General Interest Courses for Upper Division Students


**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; 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.


124, Nonconformist Cultures; 129, Social and Historical Origins of Major Theories of Criminal Behavior; 180, Juvenile Delinquency: Prevention and Control.

**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, Humanistic Foundations of Education.

**Engineering** 100, Materials and Processes Used in Manufacturing.


**Geography** 100A–100B, Principles of Cultural Geography; 103, The Relations between Nature and Culture; 110A–110B, Principles of Economic Geography; 112, Historical Geography of Transportation; 114, Industrial Localization; 120, Urban Geography; 130A, Natural Resources and Population; 130B, Open Land as a Natural Resource; 135, Energy as a Resource; 140, Analysis of Landforms; 144, Introduction to 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.

**German** 133A–B, German Cultural History and Political Institutions; 140, Introduction to the Linguistic Study of German; 160, Issues and Problems in German Literary and Cultural History; 190, Freud and Literature.

**Italian** 103A–103B, Introduction to Italian Literature; 109A–109B–109C, Dante's *Divina Commedia*; 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 Divine Comedy; 135, Petrarch and Boccaccio; 140A–B, Basic Reading: Petrarch; 150, Machiavelli; 155A–155B, The Renaissance; 170, Modern Italian Literature; 180, Film and Literature.


Landscape Architecture 3, Ecological Analysis; 125, History and Literature of Landscape Architecture; 100, Survey of Landscape Architecture.

Linguistics 106, Transformational Grammar; 110, Introduction to Phonetics and Phonology; 120, Introduction to Syntax and Semantics; 145, Comparative and Historical Linguistics.

Music 127A–127B, History of Music; 128A, Opera; 128B, The Symphonies of Beethoven; 128C, Contemporary Music; 128F, Symphonic Literature of the Nineteenth Century; 128K, Afro-American Music; 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.


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.

Oriental Languages 112, Survey of Chinese Literature and Literary Criticism; 132, History of Japanese Literature; 140, Civilizations of Eastern Asia: China; 141, Civilizations of Eastern Asia: Japan; 142, Civilizations of Eastern Asia: Korea; 143, Civilizations of Eastern Asia: Mongolia; 152, Modern Japanese


**Scandinavian** 106, History of Scandinavian Drama up to 1900; 107, The Plays of Ibsen; 108, Strindberg and His Writings; 109, Scandinavian Drama of the Twentieth Century; 120A–120B, The Novel in 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; 171, Contemporary Swedish Literature; 175, Kierkegaard.


**Hungarian** 185A–185B–185C. Survey of Hungarian Literature.

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, 1971–72
† To be given if a sufficient number of students enroll
‖ To be given even-numbered years
‖² To be given odd-numbered years
EXPLANATORY NOTE

Prerequisites for courses should be noted carefully, although they are sometimes waived at the discretion of the instructor. Lower division courses (numbered 1-99) are open to freshmen and sophomores. In no department is a lower division course acceptable for upper division credit. For exceptions see below. Upper division courses (100-199) are ordinarily open to students who have completed at least one lower division course in the given subject, or two years of college work. Adequate preparation for graduate courses (200–299), subject to the instructor’s approval, is normally 18 upper division units of work basic to the subject matter of the course. Professional courses for teachers (300–399) are specially designed for teachers or prospective teachers. These and other professional courses (400–499) are acceptable toward academic degrees only within the limitations prescribed by the various colleges or schools or the Graduate Division. The numbers 601 and 602 are reserved for special study undertaken by graduate students in preparing for the master’s examination or the Doctor of Philosophy qualifying examination, respectively.

Courses numbered 199 are supervised independent study and research courses for undergraduates, and may be graded only Passed or Not Passed. Enrollment in these courses, therefore, is subject to the limitations stated on this page as well as to certain other rules. The student must obtain the prior consent of the instructor who is to supervise the study, his major adviser, and the department Chairman (or his equivalent) in the department in which the study is to be conducted. 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; he must have completed at least 90 units of undergraduate study. 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. Course numbers preceded by the letter H are special honors courses subject to such general restrictions as may be imposed by the department.

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 the one following, and a student may normally receive credit for completion of the first ⅓, ⅔, or ⅓ of a sequence.

The number in parentheses following the course title indicates the credit value (see page 16), the abbreviation in parentheses indicates the quarter in which the course is offered, (F) fall, (W) winter, (Sp) spring.

AEROSPACE STUDIES

(Department Office, 47 Harmon Gymnasium)

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

Associate Professors:
William R. Hulings, M.S., Major, USAF
Robert D. Reid, B.A., Major, USAF

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

NOTE: For key to footnote symbols, see page 78.
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 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 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 four-year program 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 $50 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 the Advanced Course 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 $50 per month for all students regularly enrolled in the Advanced 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.

AFROTC Staff (F, W, Sp)

21A–21B–21C. World Political-Military Systems. (1–1–1)

One 1-hour lecture/seminar meeting and one hour of laboratory per week. Prerequisite: courses 1A–1B–1C or equivalent. Further extension of material introduced in Courses 1A, 1B and 1C with particular emphasis on world political and military alliances; organizational structure, roles, missions, capabilities of U.S. political and military instruments of national power; and analysis of ideological conflicts.

AFROTC Staff (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 General Course or equivalent active military service.

AFROTC Staff

Upper Division (Advanced Course)


Two 1½ hour lecture and seminar meetings and one hour of laboratory per week. Prerequisite: course 1A–1B–1C and 21A–21B–21C, or course 422 or equivalent. Development and employment of aerospace power with emphasis on its place as a factor of national power; scope and future implications of astronautics and space activities; and introduction to effective procedures of managerial communication and executive development. Mr. Hulings (F, W, Sp)

141A–141B–141C. Aerospace Management. (3–3–3)

Two 1½ hour lecture 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 junior and senior years.

AFROTC Staff

Mr. Wasson (F)

AFRO-AMERICAN STUDIES PROGRAM

The Degree of Bachelor of Arts in Afro-American Studies will be granted on the following conditions.

1) Completion of 180 units; at least 54 units must be in upper division courses.

2) Completion of the general University requirements as to Subject A (SR 636), American History and Institutions (ST 630), grade point average (SR 634) and senior residence (SR 630).

3) Proficiency in the use of English. The criterion for satisfaction of this requirement is set by the faculty of Afro-American Studies.

4) Completion of a minimum of 30 units in a core curriculum in the fields of Afro-American Studies as approved by the faculty of the program.

5) Completion of at least 15 units from the course offerings of the other programs of the Ethnic Studies Department. The faculty of the program establishes the number of units required and the list of courses acceptable in satisfaction of this requirement.

6) Completion of the major in Afro-American Studies

The Afro-American Studies major consists of a group of upper division courses in Afro-American Studies and related fields as approved by a study-list officer of the program and totaling at least 30 units in addition to the courses specified in (4).

The current requirements for the degree as approved by the faculty of the program shall be published annually in the GENERAL CATALOGUE.

Study lists—All study lists are subject to approval by a study officer of the program. Regulations as to the approval of study lists shall be adopted by the faculty of the program.

Honors—1) A student will be recommended for honors if he has completed at least one term of 12 units and has an average of at least “B” for all work undertaken in Ethnic Studies—Afro-American Studies Program and has been approved specially for inclusion in honors by the Committee on Honors either upon recommendation by the Program Faculty or upon such other basis or criterion as the Committee may determine.

2) Honor students may be granted such further privileges as the Committee on Honors determines.

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 Entomology and Parasitology; 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.
Loy L. Sammet, Ph.D.
Siegfried V. Wantrup, 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)

Assistant Professors:
Jurg H. Bieri, Ph.D.
Alain Choppin de Janvry, Ph.D.

Andrew Schmitz, Ph.D.
Professor:
Davis McEntire, Ph.D.
Associate Professor:
David W. Seckler, Ph.D. (Acting)
Assistant Professors:
Ronald G. Lorentson, B.A. (Acting)
Richard B. Norgaard, M.S. (Acting)

Lecturers:
Richard H. Courtney, Ph.D.
Kenneth R. Farrell, 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. Clarke, Mr. Lee.

Agricultural Economics is one of the majors under the Agricultural Sciences Curriculum in the College of Agricultural Sciences (see page 61), 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).

NOTE: For key to footnote symbols, see page 78.
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.

Lower Division Course

23. World Agriculture. (4)
Two 1½-hour lectures per week. Survey of world agriculture, focusing on factors involved in growth and development. Interrelations among physical features and economic, political, and social factors. Institutions, technology, and international agencies. International trade in agricultural commodities. Mr. Wallace (W)

Upper Division Courses

100A. Economic Analysis in Agriculture. (5)
Three 1½-hour lectures per week. Prerequisite: Economics 1A and 1B, or equivalent. Application of economic principles to problems of agriculture: economic structure and aspects of American agriculture; analysis of demand, supply, production of agricultural products, with particular reference to the individual firm. Mr. Courtney (F)

100B. Economic Analysis in Agriculture. (5)
Three 1½-hour lectures per week. Prerequisite: course 100A or equivalent. Application of economic principles to problems of agriculture: pricing of agricultural output and productive services, including multiple products, multiple markets, and multiple time periods; regional specialization, location and trade; determinants of economic change; effects of economic organization. Mr. Lorentson (W)
106. Analysis of Agricultural Economic Data. (5)
Three 1½-hour lectures per week. Prerequisite: Statistics 2, Mathematics 16A, or equivalents. Evaluation and treatment of economic data in agriculture, with emphasis on methods of analyzing relations among economic variables. Mr. de Janvry (W)

*110. Agricultural Finance. (4)
Two 1½-hour lectures per week. Prerequisite: Economics 1A or 1E. Farmers' credit needs, methods of financing the agricultural industry, agencies supplying agricultural credit. Mr. Thor (F)

112A–112B. Rural Sociology. (4–4)
Two 1½-hour lectures per week. Comparative rural social organization and institutions; social change in the rural environment; social aspects of agrarian reform and agricultural development. 112A focuses primarily on the United States. 112B is concerned mainly with foreign countries.
112A, Mr. McEntire (W), 112B, Mr. McEntire (Sp)

120. Agricultural Policy. (5)
Three 1½-hour lectures per week. Prerequisite: Economics 1A and 1B. Analytical and historical treatment of economic problems, governmental policies and programs affecting American agriculture.

