertens (W); Mr. LeCam, Mr. Frischtak (Sp)

135A–135B. Methods of Statistics. (4–4)

Three hours of lecture and two hours of laboratory per week. Courses 135A–135B present the principal inference methods used in science and engineering.

Prerequisite: course 133, 100B, or 134B. May not be taken for more than one unit by students having completed 130B or 131. Sampling distributions. Estimation and hypothesis testing. Applications of \( \chi^2, t, \) and \( F \) distributions. Analysis of discrete data (Poisson, binomial, multinomial distributions). Fitting linear models.

Mr. Hudson (F); Mr. Antoniak (W)


Mr. Hudson (W); Mr. Antoniak (Sp)

141. Introduction to Continuous Parameter Stochastic Processes. (4)

Three hours of lecture per week. Prerequisite: course 134B or 100B. Basic concepts of continuous parameter stochastic processes. Thorough analysis of Poisson processes and their generalizations, with applications. Consistent families of distributions, realizations, compound and nonhomogeneous Poisson processes, birth and death processes, Introduction to the Wiener process.

Mr. Dubins (Sp)

142. Introduction to Discrete Parameter Stochastic Processes. (4)

Three hours of lecture per week. Prerequisite: course 134B or 100B. Thorough coverage of finite Markov chains. Topics from: branching processes, renewal theory, discrete parameter Gaussian processes. Illustrative applications from various fields.

Mr. Barlow (W)

147. Concepts of Statistics. (4)

Three hours of lecture and two hours of laboratory per week. Prerequisite: course 134B. May not be taken for credit by students having completed 135A, 100B, 130B, or 131. A comprehensive survey course in statistical theory and methodology basic to applications in science and engineering, for students having a good background in the concepts of probability theory.

Mr. Hodges (Sp)

160. Elements of Nonparametric Inference. (5)

Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: Statistics 100C or 130B or 132 or 135B. Common nonparametric tests such as the sign test, Wilcoxon test and rank correlation tests, Null distributions and their approximations. Efficiency properties. Estimates based on these statistics.

Mr. Antoniak

161. Statistical Inference in Linear Models. (5)

Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: one of the courses Statistics 100C, 130B, or 132, and one of the courses Mathematics 111, 113B, or 190B. May not be taken for credit by students having completed 135B. Optimum point estimation in univariate linear models. Hypothesis testing and related confidence sets in the normal case.

Mr. Doksum (W)
162. Introduction to Multivariate Analysis. (5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: one of the courses Statistics 100C, 132, or 161, and one of the courses Mathematics 111, 113B, or 190B. Multivariate normal distribution, partial and multiple correlation, Hotelling's T2-test, multivariate analysis of variance.
Mr. Antoniak (Sp)

166. Sampling Surveys. (4)
Three 1-hour lectures per week. Prerequisite: course 100A or 130A or 131 or 135A or consent of the instructor. Theory of sampling and analysis of sampling methods. Unrestrictedly random, stratified, cluster and double sampling procedures.
Mr. Kuznets (Sp)

166L. Laboratory Course in Sampling Surveys. (1)
One 2-hour laboratory per week. May be taken only concurrently with course 166. Study of sampling materials and of representative designs.
Mr. Kuznets in charge (Sp)

168. Game Theory. (4)
Two 1½-hour lectures per week. Prerequisite: two years of Calculus. General theory of zero-sum, two-person games, illustrated by detailed study of examples.
Mr. Thomasian (F)

169. Dynamic Programming. (4)
Two 1½-hour lectures per week. Prerequisite: course 100A or 133 or 134. General theory of dynamic programming, illustrated by detailed study of examples.
Mr. Rader (W)

181A. Bayesian Statistics. (4)
Three hours of lecture per week. Prerequisite: one upper division course in statistics. Factorization of joint distributions. Conjugate families. Bayesian inference in binomial, Poisson, and normal models. Bayesian interpretation of the chi-square test of association and of the F-test of the general linear hypothesis.
Mr. Beran (W)

191. Experimental Courses in Probability and Statistics. (4)
Three 1-hour lectures per week. Prerequisite: consent of instructor. Recent developments of special interest to the instructor exhibited as a senior level course.
Mr. Jaeckel (W)

191B. History of Probability. (3)
Two hours of lecture per week. A broad survey of development of the mathematical concepts underlying the theory of probability and the attempted applications to the real world, beginning with the ancient Greeks and continuing through to the time of Laplace.
Miss David (Sp)

H197. Special Study for Honors Candidates. (1-7)
The Staff (F, W, Sp)

198. Directed Study for Undergraduates. (1-5)
Prerequisite: consent of instructor. Special tutorial or seminar on selected topics.
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.
Graduate Courses

Courses 210A–210B–210C constitute the bases of the graduate instruction for students whose primary interest is in mathematical statistics; course 205A–205B–205C, for those with primary interest in probability. Courses 230, 236, 240, and one of 232, 242 represent the core of the graduate program for students interested in statistics as a tool in empirical research, either experimental or observational.

200A. Introduction to Probability and Statistics at an Advanced Level. (4)
Three 1-hour lectures per week. Prerequisite: a year of upper division mathematics. Sec. 1 has stronger emphasis on theory. Intended for students who have not taken probability. (Students who have completed a course in probability will receive only partial credit.) Advanced treatment of topics in probability including: discrete probability models, axiomatic development, laws, random variables. Distribution functions, binomial, hypergeometric, Poisson, normal, central limit theorem. Probability density functions, conditional probability, expectation, variance, Chebyshev inequality, law of large numbers. Additional topics. Mr. Jaeckel, Miss Scott (F; Sp)

200B–200C. Introduction to Probability and Statistics at an Advanced Level. (4-4)
Three 1-hour lectures per week. Prerequisite: course 200A or consent of instructor.
200B, change of variables, generating functions, characteristic functions. Standard distributions, including t, F, x². Point estimation, properties and methods. Testing hypotheses, simpler applications.
Mr. Jaeckel, Miss Scott (W)
Mr. Jaeckel, Miss Scott (Sp)

200F–200G. Accelerated Introduction to Probability and Statistics at an Advanced Level. (4-4)
Three 1-hour lectures per week. Prerequisite: a year of upper division mathematics. Course covers material of 200A–200B–200C in two quarters. (Students who have completed a course in probability or statistics will receive only partial credit.)
Mr. Straf (F, W)

200L. Laboratory Course in Probability. (1)
One 2-hour laboratory per week. Strongly recommended for and open only to students in 200A. Applications of probability to "real" problems in various fields.
(F; Sp)

200M–200N. Laboratory Course in Probability and Statistics. (1-1)
One 2-hour laboratory per week. Strongly recommended for and open only to students in 200B–200C, respectively. Any of 200L, 200M, 200N may be taken without the others. Applications of probability and statistics to "real" problems in various fields.
200M, 200N (F; (W; 200M, (Sp)
201. Mathematical Bases of Probability Theory. (4)
Three 1-hour lectures per week. Prerequisite: Mathematics 105 or consent of instructor. Probability space. Random variables. Types of convergence. Expectation. Conditional probability and conditional expectation, Daniell-Kolmogorov consistency theorem, Tulee theorem. Mr. Dubin (F)

205A–205B–205C. Probability Theory. (4–4–4)
Three 1-hour lectures per week. Prerequisite: course 201 (may be corequisite) or consent of the instructor. Expectations, conditioning, Distributions and characteristic functions. Independence and marginals; convergence theorems, central limit problem. Stationarity, ergodic theorems. Elementary Markov chains. Sequence beginning (F).

Three 1-hour lectures per week. Prerequisite: a year of upper division probability and statistics. Mathematics 111 (or 112B), Course 205A or 205B is prerequisite to 210A. A survey of mathematical statistics including the theories of hypothesis testing, point estimation, confidence sets and multiple decision procedures with applications in areas such as normal theory, analysis of variance, multivariate analysis, nonparametric inference and sequential analysis. Sequence beginning (F). Mr. Lehmann (F); Mr. Lehmann (W); —— (Sp)

210M. Laboratory for Statistics 210B. (1)
One 2-hour laboratory per week. —— (W)

210N. Laboratory for Statistics 210C. (1)
One 2-hour laboratory per week. —— (Sp)

216A–216B. Theory of Nonparametric Inference. (4–4)
Three 1-hour lectures per week. Prerequisite: course 210A or equivalent. The theory of nonparametric and robust methods for problems such as the one- and two-sample problems, the hypotheses of randomness and independence, testing and estimation occurring in linear models. Asymptotic null distributions, power and efficiency.
216A, Mr. Beran (F); 216B, Mr. Bickel (W)

Three 1-hour lectures per week. Prerequisite: 205, and 210B, or 200C. Convergence of probability measures. Large sample properties of maximum likelihood estimates and Bayes estimates. Asymptotically normal families of probability measures. Asymptotic sufficiency. Von Mises differentiable statistical functions. Best asymptotically normal estimates and related tests including the $X^2$ test, likelihood ratio tests and asymptotically similar tests.
Sequence beginning (F). Mr. LeCam (F, W, Sp)

218. Theory of Statistical Decision Functions. (4)
Three 1-hour lectures. Prerequisite: consent of instructor. Maximum likelihood estimation. Completeness of the class of Bayes procedures. Invariance. Criteria for admissibility. Mr. Antoniak (F)

230A–230B. Analysis of Variance. (5–5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: 230A: Matrix algebra, a year of calculus, two quarters of upper division or graduate probability and statistics.