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. Wallace (W)

130. Agricultural Marketing. (4)
Two 1½-hour lectures per week. Prerequisite: Economics 1A. 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. Prerequisite: 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.
Mr. Siebert (Sp)

175. Economics of Natural Resources. (5)
Three 1½-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)

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 79. Must be taken on a passed or not passed basis.
The Staff (Mr. Bieri in charge) (F, W, Sp)

I. D. S. 10A–10B–10C. Man and His Environment—Crises and Conflicts. (4–4–4)
See Interdepartmental Studies for complete description of this course.

Graduate Courses

200A–200B. Economics of Agricultural Production and Consumption. (5–5)
Three 1½-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, Mr. Hoos (F), 200B, Mr. Schmitz (Sp)

210A–210B–210C. Quantitative Methods in Agricultural Economics. (5–2–2)
210A. Three 1½-hour lectures per week.
210B. Two 1½-hour lectures per week.
210C. Two 1½-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)

Two 1½-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, ——— (F); 220B, Mr. Lee (W); 220C, ——— (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)

Two 2-hour lectures per week. A seminar on the literature, current research problems, and methods of analysis in agricultural marketing. Sequence, beginning (F).
230A, Mr. Farrell (F); 230B, Mr. Clarke (W); 230C, Mr. Clarke (Sp)

Two 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, ——— (F); 270B, Mr. Norgaard (W); 270C, Mr. Wantrup (Sp)

290. Problems in Agricultural Economics Research. (3)
Two 1½-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.
Mr. Bieri, Mr. Schmitz (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)

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, 39 units as follows: agricultural science (4); microbiology (4); biology (15); physiology (4); ecology (4); botany and/or zoology (8).

Major Field, 30 units as follows: one introductory course in each of the following

NOTE: For key to footnote symbols, see page 78.
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, 41 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)
David Daube, Dr.Jur., Ph.D., D.C.L., LL.D. (Law)
Jonas C. Greenfield, Ph.D. (Semitic Languages)
Isadore Perlman, Ph.D. (Chemistry)
W. Kendrick Pritchett, Ph.D. (Greek)
Raphael Sealey, M.A. (History)

Associate Professors:
Peter Garnsey, D.Phil. (Latin)
Erich S. Gruen, Ph.D. (History)
A. M. Henrichs, D. Phil. (Classics)
Anne D. Kilmer, Ph.D. (Assyriology)
Spiro K. Kostof, Ph.D. (Architectural History)
Jacob Milgrom, D.H.L. (Hebrew)
Ruggiero Stefanini, Dottore in Lettere (Anatolian Studies)
Ronald S. Stroud, Ph.D. (Classics)
David H. Wright, Ph.D. (Art)

Assistant Professors:
Crawford H. Greenewalt, Ph.D. (Classical Archaeology)
Wolfgang J. Heimpel, Ph.D. (Assyriology)
James C. Keenan, Ph.D. (Classics)
Leonard H. Lesko, M.A. (Egyptology)
Robert J. Rodden, Ph.D. (Anthropology)

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 re-

NOTE: For key to footnote symbols, see page 78.
quirements, 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.
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.
May N. Diaz, Ph.D.
Phyllis Dolhinow, Ph.D.
Nelson H. H. Graburn, Ph.D.
John A. Graham,‡ Ph.D.
Glynn L. Isaac, Ph.D.
Herbert P. Phillips, Ph.D.
Jack M. Potter,† Ph.D.
William S. Simmons, Ph.D.

Assistant Professors:
William H. Geoghegan, Ph.D.
Robert J. Rodden, Ph.D.
Vincent M. Sarich, Ph.D.

Assistant Professor:
John U. Ogbu (Acting)

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:

NOTE: For key to footnote symbols, see page 78.
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 which may be taken from any of the I–VI groups, to total 40 units of upper division courses in anthropology.

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. Students admitted to the honors program will include in their major program H198A, Senior Honors Seminar H198B, Senior Honors Research and H198C, Senior Honors Thesis.

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 for the Ph.D. will be accepted. The M.A. degree is awarded in the course of study leading to the doctorate.

Because of the number of students who wish advanced training, only a small percentage of applicants can be accepted. Applications are considered only once a year for the following fall quarter. The deadline for application is December 15.

The Graduate Major

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. Mr. Washburn (F); Mr. Sarich (W)

2. Introduction to Archaeology. (5)
   (Formerly course 2A)
   Three 1-hour lectures and one 1-hour section meeting per week. Prehistory and cultural growth. Mr. Isaac, Mr. Rodden (W)
3. Introduction to Social and Cultural Anthropology. (5)
(Formerly course 2B)
Three 1-hour lectures and one 1-hour section meeting per week. Structure and dynamics of culture. Mr. Hammel (F); Vasbun (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

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 populational); theories of racial origins; selective bases of human variations. Mr. Sarich (Sp)

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.

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 (Sp)

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.

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.

with man's biology, his culture and his society.
Mr. Berlin (W); Mr. Kay (Sp)

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.
Mr. Washburn (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. Mrs. Dolhinow (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. Mrs. Dolhinow (Sp)

111. Problems in Primate Social Behavior. (5)
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)

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 (W)

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.

*124. Ancient Civilization of Mexico and Central America. (5)
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.
125. The World of the Ancient Maya. (5)
Three hours of lecture per week. Prerequisite: course 2 or consent of the instructor. A comprehensive study of the development and culture history of the longest sustained tradition of aboriginal New World civilization.

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.

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 (W)

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

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.

*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 Lowie Museum of Anthropology.

*131. Science in 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.

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.

Group III. Social and Cultural Anthropology: Theory and Method

140. The Nature of Culture: An Introduction to Cultural Anthropology. (5)
Not open for credit to students who have taken Course 3. Advanced level introduction to cultural anthropology for nonmajors. Mr. Dundes (W)

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.

*144. Social and Cultural Change. (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 (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.

*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.

Mr. Anderson (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)

*154. Marriage and the Family in Non-Western Societies. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Comparative analysis of types of conjugal unions and households in non-Western societies and how these change.

Mr. Anderson (Sp)

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.

Mr. Anderson (Sp)

156. Politics and Anthropology. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Anthropological concepts relevant to the comparative analysis of political ethnography.

Mr. Shack (W)

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.

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.

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 (F)

*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.

*162. Art and Culture. (5)

Three hours of lecture per week. Prerequisite: course 3 or the consent of instructor. Graph and plastic arts and their relations to culture in non-literate societies; illustrative material from the Lowie Museum of Anthropology.

*163. Education and Culture. (5)

Three hours of lecture and one hour of consultation per week. Prerequisite: course 3 or consent of instructor. Anthropological theory and method applied to the problems of education in traditional and modern cultures.

Mr. Ogbu (Sp)

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

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


Three hours of lecture per week. Prerequisite: course 3 or consent of instructor. An introduction to definition of research problems and design techniques for collection, analysis, and presentation of data.

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.

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, hypersemanticized language, relation of natural to formal languages.

Mr. Kay (F)

Group V. Area Courses

*170A–*170B. China. (5)

(Formerly numbered 190A–190B)

Chinese culture and society with emphasis on the village level.

170A: Pre-Communist China.

170B. Communist China.

*171. Japan. (5)

(Formerly numbered 191)

Ethnological treatment of historic and modern Japanese culture.

*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 (Sp)

*178. Native Peoples of South America. (5)

Archaeology, ethnohistory and ethnography.

179. Contemporary Latin America. (5)

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

Mrs. Díaz (F)
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.

Mr. Foster (Sp)

*181. Pacific Islands. (5)

(Formerly numbered 194)
The peopling of the Pacific, Oceanian races and cultures.

182. Circumpolar Regions. (5)

A survey of Arctic cultures.

Mr. Graburn (Sp)

*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.

Miss Nader (W)

186. Africa South of the Sahara. (5)

Traditional cultures and social institutions of Sub-Saharan Africa.

Mr. Ogbu (F)

188A–188B. South Asia. (5–5)

188A: Development of cultural traditions.

Mr. Mandelbaum (F)

188B: Social organization and social trends.

189. Southeast Asia. (5)

(Races, languages and cultures of Southeast Asian island and mainland.)

Mr. Phillips (W)

Group VI. General Courses

191. Experimental Courses.

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. Sarich (F); Mrs. Dolhinow, Mr. Ogbu (W); Mr. Howell (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. Senior Honors Seminar. (5)

Three hour lectures and one 1-hour consultation per week. Prerequisite: restricted to senior honor students. Systematic readings in the history of anthropology and in significant modern developments within the field.

H198B. Senior Honors Research. (5)

Prerequisite: restricted to senior honor students. Collection and analysis of research materials in close consultation with individual members of the staff. Individual conferences to be arranged. May be taken concurrently with H198C.

The Staff (F, W, Sp)

H198C. Senior Honors Thesis. (5)

Prerequisite: restricted to senior honor students. Preparation of senior thesis in close consultation with individual members of the staff. Individual conferences to be arranged. May be taken concurrently with, or following H198B.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (2–5)

Individual conferences to be arranged. Enrollment is restricted by regulations listed on page 79. 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; d. additional seminars on special topics to be announced.

Mrs. Dolhinow, Mr. Howell (F); Mr. Sarich (W); Mr. Washburn (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; h. additional seminars on special topics to be announced.

Mr. Heizer, Mr. Graham, Mr. Rowe, Mr. Isaac (W); Mr. Graham (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).

250. Seminars in Social and Cultural Anthropology. (4)

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; l. additional seminars on special topics to be announced.

Mr. Foster, Mr. Graburn, Miss Colson (F); Mr. Kay, Mr. Anderson, Mr. Hammel, Mr. Ogbu, Mr. Simmons (W); Mr. Phillips, Mr. Kay, Mr. Foster, Mr. Mandelbaum, Mr. Anderson (Sp)

251–252. Two-Quarter Seminars in Social and Cultural Anthropology. (4–4)
The following seminars extend over two consecutive quarters. Credit and grade will be assigned upon completion of the full sequence.

a. Kinship; b. social interaction; c. change; d. acculturation; e. peasant societies; f. urban cultures; g. culture structure; h. law; i. analysis of field data; j. additional seminars on special topics to be announced.