230A, theory of least squares estimation, interval estimation, and tests under the general linear fixed-effects model. One-way layout. Two- and higher order layouts. Multiple comparisons.
Sequence beginning (F). 230A, Mr. Beran (F); 230B, Mr. Scheffe (W)

232. Experimental Design. (5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: course 230A. Randomization models. Blocking, confounding, and fractional replication in 2$^n$ experiments. Response surface exploration.
Mr. Scheffe (Sp)

236A–236B. Analysis of Discrete Observations. (4–4)
236A, Miss Scott (F); 236B, Miss Scott (W)

238. Sequential Experimentation. (4)
Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: one of course 100C, 130B, 132, 135A, 200C. Wald probability-ratio tests. Truncated sequential tests. Sequential design. Industrial inspection. Sequential estimation. Two-stage procedures.

240. Nonparametric Analysis. (5)
Mr. Doksum (Sp)

242. Multivariate Analysis. (5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: course 230A. Topics selected from the following, with testing and estimation in each case: Sampling theory for multivariate normal populations. Multivariate analysis of variance and covariance. Classification and discriminant analysis. Component and factor analysis. Canonical correlations. Stochastic difference equations.
Mr. Frischtal (Sp)

248. Inference in Time Series. (5)

252. Special Stochastic Processes. (4)
Three hours of lecture per week. Prerequisite: consent of instructor. Material covered will include branching processes, point processes and birth and death processes. Equations satisfied by these processes, orthogonal polynomial solutions. First passage time. Absorption probabilities.
Mr. Kaplan (Sp)
257. Probability Models in Biology and Problems of Health. (4)
Three 1-hour lectures per week. Prerequisite: familiarity with concepts of probability and consent of instructor. Clustering of organisms over a habitat. Population dynamics. Competition of species. Epidemiology: with homogeneous exposure and with variable exposure and variable dispersal of infection. Stochastic model of survival after infection. Stochastic theories of carcinogenesis. Model of immunization. Mr. Neyman (F)

258. Statistical Problems in Modern Research in Astronomy. (4)
Three 1-hour lectures per week. Prerequisite: familiarity with concepts of probability and consent of the instructor. Preliminaries on theory. Clustering model of spatial distribution of galaxies. Selection bias. Catalogue and space distributions of characteristics of galaxies. Space abundances of morphological types. Luminosity functions. Magnitude-redshift and magnitude-diameter relations. Frequencies of supernovae. Stability of cluster. Mr. Neyman (W)

259. Statistics in Scientific Research. (5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: familiarity with concepts of probability and statistics. Recommended: course 210C or 230A and 236A. Introduction to studies conducted at the Statistical Laboratory, predominantly in biology, health, and astronomy. Material will include novel problems of design, testing, and estimation, frequently unpublished and occasionally unsolved. As need arises, particular sections of statistical theory will be reviewed. Mr. Neyman (Sp)

261. Foundations of Random Analysis. (4)
Three 1-hour lectures per week. Prerequisite: course 205B or consent of instructor. Separability, sample continuity, martingale processes, and further topics. Mr. Millar (F)

262. Information Theory. (4)
Three 1-hour lectures per week. Prerequisite: course 203A or 205A. Topics in the Shannon theory of information such as: entropy rate, channel capacity, coding theorems, error bounds, algebraic coding, sequential decoding. Mr. Feldman (W)

263. Decomposable Processes. (4)
Three 1-hour lectures per week. Prerequisite: course 261 or consent of instructor. Three part decomposition. Continuity. Levy-Itô theorem. Poisson processes and Brownian processes. Mr. Freedman (W)

265. Markov Processes. (4)
Three 1-hour lectures per week. Prerequisite: course 261 or consent of instructor. Markov independence. Time continuous transition probabilities. Strong Markov property. Semigroup methods, relation to potential theory. Mr. Freedman (Sp)

273. Topics in the Theory of Second Order Processes. (4)
Three 1-hour lectures per week. Prerequisite: consent of instructor. Second order processes. Calculus in quadratic mean. Filtering. Spectral analysis. Estimation of the spectrum. Reproducing kernels and tests of hypotheses for Gaussian processes. Mr. Mertens (W)

278. Seminars.
278A. Current Literature. (3) Supervised presentation, by students, of current supervised literature. ——— (F, W, Sp)
278B. Special Seminars. (2–6) Special topics, by means of lectures and informal conferences. Mr. Neyman (F, W, Sp)
278C. Seminar in Applied Probability and Statistics. (2–4) Special topics with informal lectures by researchers in substantive fields and by members of staff. (W)

281. Recent Advances in Probability and Statistics. (4)
Three 1-hour lectures per week. Prerequisite: consent of instructor. Recent developments and topics of current interest in probability theory and mathematical statistics.


298. Directed Study for Graduate Students. (1–5) Prerequisite: consent of instructor. Special tutorial or seminar on selected topics. The Staff (F, W, Sp)

299. Individual Research Leading to Higher Degrees. (2–6) The Staff (F, W, Sp)

602. Individual Study. (1–5)
By appointment. Prerequisite: one year of full-time graduate study and permission of the graduate adviser. Individual study in consultation with the graduate adviser, intended to provide an opportunity for qualified students to prepare themselves for certain examinations required of candidates for the Ph.D. degree. May not be used for unit or residence requirements for the doctoral degree. Course to be taken on the satisfactory or unsatisfactory basis. The Staff (F, W, Sp)

Colloquium in Probability and Statistics. (No credit)
Meeting for the presentation of original work by members of the staff, visitors, and graduate students. (F, W, Sp)

The Statistical Laboratory
When founded in 1939, the Statistical Laboratory was a unit of the Department of Mathematics and combined research with an extensive instruction program in mathematical statistics. This instruction program led to A.B., M.A., and Ph.D. degrees in statistics. In 1955, the instruction activities in statistics were taken over by the newly established Department of Statistics. Since that time the Laboratory has been functioning as a research unit.
Research activity of the Statistical Laboratory includes work on the theory of statistics and its various applications: to astronomy (cosmology), to biology (population dynamics, competition of species), to communication theory, to problems of health (theory of diagnostic tests, bio-assay, apparent associations between diseases, carcinogenesis), to experimentation, to meteorology (experiments on weather control), etc.

Some of the above research is conducted in cooperation with other units of the University and with individuals and institutions outside the University.

Every faculty member of the Department of Statistics may use the facilities of the Statistical Laboratory. A substantial number of research assistants and secretarial help are available.

**SUBJECT A: ENGLISH COMPOSITION**

(Department Office, 216 Dwinelle Annex)

Committee in Charge:
William J. Brandt, Ph.D. (*Rhetoric; Chairman*)
Phillip Damon, Ph.D. (*English and Comparative Literature*)
Ronald Stroud, Ph.D. (*Classics*)
Bruce J. Vermazen, Ph.D. (*Philosophy*)

Lecturer:
Phyllis Brooks, M.A. (*Supervisor*)

**ZOOLOGY**

(Departmental Office, 4079 Life Sciences Building)

Professors:
Max Alpert, Ph.D.
William Balamuth, Ph.D.
George W. Barlow,† Ph.D.
William E. Berg, Ph.D. (*Vice Chairman*)
Howard A. Bern, Ph.D.
Kenneth B. DeOme, Ph.D., Doctor of Medicine and Surgery (h.c)
Richard M. Eakin, Ph.D.
Cadet H. Hand, Jr.,† Ph.D.
Morgan Harris, Ph.D.
A. Starker Leopold, Ph.D.
William Z. Lidicker, Jr., Ph.D.
Daniel Mazia, Ph.D.
Satyabrata Nandi, Ph.D.
Frank A. Pitelka,‡ Ph.D.
C. H. Fraser Rowell, Ph.D.
Ralph I. Smith, Ph.D.
Robert C. Stebbins, Ph.D.
Richard C. Strohman, Ph.D. (*Chairman*)
Fred H. Wilt, Ph.D.
Oliver P. Pearson, Ph.D. (*Emeritus*)
Curt Stern, Ph.D., D.Sc. (h.c.), (*Emeritus*)

Associate Professors:
David R. Bentley, Ph.D. (*Vice Chairman*)
Ned K. Johnson, Ph.D.
Paul Licht,‡ Ph.D.
John E. Simmons, Ph.D.
David B. Wake, Ph.D.
Seth B. Benson, Ph.D. (*Emeritus*)

Assistant Professors:
Roy L. Caldwell, Ph.D.
Robert K. Colwell,‡ Ph.D.
Michael T. Ghiselin, Ph.D.
James L. Patton, Ph.D.
Mary L. Pressick, Ph.D.
Richard A. Steinhardt, Ph.D.