Sequence beginning (F): Mr. Berlin, Mr. Geoghegan, Mr. Shack
Sequence beginning (W): Miss Nader, Mr. Benedict, Mrs. Diaz

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.

Mr. Bascom (F)

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. Phillips (W); Mr. Mandelbaum (Sp)

290. Research Training. (6)

The Staff

295. History and Theory of Anthropology. (4)

Two hours of lecture per week. Prerequisite: consent of instructor.

ART

(Department Office, 238 Kroebler Hall)

Practice of Art

Professors:
Elmer N. Bischoff,† M.A.
Sidney Gordin
John C. Haley
Karl A. Kasten, M.A.
Erle Loran, M.F.A. (hon.)
James McCray, M.A.
Richard O’Hanlon
Felix Ruvolo
Peter H. Voulkos,† M.F.A.
Stephen C. Pepper, Ph.D., L.H.D., LL.D., (Mills Professor, Emeritus)
Jacques Schnier, M.A. (Emeritus)

Glenn A. Wessels, M.A. (Emeritus)

Associate Professors:
Boyd G. Allen,† M.A.
Robert Hartman, M.A.
George Miyasaka, M.F.A.
Harold Paris
David Simpson, M.A.
Chiura Obata (Emeritus)

Assistant Professors:
Jerrold Ballaine,† M.F.A.
Robert Hudson, M.F.A.
James Melchert, M.A., M.F.A.

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 1A, 1B, 1C, 1D.

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

NOTE: For key to footnote symbols, see page 78.
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 adviser at the beginning of the senior year to formulate a Senior Honors Project and to enroll in the honors course (H196Y).

The Honors Program will consist of a period of independent study under course H196Y 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: Art 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: Art 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: Art 2A-2B. An exploration of the techniques and methods of painting.

Mr. Allen, Mr. Ballaine, Mr. Kasten (F, W, Sp)

*10. An Introduction to Art. (4)
Three 1-hour lectures per week. Lectures illustrated with lantern slides. Open to nonmajors.

Mr. McCray (F)

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

The various courses in Art differ in content, use of materials, and type of subject matter, depending upon the individual aims of the artist in charge. All but Art 120 may be repeated for credit.

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

Students must have completed 20 units of lower division studio courses to enter upper division courses.

All studio courses are scheduled for three 3-hour periods per week.

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)
102A, Mr. Haley; 102B, Mr. Lorand; 102C, Mr. McCray; 102D, Mr. Ruvo; 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. Lorand, Mr. Ruvo

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. Haley (F, W, Sp)

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

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

114. Advanced Sculpture. (4)
(Formerly numbered 112, 113, 114)
114A, Mr. O’Hanlon; 114B, Mr. Gordin; 114C, Mr. Paris; 114D, Mr. Voulkos; 114E, Mr. Melcher; 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. Picture Analysis. (4)
Three 1-hour lectures per week. Prerequisite: course 2A-2B, and 10 units of Art History. Theory concerning values in painting and other visual arts, and its relation to creative expression. ——— (Sp)

Special Study Courses
H196Y. Special Study for Honors Candidates in the Practice of Art. (1–4)
Prerequisite: senior standing and qualifying scholarship record (minimum 3.0 overall GPA and 3.0 GPA in upper division courses in Practice of Art).
The Staff (Mr. Ballaine in charge) (F, W, Sp)

199Y. Supervised Independent Study and Research in Practice of Art. (1–5)
(Formerly numbered 198)
Enrollment is restricted by regulations listed on page 79. 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

History of Art
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 1A, 1B, 1C, 1D. Also Art 2A, and either Art 2B, 4 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 39 units, including six regular courses in the History of Art (other than H196 or 199). The remaining 9 units may be satisfied by other work in the History of Art, including appropriate related courses (as approved by the major adviser), or by courses in Art.
In planning his program, the student will develop two of the following fields of specialization: Ancient, Medieval, Renaissance, Baroque, Modern, Oriental. One of these is to be emphasized, and the student will take at least three courses, normally including the appropriate sequence course. For the second period or field, he will take at least two courses normally including the appropriate sequence course.
One, but not both, fields of specialization should lie in the Renaissance-Baroque area. This requirement will normally be met by one of the following pairs of courses: 160A–B; 170A–B; 160B–170A; 166–170B.

**Honors Program in the History of Art**  Qualified students (with a minimum grade-point average of 3.0, both overall and in upper division courses in the History of Art) who wish to enter the honors program in the History of Art should consult with their major adviser at the beginning of the senior year to formulate a Senior Honors Project, and to enroll in the honors course (H196Z). The project will culminate in the writing of an honors thesis.

**GRADUATE PROGRAMS**

The Department 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, 238 Kroebel Hall.

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

**Lower Division Courses**

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

130A. History of Ancient Mediterranean Art. (5)
From the Stone Age to the end of the Roman Empire.
Mr. Amyx (Sp)

130B. Introduction to the History of Art: Painting. (5)
Medieval, Renaissance, and Modern.
Mr. Chipp (F); Mrs. Williams (W); Mrs. Williams (Sp)

131A. History of Art of Black Africa. (5–5)
131B. Chinese art of the Ming and Ch'ing Dynasties.
Mr. Cahill (W)

134. The Art of Japan. (5)
Mr. Cahill (W)

136A–136B. The Art of the East. (5–5)
136A. 2500 B.C.–700 A.D. Indus valley through the Gupta period, primarily Buddhist sculpture.
Mrs. Williams (F)

136B. 700–1800 A.D. Development of the Hindu temple, and miniature painting under the Mughals and Rajputs.
Mrs. Williams (W)

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 Ceylon, Malaya-Java, Thailand, and Cambodia, from ca. 200 A.D. to 1350 A.D. Sculpture and architecture will be considered as a balance of Indian and indigenous elements.
Mrs. Williams (Sp)

140A–140B–140C. Greek Art. (5–5–5)
Prerequisite: History of Art 1A.
140A. Greek Art, Geometric and Archaic. 1100–480 B.C.
Mr. Amyx (F)

140B. Greek Art of the Classical Period. 480–323 B.C.
Mr. Amyx (W)

140C. Greek Art of the Hellenistic Period. 323–30 B.C.
Mr. Wright (Sp)

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

144. Roman Art. (5)
The art of Rome and of the Roman Empire, from its sources in the Republican era to the end of the Empire in the West.

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 750 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
154. Byzantine Art. (5) 
Three hours of lecture per week. Research papers will normally extend through two successive quarters.

155. Byzantine Art. (5) 
Prerequisite: reasonable background in Christian theology and in either medieval history or medieval civilization, and consent of instructor. The development of specifically Byzantine characteristics before iconoclasm, and their fruition in Middle Byzantine art; of specifically Byzantine characteristics before iconoclasm, and their fruition in Middle Byzantine art; and later phases of Byzantine art and its spread in Eastern Europe.

156. Byzantine Art. (5) 
Prerequisite: Byzantine Art 155 and consent of instructor. The influence of Byzantine art in Western Europe; later phases of Byzantine art and its spread in Eastern Europe.

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

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

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

163. Michelangelo and Raphael. (5) 
Prerequisite: History of Art 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. Mrs. Alpers (F)

170A–170B. Baroque Art. (5–5) 
170A. Southern Baroque Art. Mrs. Alpers (F) 170B. Northern Baroque Art. Mrs. Alpers (W)

177. Eighteenth-Century Art. (5–5) (Sp)

180A–180B. Modern Art. (5–5) 
180A. Art of the Nineteenth Century. Mr. de Caso (F) 180B. Art of the Twentieth Century. Mr. Chipp (W)

181. Painting in France, 1770–1810. (5) 
Three hours of lecture per week. Prerequisite: History of Art 180A and consent of instructor. A reading knowledge of French would be helpful. The emergence and development of French Romantic Classicism as seen through the works of David and of his immediate disciples and contemporaries. Problems in criticism and art theory will be evoked. Mr. de Caso (Sp)

182. Sculpture in Europe from Canova to Rodin. (5) 
Three hours of lecture per week. Prerequisite: History of Art 180A and consent of instructor. A reading knowledge of French would be helpful. Particular emphasis will be given to sculpture in France from Houdon to the emergence of Rodin. Mr. de Caso (Sp)

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

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

189B. The Twentieth Century.

I.D.S. 137. The Age of Charlemagne: Tradition and Innovation. (5) 
Open to all students in all disciplines. In focussing 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. Mr. Crocker (Music), Mr. Jones (English), Mr. Horn (Art), (W)

Special Study Courses

H196Z. 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 (Mrs. Alpers in charge) (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 79. 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. (F)
ART; ASTRONOMY

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

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

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

254A–254B. Seminar in Early Medieval Art. (6)
Mr. Wright (F through W)

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

260A–260B. Seminar in Renaissance Art. (3–3)
Mr. Ettlinger (F through W)

260C–260D. Seminars in Renaissance Art. (3–3)
260A–260B. Mr. Ettlinger (F through W)
260C–260D. ——— (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)

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 Kroeber 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.

ASTRONOMY

(Department Office, 601 Campbell Hall)

Professors:
George B. Field, Ph.D. (Chairman)
Ivan R. King, Ph.D.
John G. Phillips, Ph.D.
Hyron Spinrad,† Ph.D.
Harold F. Weaver, Ph.D.
Sturla Einarsson, Ph.D. (Emeritus)

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

Departmental Major Adviser: Mr. Phillips.
Graduate Adviser: Mr. Field.