Professors:
Phyllis B. Blair, Ph.D.
Dorothy R. Pitelka, Ph.D. (*Adjunct*)
Warren Winkelstein, Jr., M.D., M.P.H.

Lecturers:
Lloyd F. Austin, B.A.
John Davis, Ph.D.
Marshall White, Ph.D.

`NOTE: For key to footnote symbols, see page 86.`
The Department of Zoology presents a broad coverage of animal biology, ranging from cell and molecular biology to ecology and ethology, and including intensive offerings in vertebrate and invertebrate zoology. The zoology major may be entered after a basic year-course in biology (see General Biology) or zoology, supported by courses in chemistry and physics. The “core” of the upper division major program consists of four courses representing the areas of (1) genetics, (2) cell biology, (3) organismal animal biology, (4) natural history, systematics, ecology. These courses represent the common ground upon which more specialized senior programs and graduate study may be developed.

The Major

(1) Biology 1A, 1B; Chemistry 1A, 1B, 8A, and 8B; Mathematics 16A and 16B or equivalent; Physics 6A, 6B, and 6C. Recommended: Zoology 1, German, French, additional mathematics, statistics, additional chemistry, biochemistry, and basic courses in other biological sciences. (2) Thirty-six units of upper division Zoology, up to 16 of which may be substituted for by courses in related fields by permission of the major adviser. The program must include at least one course or sequence in each of the 4 following areas (a) Genetics. Genetics 100 or Genetics 150A–150B; (b) Cell Biology: Zoology 104 or 110A–110B or Physiology 101; (c) Organismal Animal Biology: Zoology 105 or 106–106L or 120A–120B or 124 or 131–131L or 135–135L or 135–136 or Physiology 123–123L; (d) Natural History, Systematics, Ecology: Zoology 107A–107B; or 157; or 108 plus one of the following: Zoology 156, Entomology 100, 105, 110, 150; or Zoology 155 plus one of the following: Zoology 156, Entomology 100, 105, 110, 150; or Biology 150 plus Zoology 140; or Forestry and Conservation 173. The total upper division program must include at least one quarter with laboratory, one quarter with field work, and a third quarter with laboratory or field work exclusive of units in Zoology 199, 197, or H196. (3) Seniors with a B average or better in courses of the major are encouraged to seek faculty sponsorship for independent study and research under course 199, and to participate in the pro-seminar (Zoology 198).

Honors Program Honor students may apply at the beginning of the senior year to the professor in charge of the Thesis Course (Zoology H196) for admission to the honors program. Students accepted in the honors program will complete the pro-seminar (Zoology 198) and prepare a thesis (Zoology H196).

Preparation for Graduate Study Those planning to enter graduate study in Zoology are expected to have the equivalent of a major in zoology or biology. Foreign language requirement: five quarters of college work with a grade of C or better, or competence at an equivalent level in one of the following: German, French, or Russian (other languages may be acceptable if of scientific importance). Ordinarily this requirement will have been satisfied as a condition for admission to graduate study, but if not, the foreign language deficiency must be rectified by further course work while in graduate status.

Graduate Degrees in Zoology The Department of Zoology offers the M.A. by either thesis or examination plan, details of which may be obtained from the departmental office. The program for the Ph.D. varies considerably, according to the background and interests of the individual student. All candidates for the Ph.D. must pass a written qualifying and an oral examination. The crucial part of the Ph.D. program is the thesis, based upon original research in which the candidate demonstrates the ability to conduct independent study and to incorporate the results in a thesis. Service as a teaching assistant is normally required as part of the Ph.D. program in zoology. Details of the Ph.D. program may be obtained from the departmental office.
Research Facilities

The Museum of Vertebrate Zoology is a research institute and repository for specimens and information relative to the higher vertebrate animals and has a large and growing collection of mammals, birds, reptiles, and amphibians. Research activities center on problems in evolutionary biology, with emphasis on systematics, ecology, functional morphology, biogeography, and conservation. The Museum serves many educational functions and houses a number of graduate students. The Museum also operates the Frances Simes Hastings Natural History Reservation, in upper Carmel Valley. The flora and fauna of the 1700-acre tract are completely protected for study of ecologic relations in undisturbed communities. Qualified graduate students and guest workers may pursue advanced studies and use the facilities of the museum and reservation under the sponsorship of a member of the museum staff. Persons interested may address the Director of the Museum, 2593 Life Sciences Building; or Dr. John Davis, in charge of Hastings Reservation, Carmel Valley, California.

The Cancer Research Laboratory is an interdepartmental laboratory which carries on a research, teaching, and service program designed to foster faculty, predoctoral, and postdoctoral students’ participation in cancer research. The central research program represents a multidisciplinary approach to an understanding of the neoplastic transformation and involves investigators in other parts of the University, as well as the laboratory staff. Graduate student postdoctoral research programs are supported in various areas of tumor biology: cytology, endocrinology, immunology, genetics, histopathology and somatic genetics. The laboratory also houses a major source of inbred mouse strains and the Secretariat of the University’s Cancer Research Coordinating Committee. Those interested in the laboratory’s program may communicate with the Director, 230 Earl Warren Hall.

Letters and Science List: for regulations governing this list, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE.

Lower Division Courses

1. Animal Diversity. (4)
   Three hours of lecture and two hours of laboratory per week. A survey of animal diversity including marine and terrestrial vertebrate and invertebrate types with emphasis on phylogeny and ecology. Strongly recommended for Zoology majors.
   Mr. Rowell (Sp)

10A. Animal Biology. (4)
   {Formerly numbered 10B}
   Three hours of lecture per week plus demonstrations to be arranged. Open without prerequisite to all students, but designed for those not specializing in Zoology. An outline of the main facts and principles of biology, with emphasis on human biology. (Students may not receive credit for this course if they have previously taken course 30, Biology 1A-1B, or Biology 11A-B.)
   Mr. Eakin (W)

*10B. Animal Biology. (4)
   {Formerly numbered 10C}
   Three hours of lecture per week plus demonstrations to be arranged. Open without prerequisite to all students, but designed for those not specializing in Zoology. Natural history of man in the tropics, with emphasis on ecological relations between man and other species. (Students may not receive credit for this course if they have previously taken Biology 1A-B or Biology 11A-B.)
   Mr. Rowell (Sp)

20. Basic Problems in Experimental Zoology. (3)
   Two 1-hour lectures per week. Prerequisite: sophomore status and permission of the instructor. Designed for majors or prospective majors in the physical sciences. An introductory course dealing with selected topics of current research interest in studies of evolution, cell biology and animal physiology.
   Mr. Steinhardt (W)

30. Biology and Society. (4)
   Three hours of lecture and one hour of discussion per week. Open without prerequisite to all students, including lower division students contemplating Zoology as a major who desire some perspective on the impact of biology on human life. An introduction to elementary biology with special attention to the prospects for applying the new findings of experimental biology in the manipulation of human physiology, genetics, and behavior. (Students may not receive credit for this course if they have previously taken course 10A, Biology 1A-B or Biology 11A-B.)
   Mr. Strohman (F)

Upper Division Courses

104. Introduction to Physicochemical Biology. (4)
   Three 1-hour lectures per week. Prerequisite: Biology 1 or equivalent; organic chemistry; general physics. Graduate students without the prerequisites may be admitted by consent of instructor. The living cell as an integrated molecular system; its structural organization, growth, reproduction, and work output.
   Mr. Mazia (W)

105. Vertebrate Embryology. (6)
   Two 1½-hour lectures, two 3-hour laboratories per week. Prerequisite: Biology 1. Development of the vertebrate body from fertilization through organo-
106. Evolutionary and Functional Vertebrate Anatomy. (4) Two 1½-hour lectures per week. Prerequisite: an elementary course in a biological science. Functional and evolutionary significance of the structures of the vertebrate body. (W)

106L. Laboratory in Evolutionary and Functional Vertebrate Anatomy. (3) Two 3-hour laboratories per week. Prerequisite: course 106 or concurrent enrollment therein. Comparative study of the organizational, evolutionary and functional significances of organs and structures of vertebrates. (W)

107A–107B. Natural History of the Vertebrates. (5–5) Two 1-hour lectures, one 2-hour laboratory and one 4-hour field period per week. Sequence beginning (W). Both quarters must be completed for credit. Prerequisite: Biology 1. Biology of vertebrates, exclusive of fish. Field work is emphasized. Mr. Stebbins, Mr. Patton, Mr. Johnson (W, Sp)

108. Invertebrate Zoology. (6) Three 1-hour lectures per week, plus two 3-hour laboratories per week and field trips when tides are appropriate. Prerequisite: Biology 1 or Biology 11. An introductory survey of the biology of invertebrates, stressing natural history, comparative anatomy, and evolution. Mr. Ghiselin (W)

109. Animal Evolution. (4) Two 1½-hour lectures per week, plus written reports and special readings. Prerequisite: Biology 1, Genetics 100. A course in evolutionary theory, with emphasis on basic processes, adaptive strategies, speciation, and major patterns. Mr. Wake (F)

110A–110B. Cytology. (3–3) Two 1-hour lectures per week. Prerequisite: Biology 1A–1B or equivalent. Sequence beginning (F). Both quarters must be completed for credit. The structure and function of the cell and its organelles from an historical perspective; mitosis, meiosis, introduction to cytogenetics. Mr. Alfert (F, W)

110L. Cytology Laboratory. (3) Two 4-hour laboratories per week. Prerequisite: course 110A–110B or concurrent enrollment therein. Microscope study of cell organelles, mitosis and meiosis; selected staining procedures and preparatory methods. Mr. Alfert (F, W)

111. Experimental Embryology. (4) Three 1-hour lectures per week. Prerequisite: course 105. A survey of experimental embryology and biochemical studies of animal development. Mr. Berg (F)

111L. Experimental Embryology Laboratory. (4) Two 4-hour laboratories per week. Prerequisite: course 105, recommended 111. Enrollment limited to ten students. Experimental embryology of sea urchin and amphibian embryos. Mr. Berg (W)

113. Normal and Abnormal Growth. (4) Two 1½-hour lectures per week, plus written reports. Prerequisite: Biology 1. Biosynthesis at molecular, cellular, and organismal levels; regulatory aspects of growth as seen in cell cultures and in the development of tumors. Mr. Harris (W)

114. Laboratory in Cell Biology. (3) One hour of lecture and six hours of laboratory per week. Prerequisite: course 104 or equivalent and permission of instructor. An advanced treatment of methods used in cell biology, including experiments on living cells and on isolation and characterization of organelles and their constituents. Mr. Witt, Mr. Mazia, Mr. Strolholm (F)

120A. Biology of Chemical Mediation. (4) (Formerly numbered 120) Two 1½-hour lectures and one hour of discussion per week. Prerequisite: Biology 1. Recommended: organic chemistry. Hormonal and parahormonal mechanisms with emphasis on general principles and comparative vertebrate endocrinology. Mr. Bern (F)

120B. Biology of Chemical Mediation. (4) Two 1½-hour lectures and one hour of discussion per week. Prerequisite: Biology 1. Recommended: 120A or equivalent (students interested in invertebrate biology and/or entomology may enroll with consent of instructor). Hormonal and parahormonal mechanisms with emphasis on invertebrate endocrinology and pheromonal mechanisms. Mr. Bern (W)

124. Invertebrate Physiology. (4) Three hours of lecture and one hour of discussion per week. Prerequisite: course 108 or 157, or an upper division course in physiology or entomology. Comparative physiology of nutrition, respiration, osmoregulation, coordination, effectors, and sense organs of invertebrates. Mr. Smith (W)

124L–124M. Invertebrate Physiology Laboratory. (5–5) Two 3-hour laboratory periods plus about nine hours of individual work, oral and written reports, and discussion per week. Prerequisite: course 124 (may be taken concurrently). Limited to 10 students. 124L: Topics in nutrition, respiration, excretion, and water balance. Mr. Smith (W) 124M: Topics in nervous and hormonal coordination, effectors, and sense organs. Mr. Smith (W)

131. Physiological Ecology. (4) Two 1½-hour lectures per week. Prerequisite: Biology 1ABC, or equivalent. Comparative physiology of the vertebrates with emphasis on adaptation to the various aspects of the physical environment, such as temperature, water, ions, and gases. (W)

131L. Laboratory in Physiological Ecology. (5) Two formal 3-hour laboratories per week. Student projects may also require six or more hours of additional laboratory work per week, detailed laboratory reports and several discussion sections. Prerequisite: course 131 or concurrent enrollment therein. Mr. Licht (Sp)

135. Animal Behavior. (4) Three 1-hour lectures per week plus 1 hour of discussion/demonstration (films, sound recordings, etc.). Prerequisite: Biology 1 or consent of instructor. An introduction to comparative animal behavior and behavioral physiology. Mr. Caldwell (F)
135L. Laboratory Studies of Animal Behavior. (3)

Two 3-hour laboratories per week with the possibility of field work. Prerequisite: course 135 (or concurrently) and consent of instructor. Limited to ten students.

Mr. Caldwell (Sp)

136. The Neurophysiological Basis of Animal Behavior. (3)

Three 1-hour lectures per week. Prerequisite: Biology 1 or consent of instructor. Recommended: course 135. Concepts of comparative neurophysiology, particularly as they relate to control of animal behavior (coordinated with Zoology 135). Will characterize operative components of receptor, central nervous, and neuromuscular mechanisms, and their organization into integrated systems.

Mr. Steinhardt, Mr. Bentley (Sp)

138. Social Behavior of Animals. (3)

Two 1-hour lectures per week. Prerequisite: course 135 or equivalent and consent of instructor. The description, analysis, and interpretation of social behavior, covering such topics as development of social units, comparisons of social systems, and their ecological and evolutionary implications.

Mr. Pitelka (W)

*139. Ecological Aspects of Behavior. (3)

Two 1½-hour lectures per week. Prerequisite: course 135 or Biology 150 and consent of instructor. A description of behavioral and ecological interactions at the population and community levels, covering such topics as population regulation, migration and dispersal, territoriality and competition.

Mr. Caldwell (W)

140. Animal Ecology. (3)

Three hours of lecture and one hour optional discussion section per week. Prerequisite: three quarters of upper division work in Biology (including Biology 150, or course 107A-107B, or equivalent), or graduate status in a related field. Recommended: a course in statistics. Principles of population ecology stressing vertebrates and terrestrial environments.

Mr. Pitelka (F)

141. Ecology and Evolution of Biological Communities. (4)

Two 1½-hour lectures per week. Prerequisite: course 140 or equivalent; knowledge of genetics and elementary statistics recommended. Lectures and discussion concerning the structure, development, and functional organization of natural and manipulated biological communities; analytical and mathematical approaches.

Mr. Colwell (W)

142. Marine Ecology. (4)

Two 1½-hour lectures per week. Prerequisite: Biology 150 or course 140 or equivalent. Physical, chemical, and biological environmental factors and their relationship to the distribution of marine organisms and community structure.

Miss Pressick (F)

142L. Laboratory and Field Studies in Marine Ecology. (5)

Five hours of laboratory and five hours of field work per week. Prerequisite: course 142, proposed research outline, consent of instructor and U.C. diving certification for underwater projects. One field trip, one formal discussion section, and five or more hours of laboratory per week. Independent research projects reports will be submitted. Course covers methods of ecological sampling, problem development, data analysis, and individual research.

Miss Pressick (Sp)

143. Marine Ecology. (10)

Full-time study at Bodega Marine Laboratory during six weeks of summer, including lectures, laboratory, field work, and individual study of problems in marine ecology. Class limited to sixteen students. Prerequisite: course in biology and consent of instructor.

Miss Pressick

155. General Protozoology. (6)

Three hours of lecture per week, plus seven hours of laboratory per week. Prerequisite: course in general biology with laboratory (e.g., Biology 1, Biology 11A-11B). Comprehensive survey of the protozoa, including some groups often classified with algae and fungi (i.e., plant flagellates and slime molds). Coverage in lectures includes classification and evolutionary relationships, life cycles, cellular structure and function, and considerations of ecological adaptation.