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-

NOTE: For key to footnote symbols, see page 78.
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 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–B)
- Electromagnetism and Optics (Physics 110A–B–C)
- Modern Physics and Advanced Electrical Laboratory (Physics 111A–B–C)
- Introduction to Statistical and Thermal Physics (Physics 112)
- Introductory Nuclear Physics (Physics 124)
- Nuclear Physics (Physics 129A–B)
- Quantum Mechanics and Its Applications to Atomic Physics (Physics 137A–B–C)
- Introduction to Plasma Physics (Physics 142)
- Introduction to Linear Algebra (Math. 111)
- Advanced Calculus for the Applied Sciences (Math. 120A–B–C)
- Mathematical Tools for the Physical Sciences (Math. 121A–B)
- Numerical Analysis (Math. 128A–B)
- Introduction to Atmospheric and Space Sciences (Atmos. and Space Sci. 150)
- Physics of the Earth (Geology and Geophysics 122A–B)
- Introduction to the Theory of Probability and Statistics (Stat. 100A–B–C)

Students of marked ability may well take certain graduate courses in astronomy during the senior year.
Honors Program  A student wishing to take part in the honors program in the Department of Astronomy may do so by enrolling in Astronomy H195 during his senior year, and in this course he will prepare an acceptable paper on some subject which he will choose in consultation with a staff 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 Course

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. Bowyer, Mr. King (F); Mr. Phillips, Mr. Heiles (W); Mr. Heiles, Mr. King (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. Bowyer (Sp)

127A-127B-127C-127D. General Astronomy and Astrophysics. (3-3-5-5)

127A-127B. Three 1-hour lectures per week. Prerequisite: Physics 4A, 4B, 4C, 4D, 4E; Mathematics 2C or 12B. 127A: Spherical astronomy, instrumentation, celestial mechanics, solar system. 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. Phillips (F); Mr. Gaustad (W)

127C-127D. Three 1½-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. Kuhl, Mr. Silk

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 79. Prerequisite: Astronomy 127A–B. 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 nonstellar 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. Gaustad (F)

217A–217B–217C. Stellar Atmospheres. (4-4-4)

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.
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, 218A (F); Mr. King, 218B (W); 218C (Sp)

*219. Solar System Astrophysics. (5)
Three 1-hour lectures and two 1-hour discussion sections per week. Prerequisite: course 127A–127B–127C–127D. The physical foundations of solar system astronomy. The study of planetary atmospheres and surfaces. Meteors, comets and the interplanetary medium. Observational techniques and problems. (F)

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: Astronomy 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. Mr. Boyer (W)

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.) Sequence beginning (W)

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 (F)

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. Heiles (F)

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.
Mr. Gaustad (Sp)

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. Field (W)

266. High Energy Astrophysics. (4)
Four hours of lecture per week. Prerequisite: Astronomy 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. Silk (Sp)

(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. Phillips (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. Mr. Bowyer (F, W, Sp)

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)

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)
Students completing work in this program should submit study lists to Professor C. Stuart Bowyer, Department of Astronomy, 623 Campbell Hall.

BACTERIOLOGY AND IMMUNOLOGY

(De partment Office, 3573 Life Sciences Building)

Professors: Michael Doudoroff, Ph.D.
Marian E. Koshland, Ph.D.
Roger Y. Stanier, Ph.D.
Gunther S. Stent, Ph.D.
Leon Wofsy, Ph.D. (Chairman)

Assistant Professors: George D. Hegeman, Ph.D.
Robert I. Mishell, M.D.

Professor: H. Hugh Fudenberg, M.D.

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

Departmental Major Advisers: Mr. Hegeman, Mr. Nikaido
Graduate Advisers: Mr. Doudoroff, 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-12E; Mathematics 16A-16B; Physics 6A-6B; Biology 1A-1B-1C.

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 110; Zoology 104, 110A-110B, 155; Botany 100, 130.

PLAN II

Lower Division

Chemistry 1A-1B-1C, 5, 8A-8B; Mathematics 16B or Statistics 2; Physics 6A; Biology 1A-1B-1C. 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 110 or Zoology 150 or Genetics 100; Public Health 182, 182L; Zoology 104, 110A-110B, 156; Botany 130.

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 78.
of their last quarter. Graduation with honors may be recommended for those who maintain their standing as honor students throughout their last two years, who satisfactorily complete the honors courses, and who pass the comprehensive examination. The honors program adviser will help plan each honor student's honors program individually, and his approval of their programs will be required. The honors program adviser is authorized to exempt such students from requirements concerning specific courses or sequences of courses in the major program. Students interested in enrolling in the program should consult the honors program adviser, Mr. Hegeman.

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. 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, 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–B–C, Chemistry 5 and 8, or 12; Biochemistry 102, 100A is prerequisite to 100B.

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

100B. Bacterial physiology and metabolism.
Mr. Doudoroff, Mr. Hegeman (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. Hegeman, 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–B–C; Chemistry 1C and 8A–B. Not open to students who have credit in courses 100A–B.
Mr. Doudoroff (F)

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–1C; 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.
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 (Mr. Hegeman in charge) (F, W, Sp)

191A. Community Health Aspects of Bacteriology and Immunology. (5–10)

Three hours of lecture per week. Laboratory by arrangement. Prerequisites: Biology 1A–1B–1C and permission of the instructor. The field study approach combined with seminars and tutorial guidance is employed to define community health problems, to understand how the community relates to them, and to devise alternative methods of relating to them.
Mr. Mishell (W) (F & Sp for continuing students)

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 (Mr. Hegeman in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

(Formerly numbered 195)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed/not passed basis.
The Staff (Mr. Hegeman in charge) (F, W, Sp)

Graduate Courses

202A–202B. Immunology. (4–3)

202A. Three 1-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 theorems of antibody biosynthesis.

Mr. Wofsy, Mr. Mishell, Mrs. Koshland (F)

202B. Two 1½-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.

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. Wofsy, (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.

Mr. Hegeman (F)

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

Two 1-hour lectures and one lecture-demonstration period per week. Prerequisite: a course in biology; a course in genetics; and either a course in immunology or permission of the instructor. The homograft reaction; antigens of normal and neoplastic cells; immunogenetics of tissue transplantation.

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.

Mrs. Koshland, Mr. Mishell, Mr. Wofsy (F, W, 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.

Mr. Fudenberg (Sp)

207. Structure and Function of the Prokaryotic 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 prokaryotic cells.

Mr. Nikaido (F)

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 (Mr. Hegeman 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.

Mr. Hegeman (Sp)

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 and Mr. Doudoroff in charge) (F, W, Sp, Su)

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.

Mrs. Blair (F, W, Sp)

280. Research. (1-12)

The Staff (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)
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**

Plan I: Chemistry 4A–4B–4C (or 1A–1B–1C and 5); Chemistry 12A–12B; Mathematics 1A–1B–1C; Physics 6A–6B–6C (or 4A–4B–4C); Biology 1A–1B.

Plan II: Chemistry 4A–4B–4C (or 1A–1B–1C and 5); Chemistry 8A–8B; Mathematics 16A–16B; Physics 6A–6B–6C; Biology 1A–1B–1C.

**Recommended:** Plan I: An additional course in biological science, Physics 4D–4E, a course in statistics, a reading knowledge of German and of one other foreign language.

**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 his 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 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. 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. Dekker in charge) (W)
Upper Division Courses

100A–100B–100C. General Biochemistry. (3–3–3)

Three 1-hour lectures per week. Prerequisite: a course each in organic chemistry, 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 metabolism; and control of metabolic processes. Sequence, beginning in the fall.

Mr. Rabinowitz, Mr. Snell (F);
Mr. Barker, Mr. Ballou, (W);
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. Linn (F), Mr. Milman (W); 101B: Mr. Penhoet (W), Mr. Ballou, Mr. Wilson (Sp)

102. A Survey of the Principles of Biochemistry. (4)

Three 1½-hour lectures per week. Prerequisite: a course in organic chemistry. Recommended: courses in physical chemistry and biology. Designed for non-biochemistry majors. Not open for credit to students who have credit in courses 100A–100B–100C or equivalent.

Mr. Neilands (F);
Mr. Ames, Mr. Snell (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 (F); Mr. Dekker (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. Wilson 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. Ames (Sp)

199. Supervised Independent Study and Research. (2–4)

Enrollment is restricted by regulations listed on page 79. 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–201C. Advanced Biochemical Laboratory Methods. (4–4–4)

One 1-hour lecture and three 3-hour laboratories per week. Prerequisite: graduate standing in biochemistry, and consent of the instructor. (201A: Biochemical Genetics; 201B: Enzyme Chemistry; 201C: Advanced Methods.)

Sequence, beginning in the fall.

Mr. Ames, Mr. Ballou, Mr. Rabinowitz (F, W, 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 (W)

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. Dekker, 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)

*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 104. Modern concepts of protein synthesis at a molecular level; information transfer and gene expression; biological regulation, induction, repression, permeation and feedback systems.

Mr. Ames (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. Topics covered include model systems, consideration of various means of catalysis available under physiological conditions, and appropriate aspects of enzymatic kinetics and energetics.

(W)

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. Dekker 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. Dekker 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 1971-72 will include several sections each quarter, each emphasizing a different subject. The Staff (Mr. Dekker in charge) (F, W, Sp)

BIOLOGY

Professors:
Herbert G. Baker, Ph.D. (Botany)
Robert A. Cockrell, Ph.D. (Forestry)
Cadet 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)
Lester Packer, Ph.D. (Physiology)
Roderic B. Park, 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)
Paul Licht, Ph.D. (Zoology)

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

Lecturers:
James R. Griffin, Ph.D. (Botany)
Marvaley H. Wake, Ph.D.

Field Major in Biological Sciences

Major Advisers: Mr. A. D. McLaren, Head Adviser; Plan A, Mr. E. S. Evans, Mr. P. Satir, Mr. H. H. Srebnik, Miss M. A. Williams; Plan B, Mr. R. D. Caldwell, Mr. H. V. Daly, Mr. D. Price, Mr. R. Stebbins; Plan C, Mr. H. G. Baker, Mr. R. K. Colwell, Mr. D. R. Kaplan, Mr. P. Licht.

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

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-1C (15 units).

Upper Division Courses Required of all students in the major: Genetics 100 (5 units), or Molecular Biology 110, Molecular Basis of Heredity (5 units); a course in the history or philosophy of biological science (2-5 units).

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 1—Cellular emphasis: Mathematics 16B (4 units); Chemistry 109A-109B (6 units); Biochemistry 102 (4 units); Physiology 101 or Zoology 104 (4 units); Biochemistry 102L or Physiology 101L (5 units); Zoology 110A-110B (6 units), or Medi-
cal Physics 121 (5 units), or Botany 130 (5 units) or equivalent; additional upper division courses in biological science to complete a minimum of 36 units of upper division work in the major (a course at the organismal level is recommended).

Option II—Organismal emphasis: Biochemistry 102 (4 units); Botany 144 (4 units); Physiology 102–102L (9 units), or Zoology 108A–108B (8 units); Physiology 123 or Zoology 131 (4 units); Zoology 105 (6 units). As under Option I, 36 units of upper division work are required.