Mr. Balamuth (F)

156. General Animal Parasitology. (3)

Three 1-hour lectures per week, plus demonstrations to be arranged. Prerequisite: Biology 1, or equivalent. General and comparative features of the phenomenon of parasitism. Emphasis upon properties common to diverse taxonomic groups of animal parasites.

Mr. Simmons (F)

156L. Laboratory in General Animal Parasitology. (3)

Two 4½-hour laboratories per week. Prerequisite: course 156, or consent of instructor. Zoology of protozoan, helminth, and other invertebrate parasites with selected experiments.

Mr. Simmons (F)

157. Biology of Marine Invertebrates. (10)

Full-time study at Bodega Marine Laboratory during six weeks of summer, including lectures, laboratory, field work, and individual study of marine invertebrates. Class limited to eighteen students. Prerequisite: Biology 1 or 11, or consent of instructor; an alternate to 108. Mr. Smith, Mr. Kuris

159. Experimental Protozoology. (5)

Two 1-hour lectures and two 3-hour laboratories per week, plus special problem. Prerequisite: Biology 1. Recommended: course 155, course in cell or developmental biology. Experimental analyses of protozoan organization. Protozoa as cells and organisms; aspects of physiology and morphogenesis: growth and nutrition, cyclic differentiation and regeneration, sexuality and genetics. Laboratory designed to investigate these topics. Mr. Balamuth (W)

162. Evolutionary Cytogenetics of Vertebrates. (3)

One 1-hour lecture and one 3-hour laboratory per week, to include student projects and reports. Prerequisite: a basic course in genetics; cytology recommended; and consent of instructor. The theoretical and practical applications of cytogenetics to vertebrate population structures, systematics, and phylogeny.

Mr. Patton (Sp)

163. Mammalogy. (5)

Two 1-hour lectures and two 2-hour laboratories per week, plus two weekend field trips. Prerequisite: course 107A-107B. An advanced course in the biology of mammals.

Mr. Patton (F)

164. Ornithology. (5)

Two 1-hour lectures and one 4-hour laboratory or field trip per week, plus two weekend field trips. Prerequisite: course 107A. An advanced course in the biology of birds.
165. Herpetology. (5)
Two 1-hour lectures and one 3-hour laboratory per week, plus two field trips. Prerequisite: course 107A–107B or equivalent. Advanced study of amphibians and reptiles. Mr. Stebbins, Mr. Wake (Sp)

166. Ichthyology. (5)
Two 1-hour lectures and two 3-hour laboratories per week; some weekend field trips. Prerequisite: Biology 1. Recommended: course 106 or 107A–107B. A basic course in the biology of fishes. Mr. Barlow (F)

170. American Game Birds and Mammals. (2)
(Formerly numbered IDS 170)
One hour of lecture and three hours of laboratory per week. Prerequisite: Forestry and Conservation 170 (may be taken concurrently). An introduction to the economically important birds and mammals including game species, predators, and fur-bearers. Mr. Harris (F)

180. Comparative Histology. (4)
Two 1½-hour lecture and discussion periods per week. Prerequisite: a course in comparative or mammalian anatomy, or consent of instructor. Tissues of chordates; organizations of cells and their products to form tissues and organs; functional, comparative and chemical attributes of tissue structures and activities. (Sp)

180L. Laboratory in Comparative Histology. (4)
Two 3-hour lecture and laboratory periods per week. Prerequisite: course 180, or concurrent enrollment therein, or consent of instructor. Microscopic study and identification of specialized cells and tissues in vertebrates from lampreys to primates. Fundamentals of histological and histochemical laboratory techniques. (Sp)

181. Biology of Neoplasia. (4)
Two 1½-hour lectures per week, plus individual conferences. Prerequisite: open to senior and graduate students and by consent of instructor. Lectures, assigned reading, and individual reports on biological aspects of experimental cancer research. Mr. Nandi, Mr. Harris (F)

182. Special Topics in the Biology of Neoplasia. (2)
One 2-hour meeting per week. Prerequisite: course 181 or equivalent and the consent of the instructor. Lectures and discussions covering topics of current interest in the field of neoplasia with special emphasis on the biology of human neoplasia. Mr. Nandi (Sp)

H198. Thesis Course. (3)
Prerequisite: restricted to senior honor students. Individual study and research on a special problem to be chosen in consultation with a member of the staff; preparation of a thesis on broader aspects of this work; may be repeated for credit.

197. Extra Session Work. (1–4)
Work on assigned topics carried on in the field, or in Berkeley when the University is not in session, under the direction of a staff member.

The Staff (Mr. Strohman in charge) (Su, F, W, Sp)

198. Proseminar in Zoology. (1)
One 1-hour meeting per week, plus individual conferences. Prerequisite: upper division standing with an over-all B average, and at least a B average in the major. Reporting and group discussion on selected topics. Although organized by designated faculty member, others will participate.

Miss Pressick (F); Mr. Strohman (W); Mr. Berg (Sp)

199. Supervised Independent Study and Research. (1–5)
Prerequisite: background courses in chosen subjects. Enrollment is restricted by regulations listed on page 87. Must be taken on a passed or not passed basis.

The Staff, Mr. Strohman in charge (Su, F, W, Sp)

Graduate Courses
For admission to a graduate course, a student should have permission of the instructor (which may be given to graduate students and to seniors with not less than a B average), and should have had 18 units of basic upper division preparatory work.

*201. Molecular and Cellular Aspects of Development. (3)
Two 1½-hour lectures per week. Prerequisite: courses 104, 105, and 150 or equivalent. Advanced treatment of cellular developmental biology. Regulation of cell biosynthesis and differentiation.

Mr. Wilt (Sp)

210. Seminar in Cytology. (2)
One 2-hour meeting per week. Prerequisite: course 110A–110B. Critical discussion of basic problems and recent literature in descriptive cytology and cytochemistry. Mr. Alfert (Sp)

*212. Laboratory in Cell Biology. (4)
One 1-hour lecture, two 4-hour laboratories per week. Prerequisite: course 104. Recommended: a course in biochemistry. Isolation and characterization of cells and subcellular particles. Students assigned individual experimental procedures involving (a) enzyme structure relationships, (b) energy generation and utilization, and (c) biosynthesis of macromolecules.

Mr. Wilt, Mr. Strohman (F)

215. Seminar in Physicochemical Biology. (2)
One 2-hour meeting per week. Prerequisite: courses 104 and 212, or consent of the instructor. Seminar discussion of recent literature.

Mr. Mazia, Mr. Strohman (Sp)

*216. Somatic Cell Heredity. (2)
One 2-hour meeting per week. Prerequisite: consent of the instructor. Developmental, genetic, and neoplastic changes in isolated cell systems.

Mr. Harris (W)

218. Seminar on Fine Structure. (2)
One 2-hour meeting per week. Prerequisite: a course in cytology or histology, or consent of the instructor. Reports and discussion of recent and current studies in ultrastructure research.

Mr. Eakin (Sp)

219. Seminar in Developmental Biology. (2)
One 2-hour meeting per week. Prerequisite: course 105 or equivalent.

Mr. Berg (Sp)

*220. Special Topics in Biology of Chemical Mediation. (2)
One 2-hour lecture and discussion period per week. Prerequisite: consent of instructor. Topics will
vary from year to year. In alternate years the course will deal with neurosecretion and neuroendocrinology and will be intended primarily for graduate students in neurobiology. Mr. Bern (Sp)

221. Seminar in Comparative Endocrinology. (2)
One 2-hour meeting per week. Prerequisite: course 120, or Physiology 141, or equivalent. Recommended: course 220. Mr. Bern (Sp)

*229. Seminar in Marine Biology. (2)
One organizational meeting (arranged) and one weekend meeting at Bodega Marine Laboratory. Prerequisite: consent of instructor. Topics to vary. May be repeated for credit. Mr. Hand (W)

231. Seminar in Physiological Ecology. (2)
One 2-hour meeting per week. Prerequisite: consent of instructor. Mr. Caldwell (F, W)

236. Seminar in Comparative Neurophysiology. (2)
One 2-hour meeting per week. Prerequisite: consent of instructor. Critical discussion of current problems. Mr. Steinhardt, Mr. Rowell (W)

237. Seminar in Animal Behavior. (2)
One 2-hour meeting per week. Prerequisite: course 135 or equivalent and consent of the instructor. Mr. Pitelka (Sp)

Two 2-hour lecture and discussion periods per week, plus written reports. Prerequisite: course 140 or equivalent. A comparative review of population and life cycle characteristics; types of population organization evolved among higher animals, especially vertebrates. Mr. Pitelka (Sp)

244. Seminar in Animal Ecology. (2)
One 2-hour meeting per week. Prerequisite: course 140 or equivalent, and consent of instructor. Mr. Pitelka (W)

245. Ecological Research Reviews. (1)
One 1½-hour meeting per week. Prerequisite: graduate standing, basic courses in ecology and consent of instructors; enrollment limited. Reports and discussions of original research. Mr. Wake, Miss Pressick, Mr. Caldwell, Mr. Pitelka (F, W, Sp)

*248. Genetic Ecology. (2)
Two 1-hour meetings per week. Prerequisite: an upper division course in genetics and one in animal ecology (course 140 or equivalent). Lectures and discussion concerning the relationships between the genetic composition of populations and ecological processes. Specific topics will vary from year to year. Mr. Lidicker (W)

*254. Biology of Parasitic Protozoa. (5)
Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: course 156 or equivalent background in general parasitology. Detailed treatment of parasitic protozoa, with reference to morphology, life cycles, and host-parasite interactions. Examples of medical and veterinary importance are included with other forms in the interest of presenting a comprehensive survey. Offered occasionally in place of Zoology 255. — (W)

256. Seminar in Protozoology. (2)
One 2-hour meeting per week, plus outside preparation of papers. Prerequisite: course 155 or 255, or consent of instructor. Mr. Balamuth (Sp)

*257. Advanced Biology of Marine Invertebrates. (6)
Full-time study at Bodega Marine Laboratory during the first summer session. Lectures, seminar discussions, and individual study of selected problems. Class limited to six students. Prerequisite: 108 or 157 and consent of instructor. Mr. Smith, —

258. Advanced Invertebrate Zoology. (3)
Two hours of lecture per week, plus individual conferences. Prerequisite: course 108 or equivalent. General biology of a selected major group of invertebrates. May be repeated for credit. Mr. Ghiselin (F)

259. Seminar in Invertebrate Zoology. (2)
One 2-hour meeting per week, plus individual conferences. Prerequisite: consent of instructor. Mr. Smith (F)

*267. Seminar on Speciation in Vertebrates. (2)
One 1½-hour meeting per week. Prerequisite: course 107A–107B. Review of problems of speciation and isolating mechanisms in vertebrates, with emphasis on current literature. Mr. Patton (F)

268. Vertebrate Review. (2)
One 1½-hour meeting per week. Review of current literature on ecology and evolution of higher vertebrates. May be repeated for credit. Mr. Lidicker (W)

275. Seminar in Wildlife Ecology and Population Dynamics. (2)
One 2-hour meeting per week. Prerequisite: course 170 or equivalent. Mr. Leopold, Mr. White (Sp)

*280. Chordate Neurology. (2)
One 2-hour lecture and discussion period per week. Prerequisite: course 150 or consent of instructor. Organization, composition and regulatory mechanisms of chordate nervous systems. Subject matter will vary from year to year. (F)

283. Tumor Biology Research Review. (1)
Two hours of discussion per week. Prerequisite: graduate standing, basic courses in biology of neoplasia, and consent of instructor. Report and discussion of original research and defense of research proposals. Mr. Nandi (F, W, Sp)

284. Seminar on Biology of Neoplasia. (2)
One 2-hour meeting per week. Prerequisite: course 181 and consent of instructor. Presentation and discussion of current research in biology of neoplasia. Mr. Nandi, Mr. Harris, Mr. Bern, Mrs. Pitelka (Sp)

285. Seminar in Comparative Neurochemistry. (2)
One 1½-hour meeting per week. Prerequisite: consent of instructor. Correlative review of recent advances in comparative and experimental neurochemistry of invertebrates and vertebrates. (W)

294A–294B. Principles and Concepts of Modern Zoology. (2–2)
One 2-hour lecture and discussion period per week and recommended reading. Prerequisite: graduate standing and consent of instructor. Beginning graduate students are expected to attend. Must be taken on a pass/not pass basis. Sequence beginning (F), Mr. Harris (in charge) (F); Mr. Rowell (in charge) (W)
296. Research. (1–12)
Credit awarded according to work planned and accomplished. Must be taken on a passed/not passed basis. The Staff (Su, F, W, Sp)

299. Special Study for Graduate Students. (1–4)
Reading or other advanced study by arrangement with a staff member. The Staff (Su, F, W, Sp)

401. General Biological Microtechniques. (3)
Two hours of lecture and four hours of laboratory per week. Prerequisite: a course in general biology with laboratory. Preparation of invertebrate and vertebrate tissues for light microscopy. Basic histological and histochemical laboratory techniques including whole mounts, use of anesthetics, fixation, embedding, sectioning and staining of tissues. The paraffin method is emphasized. Mr. Austin (W)

601. Individual Study for Master's Students. (1–8)
Individual study for the comprehensive examinations or language requirements in consultation with the graduate adviser. Units may not be used to meet either unit or residence requirements for a master's degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Su, F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
Individual study in consultation with the graduate adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. May not be used for unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Su, F, W, Sp)

Zoology Seminar. (No credit)
Meetings for the presentation of original work by the faculty, visiting lecturers, and graduate students. Attendance by all graduate students is recommended.
In charge: Mr. Bentley (F); Mr. Lidicker (W); Mr. Albert (Sp)

DIDS (The Sciences) 191A. Introduction to Aquanautics. (4–5)
See Interdisciplinary and General Studies, Division of, for complete description of this course.

IDS 100. Problems in Marine Biology. (15)
See Biology for a complete description of this course.

IDS 200. Comparative Neurophysiology. (4)
(Formerly Zoology 225)
See Interdepartmental Studies for the complete description of this course.

IDS 200L. Advanced Laboratory in Neurophysiology. (5)
(Formerly Zoology 225L)
See Interdepartmental Studies for the complete description of this course.

IDS 204. Animal Behavior Research Reviews. (1)
See Interdepartmental Studies for complete description of this course.

*IDS 250. Experimental Helminthology. (5)
See Interdepartmental Studies for the complete description of this course.
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Absence, leave of, 22
Academic residence, 33
Academic Senate, 9
Academia, degrees for members of, 35
Accommodations, living, 53
Acting; see Dramatic Art, 173
Administration, 9, 528
Admission, 11
-- in advanced standing, 12
-- application and fee, 11
-- with bachelor's degree, 13
-- by examination, 12
-- to graduate study, 27
-- students from other countries, 14
-- grades and grade points, 18
-- special circumstances, 13
-- Subject A requirement, 24
-- visiting scholars, 29
Advanced standing, admission to, 12
Advisers, faculty
-- for foreign students, 31
-- graduate, 30
-- language training, 43
Aerospace Studies, department of, 87
Afro-American Studies Program, 284
Agricultural Chemistry, 89
Agricultural Chemistry, Group in, 38
Agricultural Economics, department of, 89
Agricultural Sciences, College of, 67, 93
research units, 65
Air Force ROTC Program, 55
Altaic languages, 407
Altaic and Tibetan, 410
Alumni Association, 61
placement center, 52
American History and Institutions
-- requirement, 25
Anatomy; see Physiology-Anatomy,
department of, 431
Ancient History and Mediterranean
Archaeology, 93
Ancient History and Mediterranean
Archaeology, Group in, 38
Anthropological and Sociological Studies;
see Religious Studies, 467
Anthropology, department of, 94
Application for admission and fee, 11
-- to graduate study, 27
Arabic, 391
Archaeology; see Anthropology, Classics,
Near Eastern Studies,
Paleontology
Architecture, department of, 263
Architecture, Landscape, 277
Architecture, Naval, 196, 206, 246
Army ROTC Program, 55
Art, department of, 101
-- History of Art, 103
-- Practice of Art, 101
Art and Archaeology of the Near East,
390
Art Galleries, 107
Arts; see Interdisciplinary and General
Studies, Division of, 336
Arts and Lectures, Committee for, 60
Asian Studies, Group in, 38
Assistantships, research or teaching, 47
Associateships, 47
Astronomy, department of, 108
ASUC, 59
Athletic Privilege Card, 64
Bachelor of Arts degree, university
-- requirements, 24
-- letters and science requirements, 71
Bacteriology and Immunology, depart-
-- ment of, 112
Bancroft Library, 56
Bears Lair, 57
Berkeley campus, 10
Bibliography, 357
Biochemistry, department of, 115
Biogeography, Tropical, 49
Biology, 117
Biology, department of Molecular, 378
Biophysics; see Medical Physics, 375
Biophysics, Bioradiology, and Medical
-- Physics, Group in, 39
Biostatistics, 121; see also Statistics,
department of, 515
Biostatistics, Group in, 39
Botany, department of, 122
Buddhist Studies, 126
Buddhist Studies, Group in, 39
Business Administration, department of,
126
Business Administration, Graduate School
of, 72
Business Administration, School of, 72
research unit, 65