PLAN B (specialization in the area of systematic biology and morphology; study of the structure, classification, and evolution of living things): Botany 100 and 105 (8 units); Botany 110 or 120 (4 units); Botany 144 or Entomology 102A–102B or Physiology 123 or Zoology 104 (4 to 8 units); Zoology 107A–107B (8 units); Zoology 108A–108B, or Entomology 100 and one of the following: Entomology 101, 104, 105, or 110 (8 to 10 units); to complete a minimum of 36 units.

PLAN C (specialization in the area of ecology; study of the relations between living things and their environment): Mathematics 16B (4 units); Biology 150 (4 units); Botany 100 or 120 (4 units); Zoology 107A–107B or 108A–108B (8 units); Physiology 123 or Zoology 131 (4 units); Entomology 105 or Zoology 140 or Botany 154 (4 units); additional upper division courses in biological sciences to complete a minimum of 36 units of upper division work in the major; at least one course in statistics is recommended.

Honors Program The honors program consists of completion of Biology H198, Proseminar in Biology (1 unit), and Biology H195A–195B, Special Study for Honors Candidates (6 units total), followed by a comprehensive examination.

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

Lower Division Courses

1A–1B–1C. General Biology. (5–5–5)

Three hours of lecture and three hours of laboratory per week. Prerequisite: Chemistry 1A (semester system) or Chemistry 1A–1B (quarter system) and Chemistry 8A (may be taken concurrently) or Chemistry 1C. Intended for students majoring in biological sciences, but open to all qualified students. Sequence beginning in the fall.

Mr. Packer (in charge), Mr. Cockrell, Mr. Laetsch, Mr. Park, Mr. Smith, Mr. Simmons, Mrs. Wake

Natural Science 1A–1B–1C. Contemporary Natural Science. (5–5–5)

See Natural Science for the complete description of this course.

2. Topics in Biology. (2)

One hour of lecture per week. Prerequisite: preferentially open to freshman, consent of instructor required. Reading and discussion of works which provide the foundations for present day biological theory and practice. Mr. D. Branton in charge (F) Mr. Laetsch (W); Mrs. Wake (Sp)

10. Marine Resources. (4)

Three 1-hour lectures and one 1-hour demonstration per week. Prerequisite: open without prerequisite to all students and designed for those not specializing in the biological sciences. A consideration of the general role of marine organisms in man's activities. Emphasis is placed on the food chain and its relationship to the commercial fisheries.

Mr. West (Sp)
and illustrates the main facts and principles of organization, functions, heredity, and evolution of plants and animals, and introduces the student to the methods of the life sciences. Sequence, beginning in the fall. Both parts must be completed to receive credit toward natural science requirement of the College of Letters and Science.

Mr. Jones, Mr. Licht (in charge) (F); Mr. Jones, Mr. Bentley (in charge) (W)

Upper Division Courses

Interdepartmental Studies 100. Problems in Marine Biology. (15)

Full-time study at the Bodega Marine Laboratory. Prerequisite: Biology 1 or 11 and consent of instructor. Lectures, laboratory, field work and directed study on selected topics, stressing experience in original research. Mr. Hand, Mr. Ghiselin (Sp)

150. General Ecology. (4)

Two lectures, one 1-hour conference per week. Prerequisite: Biology 1A–1B–1C or 11A–11B; or Contemporary Natural Science 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. Griffin, Mr. Lidicker, Mr. Pitelka

Biology 150 is jointly administered by the departments of Botany and Zoology.

153. Developmental Biology. (3)

Three hours of lecture per week. Prerequisite: Biology 1A–1B–1C. 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 (F)

BIOSTATISTICS

(Administrated by an Interdepartmental Group)

Professors:
Chin Long Chiang, Ph.D.
Joseph L. Hodges, Jr., Ph.D.
Lucien LeCam, Ph.D.
Jerzy Neyman, Ph.D., D.Sc. (hon.), LL.D. (hon.), Ph.D. (hon.) (Emeritus)
Carroll E. Palmer, M.D., Ph.D.

Graduate Advisers: Mr. Chiang and Miss Scott.

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.

NOTE: For key to footnote symbols, see page 78.
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. Chiang and Miss Scott.

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. One foreign language under Option I is required of a Ph.D. candidate; French, Russian, and German are the acceptable languages. The dissertation is administered according to Plan B.

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 in cooperation with the Kaiser Foundation Hospitals. 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.

BOTANY

(Department Office, 2017 Life Sciences Building)

Professors:
Herbert G. Baker,† Ph.D.
Daniel Branton, Ph.D.
Lincoln Constance, Ph.D.
Ralph Emerson, Ph.D.
William A. Jensen, Ph.D. (Chairman)
Watson M. Laetsch, Ph.D.
Leonard Machlis, Ph.D.
Robert Ornduff, Ph.D.
Roderic B. Park, Ph.D.
Lee Bonar, Ph.D. (Emeritus)
Adriance S. Foster, Sc.D. (Emeritus)

Herbert L. Mason, Ph.D. (Emeritus)
George F. Papenfuss, Ph.D. (Emeritus)

Associate Professors:
O'Neil R. Collins, Ph.D.
Russell L. Jones, Ph.D.
Donald R. Kaplan,† Ph.D.

Assistant Professor:
John A. West, Ph.D.

Lecturer:
John L. Strother, Ph.D.

Departmental Major Adviser: Mr. Jones.

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

NOTE: For key to footnote symbols, see page 78.
studies in areas of special interest. Background courses in the physical sciences, particularly chemistry, are taken in the freshman year while the required, introductory, year-sequence in Biology (1A–1B–1C) 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–1C; Chemistry 1A–1B, 8A–8B; two additional quarters of chemistry (from 1C, 5, or 14) or calculus (Mathematics 1A–1B–1C or 16A–16B or 190A–190B) or Physics 6A–6B–6C.

Upper Division  Biochemistry 102; Botany 100, 105, 110, 120 or 124 or 125, 140A–B; Genetics 100 or Zoology 151A–151B. 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.

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

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 (F) Three 1-hour lectures and one 2-hour laboratory-discussion period per week. Mr. Collins (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. Machlis (F)

Upper Division Courses

Upper division courses in botany, with some exceptions, have Biology 1A–1B–1C as a prerequisite; however, students who have taken Biology 11A–11B with a grade of B or better may seek admission to upper division botany courses by consent of the instructor.

100. Comparative Morphology of Algae and Fungi. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B–1C. Mr. West (in charge). Mr. Collins (W)

101. Survey of Mycology. (4)
Two 1-hour lectures and two 3-hour laboratory or field periods per week. Prerequisite: Biology 1A–1B–1C 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)

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 11A–11B.1

Mr. West

105. Comparative Morphology of Archegoniates. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B–1C. Structure, reproduction, and relationships of bryophytes and lower vascular plants.

Mr. West

110. Comparative Morphology of Seed Plants. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 105. An analysis of the organographic diversity of gymnosperms and angiosperms with particular emphasis on the developmental mechanisms responsible for the variety of form and the significance of this diversity in relation to the environments in which the plants grow.

Mr. West

115. Plants and Man. (3)
Three 1-hour lectures 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. Ornduff (F)

115L. Plants and Man, Laboratory. (1)
One 3-hour laboratory per week. Prerequisite: the same as for course 115. Laboratory, demonstration, discussion sections and field trips. To accompany course 115. If taken must be concurrent with course 115.

Mr. Lloyd

120. Taxonomy of Seed Plants. (4)
Two 1-hour lectures and two 3-hour laboratories per week plus field work. Prerequisite: Biology 1A–1B–1C. Lectures on phylogeny and classification of spermatophytes; laboratory and field work illustrating taxonomic principles and methods.

Mr. Constance (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 Saugeen 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

Mr. Savage

125. The California Flora. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Open without prerequisite to all students. The course will emphasize the relation of California plants to soils, climate, and geological history. The use of keys and an examination of the native and introduced members of the state's flora will take place in the laboratory. Acceptable in place of course 120 for the major.

Mr. Constance (Sp)

130. Plant Cytology. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Biology 1A–1B–1C. A synthesis of morphological, biochemical and genetical information on cell function, reproduction and development.

Mr. Branton (F)
Botany 140A–140B. Form and Function in Vascular Plants. (4–4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Botany 110; Biochemistry 102 recommended. A two-quarter sequence combining the disciplines of plant anatomy and physiology in a unified approach to the study of plant structure and function.
104A deals with the basic functioning of the adult vegetative plant and the relation of anatomy to problems of maintenance physiology.
104B deals with the anatomy and physiology of reproduction and development.
Mr. Park (in charge), Mr. Branton (W)
Mr. Jones (Sp)

144. Plant Physiology. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B–1C. A study of the physiology of higher plants, with emphasis on mineral nutrition, transport phenomena, developmental aspects of growth and environmental physiology. Recommended for biology field majors and students working toward the general secondary teaching credential. Not open to students who have taken course 140A–140B.
Mr. Machlis (F)

*154. Plant Ecology. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Biology 1A–1B–1C and Botany 150. The structure, development, and history of the vegetation of selected regions of the world and the energetics and nutrient flow in ecosystems. Recommended to be taken in the senior year. Given in alternate years.
Mr. Baker (W)

H195. Special Study for Honors Candidates. (1–6)
Prerequisite: restricted to junior and senior botany majors. The Staff (Mr. Jones in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Additional limitation: Overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis.
(Mr. Jones 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. Phycosporicetes, Ascomycetes, and Deuteromycetes (in part). Given in alternate years.
Mr. Emerson (W)

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

*204. Algology. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 100. A survey of the golden-brown and green algae. Given in alternate years.
Mr. West (W)

205. Algology. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 100. A survey of the blue-green, brown and red algae. Given in alternate years.
Mr. West (Sp)

*206. Bryology. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 105. An advanced treatment of the biology of the mosses, liverworts, and hornworts. Given in alternate years. (F)

*220. Advanced Taxonomy. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Given in alternate years. Prerequisite: courses 120, 212. A survey of the morphological approaches, research tools, and literature basic to the 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. (4)
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. (4)
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. (W)

247. Plant Sex Hormones. (2)
Two 1-hour lectures per week. Prerequisite: Botany 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. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 140 and Physics 6A–6B–6C. The role of advanced research techniques in elucidating physiological processes. Mr. Park (Sp)

*249A–249B–249C. 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. Designed for candidates for the Ph.D. in the area of plant physiology. Given in alternate years.
(F, W, Sp)
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.