Calendar, 2
Cancellation of registration, 22
Cancer Research Laboratory, 522
Candidacy
advancement to, 36, 41
notice of intended, 41
Candidates's degree, 41
Cell Physiology, department of, 138
Cellular Biophysics, 376
Ceramic Engineering, 203
Ceramics; see Design, department of, 274
Chancellors, 9, 529
Charter Day, 7
Chemical Engineering, department of, 139
Chemistry, Agricultural, 89
Chemistry, College of, 68
Chemistry, department of, 143
Chicano Studies Program, 287
Chinese, 407, 409
Christian Studies; see Religious Studies, 467
City and Regional Planning, department of, 269
Civil Engineering, department of, 193, 197, 211
Classical Languages, 149
Classical Studies in Rome, Intercollegiate Center for, 149
Classics, department of, 148
Classics; see Foreign Literature in Translation, 296
Clubs, special interest, 60
College of California, 7
College Entrance Examination Board, 12
Colleges and Schools at Berkeley, 67
Colleges and Schools in San Francisco, 79
Communication and Public Policy, group major in, 154
Community Projects Office, 59
Comparative Literature, department of, 155
Comparative Literature; see Foreign Literature in Translation, 296
Comparative Biochemistry, Group in, 39
Comparative Pathology, Group in, 39
Computer Center, 58
Computer Science, department of, 161
Conduct, 22, 31

Conservation of Natural Resources, field major in, 165
Contemporary Asian Studies Program, 290
Contra Costa Academy, 7
Counseling Center, 51
Course numbering, explanation of, 87
Courses and Curricula, 87
Courses of general interest for upper division students, 81
Cowell Memorial Hospital, 14, 50
Credit, course, 18
by examination, 20, 35
passed-or-not-passed, 21
transfer from other institutions, 36
Criminology, department of, 167
Criminology, School of, 73
Cuneiform, 392

Dance; see Dramatic Art, 173
Deans, 530
Debate, 60
Defense Language Institute at Monterey, 43
Degrees; see bachelor's, master's, doctor's academic, 35
Academic Senate members, 35
declaration of candidacy, 23, 36
duplication of, 35
graduate, 48
progress toward, 22
university requirements, 24
Dentistry, School of, in San Francisco, 79
Design, department of, 274
Design and lighting; see Dramatic Art, 174
Dietetics, 397
DIGS; see Interdisciplinary and General Studies, Division of, 336
Dining facilities, 57
Directing; see Dramatic Art, 174
Disqualification, 19
Doctor's degree, 37; see also requirements in various departments
Drama, 60
Dramatic Art, department of, 171
Dravidian, 506
Dutch; see department of German, 320
Dutch; see also Foreign Literature in Translation, 296

Ecology; see Environmental Studies, 282
Economic history courses, 332
Economics, department of, 177
Education, department of, 182
Education, School of, 73
Education abroad program, 44, 62
Education, Physical, department of, 420
Educational Career Services, Office of, 53
Egyptian, 392
Electrical Engineering and Computer Sciences, 194, 198, 227
Endocrinology, Group in, 39
Engineering, College of, 68
research units, 65
Engineering, departments and divisions, 193, 208
Ceramic, 203
Civil, 193, 197, 211
Double Major, 206
Electrical and Computer Sciences, 194, 198, 222
Engineering Geoscience, 204, 237
Engineering Science, 199
Environmental Engineering, 207
Fluid Mechanics; see Mechanical Engineering
Hydraulic and Sanitary; see Civil Engineering
Industrial and Operations Research, 195, 201, 231
Materials Science, 195, 202, 234
Mechanical, 196, 204, 238
Metallurgy, 203
Naval Architecture, 196, 206, 246
Nuclear, 197, 206, 247
Structural Engineering and Structural Mechanics; see Civil Engineering
System Science and Public Systems, 207
Thermal Systems; see Mechanical Engineering
Transportation; see Civil Engineering
Engineering Mathematical Statistics; see Statistics, 513
English, department of, 250
English for Foreign Students, 256
Enrollment in classes, 17
Entomological Sciences, department of, 257
Environmental Control Systems, 265
Environmental Design, College of, 69, 262
Environmental Engineering, 207
Environmental Health Sciences, Group in, 39
Environmental Planning, the Ph.D. Degree in, 279
Environmental Studies, 282
physical, biological, and social sciences, 283
Epidemiology, Group in, 39
Ethnic Studies Programs, 284
Afro-American Studies, 284
Chicano Studies, 287
Contemporary Asian Studies, 290
Native American Studies, 292
Examinations, 20
admission by, 12
to graduate study, 28
achievement tests, 12
American History and Institutions, 25
course credit by, 20, 35
medical-physical requirements, 14, 33
midterm and final, 20
qualifying, 41
scholastic aptitude, 12
Subject A, 24
Expenses of students, 64
Extension, University, 10, 35
Facilities and services, 50
graduate, 43
Faculty and instruction, 8
Faculty advisers
for foreign students, 31
for graduate students, 30
Fees and expenses, 63
Athletic Privilege Card, 64
registration, 63
late registration, 14
nonresident tuition, 15, 46, 64
Subject A, 24
Fellowships
honorary traveling, 46
National Defense Education Act, 46
teaching, 47
Field Studies Program, 79
Filing study list, 17
Financial Aid, Office of, 44, 53
Fluid Mechanics; see Mechanical Engineering
Folklore, 295
Folklore, Group in, 39
Food Science; see Nutritional Sciences, 397
Food Science, Group in, 39
Footnote Symbols, Key to, 86
Foreign language training, 43
Foreign Literature in Translation, 296
Foreign students
admission, 14
to graduate study, 29
advisers, 31
English for, 256
health insurance, 64
I House, 61
registration, 31
study list and study list limits, 33
Forestry and Conservation, department of, 298
Forestry and Conservation, School of, 74
research units, 65
Fraternities, 52
French, department of, 302
French; see Foreign Literature in Translation, 296
General Interest Courses for Upper Division Students, 81
Genetics, department of, 306
Genetics, Group in, 39
Geography, department of, 309
Geology and Geophysics, department of, 314
Geoscience, Engineering, 204, 237
German, department of, 320
German; see Foreign Literature in Translation, 296
Grade points, grades and, 18
Graduate Assembly, 59
Graduate Division, 27
facilities and services, 43
financial aid, 44
minority program, 46
regulations and procedures, 30
research units, 65
study abroad, 44
Graduate programs; see under colleges and schools section, 67–80;
under various departments in course section
Graduate Theological Union, 43
Greek, 149, 151
Harmon Gymnasium, 57
Hastings College of the Law in San Francisco, 79
Health Service, Student, 14, 50
Hearst Gymnasium, 57
Hebrew, 393
Hindi-Urdu, 506
History, department of, 325
History of Art, 103
History of science courses, 332
History of the Theatre; see Dramatic Art, 174
History of the University, 7
Honors, 20; see also honors courses in various departments
Hospital, Cowell Memorial, 14, 50
Housing information services, 53
Humanities; see Interdisciplinary and General Studies, Division of, 336
Hungarian; see Slavic Languages and Literatures, department of, 481
Hungarian; see Foreign Literature in Translation, 296
Hydraulic and Sanitary Engineering; see Civil Engineering
Immunology, department of Bacteriology and, 112
Immunology, Group in, 39
Indian Civilization; see South and Southeast Languages and Literatures, 501
Indonesian-Malay, 507
Industrial Engineering and Operations Research, 195, 201, 231
Intercampus Exchange Program, 29
Interdepartmental Studies, 330
Interdisciplinary and General Studies, Division of, 336
the Arts, 339
the Humanities, 337, 339
the Sciences, 340
the Social Sciences, 338, 340
Interdisciplinary Groups, 38
Interior Design; see department of Design, 274
International Education, 44, 62, 341
International House, 61
Internship/Study Opportunities in Professional Schools Program in India, 44
Iranian and Persian, 394
Islamic Studies; see Religious Studies, 467
Italian, department of, 341
Italian; see Foreign Literature in Translation, 296
Japanese, 407, 410  
Jewish Studies; see Religious Studies, 467  
Joint doctoral programs, 43  
Journalism, department of, 345  
Journalism, School of, 75

Korean, 410

Laboratories, centers, institutes, 65  
Landscape Architecture, department of, 277  
Language Laboratory, 57  
Language training adviser, 43  
Latin, 149, 152  
Latin American Studies, Sponsoring Committee for, 39