431. Techniques of Electron Microscopy for Biologists. (3)
One 1-hour lecture and two 3-hour laboratories

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**BUSINESS ADMINISTRATION**

(Department Office, 350 Barrows Hall)

Professors:
David A. Alhadeff, Ph.D.
Hector R. Anton, Ph.D.
K. Roland A. Artle, Econ. Dr.
Frederick E. Baldwin, Ph.D.
Wayne S. Boulton, Ph.D., C.P.A.
John P. Carter, Ph.D.
Earl F. Cheit, Ph.D., LL.B.
C. West Churchman, Ph.D.
Norman R. Collins, Ph.D.
Michael Conant, Ph.D., J.D.
Malcolm M. Davison, Ph.D., J.D.
Leonard A. Doyle,† Ph.D., C.P.A.
Joseph W. Garbarino, Ph.D.
John C. Harsanyi, Ph.D.
Austin C. Hoggatt, Ph.D.
Richard H. Holton, Ph.D. (Chairman)
Sidney S. Hoos, Ph.D.
Roy W. Jastram, Ph.D.
Van Dusen Kennedy, † Ph.D.
Clark Kerr, Ph.D., LL.D.
Choh-Ming Li, † Ph.D.
C. Bartlett McGuire, M.A.
Thomas A. Marschak, Ph.D.
Maurice Moonitz, Ph.D., C.P.A.
Frederic P. Morrissey, Ph.D.
Francesco M. Nicosia, † Ph.D., Dottore in Economia e Commercio

—

John T. Wheeler, † Ph.D.
Ira B. Cross, Ph.D., LL.D. (Flood Professor, Emeritus)
Delbert J. Duncan, Ph.D. (Emeritus)
Ewald T. Grether, † Ph.D., LL.D., ekon. dr. (hon. c.) (Flood Professor, Emeritus)
Charles C. Stacheling, M.S., C.P.A. (Emeritus)
Catherine DeMott Quire, Ph.D. (Emeritus)

Associate Professors:
Louis P. Bucklin, Ph.D.
James M. Carman, Ph.D.
Alan R. Cerf, C.P.A., Ph.D.
Edwin M. Epstein, † LL.B., M.A.
Robert C. Goshay, Ph.D.
Nils H. Hakansson, Ph.D., C.P.A.
F. Theodore Malm, Ph.D.
Raymond E. Miles, Ph.D.
John G. Myers, Ph.D.
Jack D. Rogers, Ph.D.
Milo W. Smith, J.D.
Wallace F. Smith, Ph.D.
Willard I. Zangwill, Ph.D.

Assistant Professors:
David A. Aaker, † Ph.D.
Fred D. Arditti, Ph.D.
Mark B. Garman, † Ph.D.
Richard C. Grinold, Ph.D.
Stephen P. Magee, † Ph.D.
Leonard Merewitz, † Ph.D.
Victor Niederhoffer, † Ph.D.
David H. Pyle, † Ph.D.
B. F. Roberts, † Ph.D.
Karlene A. Roberts, Ph.D.
Barr Rosenberg, Ph.D.
Romesh Saigal, Ph.D.
Richard L. Sandor, † Ph.D.
S. Prakash Sethi, Ph.D.

NOTE: For key to footnote symbols, see page 78.
Undergraduate Curriculum

Lower Division

Students may complete basic lower division courses in the College of Letters and Science or its equivalent at other institutions, or they may elect to complete lower division work in one of the colleges of applied sciences. Counselors in the School of Business Administration will assist lower division students in selecting courses prerequisite to upper division courses. Detailed information on lower division preparation is available in the ANNOUNCEMENT OF THE SCHOOL OF BUSINESS ADMINISTRATION.

Courses which are required in Business Administration are:

100—The Price System and Business Enterprise
101—Business Fluctuations and Forecasting

And, at least three of the following courses:

110—Legal Environment of Business
130—Financial Management
150—Organizational Behavior

111—Social and Political Environment of Business
120—Managerial Accounting

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
Administrative and Policy
Applied Economics
Finance
Organizational Behavior and Industrial Relations

Marketing
Operations Research
Production Management
Real Estate and Urban Land Economics
Risk and Insurance
Transportation

Preparation for Graduate Study  Admission 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, Real Estate and Urban Land Economics, and Transportation.

The Master of Science (MS) is offered for more specialized work. The core is composed of BA 101G, 102G, 120G, and 111G, and in addition the following are required for advanced standing: Mathematics 1A–1B–1C and 51A–51B–51C, Statistics 134A–134B, Statistics 135A–135B or equivalent. Equivalency may be granted on the basis of prior courses or courses plus examinations. At present the MS is offered only in Operations Research.

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)

2. Principles of Accounting II. (5)
Two 1½-hour lectures and 3 hours of laboratories per week. Prerequisite: course 1. Cost accounting and other managerial accounting methods, special statements, and special problems of various forms of business organizations. The computer application is continued in the laboratory.
The Staff (Mr. Vance in charge) (F)

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.
The Staff (Mr. Moonitz in charge) (W)

Upper Division Courses

Prerequisite: Economics 1A–1B, Statistics 2 or equivalent, Mathematics 16A–16B or equivalent and junior standing except where special provision has been made for students in certain curricula.

100. The Price System and Business Enterprise. (5)
Three 1½-hour lectures per week. Prerequisite: Economics 1A–1B, Mathematics 16A. 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. The Staff, Mr. Keisto, Mr. Merewitz, Mr. Sandor, Mr. B. Roberts (F, W, Sp)

101. Business Fluctuations and Forecasting. (5)
Three 1½-hour lectures per week. Prerequisite: course 100 and Statistics 2 or 20. 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. The Staff, Mr. Sandor, Mr. Rosenberg, Mr. Keisto, 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. The Staff, Mr. Merewitz (Sp)

103. Theory of 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 business activity for the economy.

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. The Staff, Mr. Katz, Mr. Conant, Mr. M. Smith, Mr. Cheit (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. The Staff, Mr. Sethi, Mr. Katz, Mr. Votaw (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.

120. Managerial Accounting. (5)
Two 1½-hour lectures and one two-hour laboratory per week. Prerequisite: course 1 or the equivalent. 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. Boutell, Mr. Buckman (W, Sp)

121. Financial Accounting I. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: course 1 and 2 or the equivalent. Required for those specializing in accounting. An intermediate level course in the theory and practice of financial accounting. The measurement and reporting of the economic effects of events involving working capital and long-term plant assets.
Mr. Vance, Mr. Cerf (F, W, Sp)

122. Financial Accounting II. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: course 121 with a grade not lower than C. 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 indexes; accounting for the financial effects of pension plans, other advanced accounting problems.
Mr. Moonitz (Sp)

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

125. Administrative Accounting. (4)
(Formerly 120)
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, 2, 10, or 120. Accounting and its uses in analyzing, planning, and controlling the operations of organizations of all types.

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.

127. Accounting Systems for Management Information and Control. (5)
Two 1½-hour lectures and one 2-hour laboratory per week. Prerequisite: courses 122 and 124. The study of accounting systems, including computer-oriented systems, with an emphasis on the information and control functions of the management decision-making process.
Mr. Boutell, Mr. Kettler (W)

128. Federal Income Taxation. (5)
Three 1½-hour lectures per week. Prerequisite: courses 1 and 2 or the equivalent or consent of the instructor. 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 (Mr. Vance in charge) (W)

130. Financial Management. (5)
Three 1½-hour lectures per week. Prerequisite: course 2 and 100. 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. Morrissey, Mr. Goshay (F, 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. Carter, Mr. Niederhofer (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 (W)
154. 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 1-hour laboratory per week. Management problems related to the specification and control of standards with respect to productivity, equipment, and jobs; elementary models for scheduling, maintenance, and inventory control procedures; relation of these problems to motivation, incentives, and cost control.

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, scheduling operations, production layouts, line-balancing and waiting line analysis, systems for maintenance and reliability, and applications of linear programming to production planning, materials-handling and other ancillary systems.

Mr. Davisson (F, 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.

150. Organizational Behavior. (5)
Four 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.

Mr. Malm, Rogers, Revzan (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)

152. Collective Bargaining Systems. (5)
Four class hours per week. Prerequisite: course 154 or Economics 150. The nature, institutions and processes of collective bargaining. Analyses of labor-management issues and their economic and political significance. Comparative analyses of industrial relations systems in major industries and in other countries.

Mr. Garbarino (Sp)

153. Labor Law. (5)
Four class hours per week. Prerequisite: course 154 or Economics 150. Economic analysis of the problems and issues arising out of legislative and judicial efforts to define the rights, duties, and responsibilities of labor organizations and management in the field of labor relations.

Mr. Davison (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. Malm, Strauss (W, Sp)

160. Marketing. (5)
Three 1½-hour lectures per week. Prerequisite: course 100 or one college level course in statistics and micro-economics. 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. Balderston, Aaker, Revzan (F, W, Sp)

161. Industrial Procurement. (5)
Three 1½-hour lectures per week. Prerequisite: course 160 or 160G. 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. Revzan (Sp)

162. Retailing. (5)
Three 1½-hour lectures 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)
Three 1½-hour lectures 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. Myers, Nicosia (W, Sp)

165. Marketing Management. (5)
Three 1½-hour lectures 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.

(— (W)

166. Wholesaling. (5)
Three 1½-hour lectures 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)
Three 1½-hour lectures per week. Prerequisite: senior standing with Marketing as a field of emphasis. Analysis of special topics in marketing including geographic market structures, price policy, agricultural marketing and other topics. Course may be repeated for credit.

Mr. Aaker, Buckley (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.

174. Contemporary Problems in Transportation. (5)
Three 1½-hour lectures per week. Selected topics of current interest in transportation: new developments in transportation legislation and policy; the shifting demand for transportation; innovation in analysis and technology; urban transport problems.

175A-175B. Survey of Operations Research. (5-5)
Four hours per week. Prerequisite: Mathematics 16A-16B, Statistics 16 or equivalent; courses 107G and 108G or equivalent for graduate students. 175A prerequisite to 175B. Topics as in 176A-176B treated at a somewhat lower mathematical level. Credit will not be given for both 175A-175B and 176A-176B.

Mr. Koenigsberg, Mr. Garman (F, Sp)

176A-176B. Introduction to Operations Research. (5-5)
176A. Prerequisite: Mathematics 51A-51B-51C or equivalent; or consent of instructor. Introduction to the analytic techniques and models of operations research and management science with applications to business problems. Linear programming: computational aspects and economic interpretation of solutions. Deterministic dynamic programming. Credit will not be given for both 176A and 175A.

176B. Prerequisite: course 176A, Statistics 134A-134B or equivalent, or consent of instructor. Continuation of 176A. Nonlinear programming; development of Kuhn-Tucker conditions; algorithms. Introduction to inventory theory. Markov decision models; queueing theory. Credit will not be given for both 176B and 175B.

Mr. Grinold, Mr. Saigaal (F)

Two 2-hour meetings per week. Prerequisite: a course in programming or familiarity with one 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)

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. Schaaf (F, W, Sp)

181. Valuation of Real Property. (5)
Three 1½-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)

183. The Management of Real Estate Resources. (5)
Three 1½-hour lectures per week. Prerequisite: course 180. Real estate debts and equity financing; mortgage market structure; effects of credit on demand; equity investment criteria; locational decisions; public policies in real estate finance and urban development.

Mr. Schaf (W)

185. Introduction to International Business. (5)
Four and one-half hours per week. Prerequisite: Economics 190A or equivalent and 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)
Two 1½-hour lectures and one 1½-hour laboratory 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. Marschak, Mr. Harstany (W, Sp)

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

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis.

The Staff (Mr. Goshay 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 class meeting per week. Economic analysis applicable to the problems of business and operation of our enterprise system; the determination of prices, input and outputs; effects of the state of the competitive environment on business policies.

Mr. Alhadelf, Mr. Artle, --- (F, W, Sp)

102G. Economic Analysis for Business Decisions II. (4)
Three hours of class meeting per week. Prerequisite: course 101G. Factors responsible for economic instability; analysis of public and business policies resulting from business fluctuations.

Mr. Doyle, Mr. Kelso, Mr. Alhadelf, Mr. Rosenberg (F, W, Sp)

107G. Quantitative Analysis For Business Decisions I. (4)
Three 1½-hour lectures per week. Uses of formal models, models of the decision problem, rational choice under uncertainty, linear and nonlinear programming, multistage problems.

Mr. Garman, Mr. Hoggatt (F, W, Sp)
108G. Quantitative Analysis For Business Decisions II. (4)
Three 1 ½-hour lectures per week. Prerequisite: course 107G. Continuation of course 107G. The application of statistical methods in managerial and business problems. ———, Mr. Aaker (F, W, Sp)

111G. Political, Social and Legal Environment of Business. (4)
Three hours of lecture 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. Chett, Mr. Conant, Mr. Epstein, Mr. Votaw (F, W, Sp)

112G. Political, Social and Legal Environment of Business. (4)
Three 1 ½-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. Bouteil, Mr. Kettler, Mr. Vatter (F, W, Sp)

121G. Accounting II—Managerial Accounting. (4)
Three 1 ½-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 budgets and standards. Mr. Anton, Mr. Staubus, Mr. Kettler, Mr. Vatter (F, W, Sp)

130G. Financial Policies of Business. (4)
Three hours of lecture per week. Prerequisite: course 121G 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. Morrissey, Mr. Goshay, Mr. Pyle (F, W, Sp)

140G. Production Organization and Management. (4)
Three hours of lecture and one 1 ½-hour laboratory per week. Prerequisite: course 108G (may be taken concurrently). 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. Grinold (F, W, Sp)

150G. Organizational Behavior. (4)
Three hours of lecture 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 (F, W, Sp)

160G. Marketing Organization and Policies. (4)
Four hours of lecture 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. 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 Economic analysis of the problems of business. (4-4)
(Formerly 101G—102G, Ph.D. sections) 200A: 4 ½ hours of class meetings per week. Prerequisite: limited to Ph.D. students.

200A Economic Analysis to the problems of business and operation of our enterprise system; the determination of prices, input and outputs; effects of the state of the competitive environment on business policies. (F)
200B. Prerequisite: course 200A. Factors responsible for economic instability; analysis of public and business policies resulting from business fluctuations. Mr. Artle (W)

202A—202B—202C—202D. Seminars in the Application of Economic Analysis to Resource Allocation Problems of Private and Public Enterprise. (4-4-4-4)
(202B formerly numbered 202; 202C formerly numbered 205)
Four hours of meetings per week. Prerequisites: courses 101G—102G or equivalent. No seminar in the series is prerequisite to any other.

202A. Market failures and market substitutes; environmental problems. Efficiency in resource allocation: the competitive utopia; limitations and failures of markets; decision-making in the public sector; bounds of the business firm. Mr. Artle (F)
202B. Benefit-Cost analysis. Management in the Public Sector. Planning-programming—budgeting systems and benefit-cost analysis for resource allocation and planning in the public sector. Use of pricing in public enterprise. Efficiency when profit criteria are absent. Applications in natural resources, medical services, transportation, education. Mr. Merewitz (W)
202C. Planning and evaluating research and development programs. Nature of technological change and its role in managerial economics. Topics include technological change in forecasting and planning models, management and planning of R & D in the firm and technological forecasting. Mr. Sandor (Sp)
202D. Economics of discrimination and poverty. Analysis of the economic issues in discrimination and poverty with special emphasis on employment, income distribution, wealth accumulation, human capital and consumption. The relationships between discrimination and poverty and measures to deal with both are also covered.

203A—203B—203C—203D. Seminars in Economic Forecasting and Private and Public Planning and Policy. (4-4-4)
(203A formerly numbered 203; 203B formerly numbered 204; 203D formerly numbered 207)
Four hours of meetings per week. Prerequisite:
101G–102G or equivalent. No seminar in the series is prerequisite to any other.

203A. Business forecasting: techniques and applications. Consideration of the techniques of long-run and short-run forecasts of business activity. Examination of typical models, data problems, and other projection requirements. Problems and examples in particular forecasts. Mr. Kelso (F)

203B. Regional and Industrial Analysis and Forecasting. Examination of models and techniques for analyzing and forecasting regional and industrial activity. Consideration of data problems and some specific operational models. Mr. B. Roberts (W)

203C. Enterprise forecasting and planning. Forecasting as the description of an uncertain environment. Non-theoretical treatment of forecasting principles and statistical decision theory, with emphasis on applications to planning. Forecasting from a cost-benefit standpoint. Case studies of the use of forecasting in operations control and long-term planning.

203D. Econometric Forecasting Methods. Prerequisite: recommend Economics 240 or Economics 241A–241B. Methods to be covered include naive forecasting procedures, time series analysis, regression and vector auto-regression, simultaneous equation estimation. Statistical foundations will be summarized, with major emphasis placed on the relevance of alternative forecasting strategies in planning and control.

Mr. Rosenberg (Sp)

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)


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. Cheit (Sp)

220. Advanced Financial Accounting. (4) Three 1½-hours of lecture 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. Hakansson, Mr. Vatter (F, Sp)

221. Accounting Theory I. (4) Two 1½-hours of lecture 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. Moonitz, Mr. Staubus (F, W)

222. Accounting Theory II. (4) Two 1½-hours of lecture 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. Moonitz, Mr. Anton (W, Sp)

224. Advanced Managerial Accounting. (4) Two 1½-hours of lecture per week. Prerequisite: course 121G or equivalent. The theory and practice of cost determination and cost analysis in relation to the management control function.

Mr. Anton, Mr. Staubus (F, Sp)

225. Seminar in Managerial Accounting. (4) Two 1½-hours of lecture per week. Prerequisite: course 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. Doyle (Sp)

226. Auditing Practice and Problems I. (4) Two 1½-hour sessions 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. Boutell (Sp)

227. Auditing Practices and Problems II. (4) Two 1½-hour sessions per week. Prerequisite: course 226. Seminar in current professional problems in auditing; student research.

Mr. Kettler (W)

228. Advanced Topics in Income Taxation. (4) Two 1½-hours of lecture 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)

230. Theory of Financial Management. (4) Three hours of meetings per week. Prerequisite: course 150G or equivalent. 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. Pye, Mr. Hakansson (F, W, Sp)


Mr. Alladef, Mr. Einzig, Mr. Pyle (F, W, Sp)


Mr. Niederhoffer, 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. Pye, Mr. Hakansson (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. Pye (W, Sp)

236. Seminar in Investments. (4)  
Three hours of meetings per week. Prerequisite: course 233.  
Mr. Niederhoffer (W)

*237. Risk and Insurance. (4)  
Three hours of meetings per week. Prerequisite: course 137 or equivalent; permission of instructor.  
This course provides an overview of the historical, economic, mathematical-actuarial, social, and managerial foundations of the risk insurance field.

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

241. Facilities Planning and Production Control. (4)  
Two 1½-hour meetings and one 1-hour laboratory 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 sessions 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, problemsolving approaches for less restricted cases are also considered.  
Mr. Rogers (W)

243. Analysis for Production Management. (4)  
Two 2-hour sessions 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.  
Mr. Saigal (Sp)

*248. Seminar in Production Management. (4)  
Two 2-hour sessions 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.