Law, department of, 347  
Law, School of, 75  
research units, 65  
Law and Society, 355  
Law and Society, Committee for, 39  
Lawrence Berkeley Laboratory, 66  
Lawrence Hall of Science, 58  
Lectures, 60  
Letters and Science, College of, 70  
research units, 65  
Librarianship, School of, 76, 356  
research units, 66  
Libraries, 56  
Limited status admission, 13  
Linguistics, department of, 359; see also department of German, 320  
Literature of Theatre; see Dramatic Art, 173  
Literature, Foreign, in Translation, 296  
Lithuanian; see Slavic Languages and Literatures, department of, 481  
Living accommodations, 53  
Logic and the Methodology of Science, 363  
Logic and the Methodology of Science, Group in, 39  
Lost-and-found service, 62

Major, declaration and change of, 22  
Malay-Indonesian, 507  
Marine Corps programs, 56  
Master's degree, 36; see also various departments  
Materials Science and Engineering, 195, 202, 234  
Mathematics, department of, 364  
Mechanical Design; see Mechanical Engineering  
Mechanical Engineering, department of, 196, 204, 238  
Medical-physical examination requirement, 14, 33  
Medical Physics, 374, 376  
Medicine, School of, in San Francisco, 79  
Medieval Studies, 49, 107  
Medieval Studies, Committee on, 39  
Metallurgy, 203  
Microbiology, Group in, 39  
Military information, 54  
Military Science, department of, 377  
Minority program, 46  
Modern Indo-Aryan; see South and Southeast Asian Languages and Literatures, department of, 501  
Moffitt Library, 56  
Molecular Biology, department of, 378  
Morrison Library, 56  
Museum of Paleontology, 412  
Museum, University Art; see Art Galleries, 107  
Museum of Vertebrate Zoology, 522  
Music, 60  
Music, department of, 380

National Defense Education Act fellowships, 46  
Native American Studies Program, 292  
Naval Architecture, department of, 196, 206, 246  
Naval Science, department of, 386  
Navy and Marine Corps programs, 56  
Near Eastern Studies, department of, 387, 389  
Near Eastern Studies; see Foreign Literature in Translation, 296  
Nepali, 507  
Neurobiology, group major in, 395  
Nonresidents  
Admission in advanced standing, 12  
Tuition, 15, 46, 64  
Nuclear Engineering, department of, 197, 206, 247  
Nursing, School of, in San Francisco, 79  
Nutrition, Group in, 39  
Nutritional Sciences, department of, 397, 400

Operations Research, Industrial Engineering, department of, 195, 201, 231
Optometry, department of, 402
Optometry, School of, 76
Optometry Clinic, 50
Organizations and activities, student, 59
Oriental Languages, department of, 406, 408
Oriental Languages; see Foreign Literature in Translation, 296

Paleontology, 412
Paleontology Museum, 412
Parasitology; see department of Entomological Sciences, 257
Parasitology, Group in, 39
Passed-or-not-passed credit, 21
Pathology, Plant, 436
Persian and Iranian, 394
Pest Management Curriculum, 415
Pharmacy, School of, in San Francisco, 79
Philology, Romance, 476
Philosophy, department of, 415
Physical anthropology courses, 97
Physical Education, department of, 420
Physical Science, field major in, 424
Physically Disabled Students Program, 52
Physics, department of, 425
Physiological Optics; see Optometry, 402
Physiological Optics, Group in, 39
Physiology-Anatomy, department of, 431
Placement Center, Student and Alumni, 52
Plant Nutrition, 501
Plant Nutrition, Soils and, department of, 498
Plant Pathology, department of, 436
Plant Physiology, Group in, 39
Playwriting; see Dramatic Art, 173
Police, University, 62
Political Science, department of, 438
Portuguese, department of Spanish and, 508
Portuguese; see Foreign Literature in Translation, 296
Postdoctoral fellows, 29
Pre-Professional advising (dentistry, law, medical technology, medicine, nursing, pharmacy and physical therapy), 51
Probation, 19
Programs for teachers, 79
Psychology, department of, 447
Public Affairs; see Public Policy
Public Health, department of, 454
Public Health, School of, 77
research units, 66
Public Policy, Graduate School of, 77, 464
Publications, student, 60; see also University Press, 61
Quarter system, 18

Radiation Biophysics, 376
Range Management, Group in, 39
Range Science, 301
Readmission, application for, 22, 32
Reapplication for admission, and fee, 28
Recreational facilities, sports and, 57
Regents, 9, 528
Regional Planning, City and, 269
Registration, 14, 31
Registration fee, 63
Religious Studies, 467
Research at Berkeley, 9, 65
Reserve Officers Training Corps, 54
Residences, University operated or registered, 53
Residential Program, 469
Rhetoric, department of, 469
Romance Languages and Literatures,
Group in, 39
Romance Philology, 476
Romance Philology, Group in, 39
ROTC programs, 54
Russian and East European Studies,
Certificate in, 49
Russian and East European Studies,
Committee for Certificate in, 39

Sanskrit, 507
Scandinavian, department of, 477
Scandinavian; see Foreign Literature in Translation, 296
Scholarship requirements, minimum, 19
Schools and Colleges in Berkeley, 67
Schools and Colleges in San Francisco, 79
Science and Mathematics Education, 480
Science and Mathematics Education,
Group in, 39
Seismographic Stations, 316
Semetics, 394
Services and Facilities, 50
Slavic Languages and Literatures, department of, 481
Slavic Languages and Literatures; see Foreign Literature in Translation, 296
Social Sciences; see Interdisciplinary and
General Studies, Division of,
field major in, 336, 338
Social Security, 54
Social Welfare, department of, 486
Social Welfare, School of, 78
Sociology, department of, 490
Soil Science, 499
Soil Science, Group in, 39
Soils and Plant Nutrition, department of,
498
Sororities, 52
South and Southeast Asian Languages
and Literatures, department of,
501
South and Southeast Asian Languages
and Literatures; see Foreign
Literature in Translation, 296
South Asian, 504
Spanish and Portuguese, department of,
508
Spanish; see Foreign Literature in Trans-
lation, 296
Special admission, 13
Special status admission, 13
Sports and recreational facilities, 57
Standards of Scholarship and Dismissal
for Academic Deficiencies, 32
Stanford-California exchange program, 43
Statement of Firm Intent to Register, 29
Statistical laboratory, 519
Statistics, department of, 513
Strawberry Canyon Recreation Area, 57
Structural Engineering and Structural
Mechanics; see Civil
Engineering
Student and Alumni Placement Center, 52
Student Health Service, 50
Student Relations and Programs, Office of,
51
Students, 8
conduct, 22, 31
financial aids, 44, 53
health service, 50
living accommodations, 53
organizations and activities, 59
other countries, 14
services and facilities, 50
union and student center, 58
Study abroad for graduate students, 44
for undergraduates, 62
Study list, filing, 17
limits, 33
Subject A, English composition, 520
entrance requirement, 24
English for foreign students, 256
Summer Program for Teachers, 79
SUPERB, 59
System Science and Public Systems, 207
Teaching assistantships and fellowships,
47
Teaching credentials, 49
Tests; see examinations
Textile; see department of Design, 274
Theatre, History of; see Dramatic Art, 174
Theatre, Literature of; see Dramatic Art,
173
Theatre, TV, and radio, 60
Theatre, University; see Dramatic Art,
172, 175, 176
Theological Union, Graduate, 43
Theoretical Biophysics, 376
Thermal Systems; see Mechanical Engi-
eering
Tibetan, Altaic and, 410
Transfer after disqualification, 19
Transportation Engineering; see Civil
Engineering
Tropical Biogeography, 49
Turkish, 395
Undergraduate Admission, Procedures,
and Regulations, 11
Units, courses and, 18
University Art Museum, 107
University Extension, 10, 35
University operated or registered resi-
dences, 53
University Press, 61
University Theatre, 172, 175, 176
University Married Students Housing, 53
Urban Design, Joint Program in, 279
Urdu, Hindi, 506
Varsity debate, 60
Veterans and dependents, aid to, 54
Veterinary Medicine, School of, at Davis,
68
Visiting scholars, 29
Wildlife science, 301
Withdrawal and re-entry, 22
graduate, 31
Wood Science, 300
Wood Science and Technology, Group in,
39
Zoology, department of, 520
A Note on the Production of this Catalogue

In printing this year’s catalogue, we have turned to an interesting source of ink—salvage. During the past year the University Printing Department saved all the ink left over from work involving color. The catalogue has been printed with this salvage—saving the University $700 since the 200 pounds of ink consumed would have cost $3.50 a pound on today’s market. There is also the ecological advantage of not having released this ink as a waste product (and additional pollutant) into our environment.
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