253. Labor-Management Relations in the Public Sector. (4)  
(Formerly numbered 291A)  
Three hours of lecture 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 (W)

255. Seminar in Manpower Economics and Labor Markets. (4)  
Three hours of class 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 hours of lecture per week. The study of the management and development of human resources. Study and discussion of research findings relating the effective utilization of individuals 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)

259A—259B. Seminar in Labor-Management Problems and Policies. (1-1)  
One hour per week. Labor-management relations in modern industrial society. Goals and objectives of enterprises and unions. Contemporary issues in collective bargaining and governmental regulation. Relations between labor, industry and government in Western Europe, Asia and developing countries. To be given in conjunction with Interdepartmental Studies 260. Credit and grade awarded upon completion of full sequence.  
(W, Sp)

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 processes of household and industrial consumer; promotion management, including advertising and personal selling.  
Mr. Myers, Mr. Nicosia (F, W)

261. Marketing Analysis and Management II. (4)  
Three hours of meetings per week. Prerequisite: course 260 or equivalent. Product and price policies; management of the marketing organization; sales management, control and analysis; integration of the marketing program.  
Mr. Bucklin (W, Sp)
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. Revzan (Sp)

263. Communication Processes in Marketing. (4)
(Formerly numbered 264)
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)
(Formerly numbered 291C)
Three hours of meetings per week. **Prerequisite:** consent of the instructor. 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)

265. Marketing Organization. (4)
Three hours of meetings per week. **Prerequisite:** three quarter courses in marketing 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 "orderly" marketing.
Mr. Revzan (F)

266. 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 (F, W)

269. Seminar in Marketing. (4)
Three hours of meetings per week. **Prerequisite:** open to M.B.A. candidates with a minimum of three 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. Carman, Mr. Grether, Mr. Bucklin (F, W, Sp)

270. Transportation Management. (4)
Three hours of class 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 lecture per week. Public spending on urban transportation, civilian air transport, highways, ports. Cost analysis, pricing. Demand analysis.
Mr. Merewitz (W)

274. Seminar in Transportation. (4)
Three hours of class per week. A topic of interest will be selected each quarter. Course may be repeated for credit.
Mr. Carter (Sp)

275. Seminar in Operations Research. (4)
Two 2-hour meetings per week. **Prerequisite:** courses 277A-277B-277C. May be taken concurrently with course 277C in some cases. Applications and more detailed treatment of topics covered in 277A-277B-277C. Instructor and student interest will determine topics and applications treated. Each student will prepare a research paper dealing with an application of the techniques to a concrete problem.
Mr. Churchman (Sp)

276. Philosophy of Management Science. (4)
Two 2-hour meetings per week. This seminar is essentially a study of models for measuring the values on 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)

277A-277B-277C. Topics in Operations Research. (4-4-4)
277A. Three hours per week. **Prerequisite:** course 176A-176B or equivalent. Inventory theory, including optimality of (S, s) policies; Stochastic dynamic programming; general results and applications.
Mr. Grinold (F)

277B. Three hours per week. **Prerequisite:** course 277A. Continuation of course 277A. Topics in queuing theory, renewal theory, and Markov processes: general results and applications to decision problems.
Mr. Grinold (W)

277C. Three hours per week. **Prerequisite:** course 277B or consent of instructor. Continuation of course 277B. Advanced topics in programming, including decomposition algorithms, generalized linear programming, stochastic programming, Branch and bound techniques. Topics in graph theory. Applications.
Mr. Saigal (Sp)

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. Schauf, Mr. W. Smith (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; economic aspects of property rights; unmet housing needs.
Mr. W. Smith (W)

284. Seminar in Real Estate and Urban Land Economics. (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. Carman (Sp)

Two 2-hour 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)

286. International Operations Management. (4)

Two 2-hour meetings per week. Prerequisite: course 185 and Economics 190A or equivalent; or 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. Holton, Mr. Sethi (W, Sp)

287. International Financial Management. (4)

Two 2-hour 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.

Mr. Einzig (W, Sp)

289. Seminar in International Business. (4)

Two 1½-hour 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, Mr. Burns (W, Sp)

290. Organization and Decision. (4)

Three hours of lecture and 1½-hour laboratory 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. Marschak (F, 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)

291B. Marketing Models. (4)

Prerequisite: consent of instructor. Examination of models currently being used in several aspects of marketing including Bayesian, stochastic, and those underlying multivariate analysis. Attention will be given to both model building and model testing using from the perspectives of the marketing researcher and marketing manager.

Mr. Aaker, Mr. Myers, Mr. Nicosia (W, Sp)

291E. Organization Development. (4)

Three hours of lecture per week. Field work also required. Prerequisite: course 257 or related graduate course in organizational behavior from Departments of Psychology, Sociology, or Political Science. Course analysis of current theories, practices, and problems in organization development. Techniques examined include sensitivity training, team building, management grid, and data feedback. Problems of entry, change, and development of sustaining mechanisms are examined. Students observe OD activities in local organizations.

Mr. Miles (Sp)


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. Wheeler (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 (W)

292C. Prerequisite: course 292C 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. Anton 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. Balderston, Mr. Jastram (F, 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. Jastram (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. Anton, Mr. Rogers 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. Anton 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.)
(See Interdepartmental Studies for the complete description of this course.)
IDS 260. Patterns in Collective Bargaining. (3)
(See Interdepartmental Studies for the complete description of this course.)

CELL PHYSIOLOGY

(Department Office, 251 Hilgard Hall)

Professor:
Daniel I. Arnon, Ph.D. (Chairman)

Lecturers:
Bob B. Buchanan, Ph.D.
David B. Knaff, Ph.D.
Berah D. McSwain, Ph.D.
Richard Malkin, Ph.D.

Graduate Adviser: Mr. Arnon.

The Department of Cell Physiology, in the College of Agricultural Sciences, offers a program of graduate instruction and research concerned with mechanisms of cellular processes, with special emphasis on bioenergetics.

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–1C) 15 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. 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.

NOTE: For key to footnote symbols, see page 78.
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 (F)

299. Research. (1-12)
Prerequisite: consent of the instructor.
The Staff (Mr. Arnon in charge) (F, W, Sp)

CHEMICAL ENGINEERING

(Department Office, 201 Gilman Hall)

Professors:
LeRoy A. Bromley,† Ph.D.
Donald N. Hanson, Ph.D.
C. Judson King, Sc.D. (Vice-Chairman)
Scott Lynn, Ph.D.
David N. Lyon, Ph.D.
John S. Newman, Ph.D.
Eugene E. Petersen, Ph.D.
Robert L. Pigford, Ph.D.
John M. Prausnitz, Ph.D.
Charles W. Tobias, Ph.D. (Chairman)
Theodore Vermeulen, Ph.D.
Charles R. Wilke,† Ph.D.

Associate Professors:
Alan S. Foss, Ph.D.
Simon L. Goren, D.Eng.
Edward A. Grens, Ph.D.
Robert P. Merrill, Sc.D.

Mitchel Shen, Ph.D.
Michael C. Williams,‡ Ph.D.

Assistant Professors:
Alexis T. Bell, Sc.D.
Lee F. Donaghey, Ph.D.

Professors:
Douglas W. Fuerstenau, Sc.D.
Thomas K. Sherwood, Sc.D. (Visiting)

Lecturers:
E. Morse Blue, M.S.
Gerhard Klein, M.S.
Arthur I. Morgan, Jr., Ph.D.
Rolf H. Muller, Ph.D.
Charles F. Oldershaw, M.S.
Otto Redlich, Ph.D.

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, 12E, 14, 110A, 110B, 111A, 111B, 112E. 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 22); 27 units in the humanities and social sciences, chosen from a list provided by the College of Chemistry.

Interdisciplinary Options. The technical electives listed above (including those specifically prescribed in chemical engineering and in the College of Engineering) may

NOTE: For key to footnote symbols, see page 78.
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 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.

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.

140. Introduction to Chemical Engineering. (3)

Two 1-hour lectures and one 1-hour discussion 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. Pigford (F); Mr. Hansen (W); Mr. Sherwood (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. Newman (F) Mr. Petersen (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. Sherwood (W); Mr. Prausnitz (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. Petersen (F); Mr. Bell (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, Sp)

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. Bell (W); Mr. Petersen (Sp)

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

Three 1-hour lectures and one 1-hour discussion 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. Greens (F); Mr. Hansen (Sp)

151A–151B. Unit Operations Laboratory. (4-4)

Four 3-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, and heat transfer. Emphasis on investigation of basic relationships important in engineering. Experimental design, analysis of results, and preparation of engineering reports are stressed.

Mr. Lynn (F); Mr. Vermeulen (W); Mr. Bromley (Sp)

151B. Prerequisite: course 150B. Experiments in mass transfer, simultaneous heat and mass transfer, vaporization and condensation, and separation techniques.

Mr. Lynn (F); Mr. Vermeulen (W); Mr. Bromley (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 (F)
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. Williams (W)

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 (Sp)

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. Blue (W); Mr. Oldershaw (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. King, Mr. Lynn (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 culture.
Mr. Wilke (Sp)

191S. Solid-State Engineering. (3)
Three lecture hours per week. Prerequisite: Materials Science and Engineering 130 or graduate standing. Preparation of solid-state materials—principles of crystal growth and purification; thin film preparation; control of growth defects and morphology. Influence of defects on electrical, optical, and magnetic properties. Development of materials processing techniques to control physical properties.
Mr. Donaghey (W)

192. Individual Study for Advanced Undergraduates. (2–5)
Prerequisite: consent of instructor. Independent study on theoretical or computational problems. The Staff (Mr. Tobias in charge) (F, W, Sp)

H194. Research for Advanced Undergraduates. (3–5)
Prerequisite: consent of instructor. Students with honors standing may prosecute 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. Tobias in charge) (F, W, Sp)

196. Special Laboratory Study. (2–5)
Prerequisite: consent of instructor. Special laboratory work for advanced students.
The Staff (Mr. Tobias in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulation listed on page 79. Additional limitation: nolaboratory study only. Must be taken on a passed or not passed basis.
The Staff (Mr. Tobias 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. Bell (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. Greens (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. ——— (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 (W)

244. Applied Chemical Kinetics. (3)
Three 1-hour lectures per week. Prerequisite: course 142 or equivalent, or consent of instructor. Collision theory and transition state calculations, chain reactions and free radical mechanisms, adsorption phenomena, Langmuir-Hinshelwood kinetics, description of selected systems of industrial importance. Mr. Merrill (W)

245. Catalysis. (2)
Two 1-hour lectures per week. Prerequisite: course 244 or Chemistry 219A, or consent of instructor. Fundamentals of catalytic systems with emphasis on current theoretical progress. Catalysis by metals, semiconductors, and oxides emphasizing the correlations between solid state properties and catalytic activity. Mr. Merrill (W)

246. Principles of Electrochemical Engineering. (3)
Three 1-hour lectures per week. Prerequisite: graduate standing, or 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 (Sp)

247. Chemical Reaction Analysis. (3)
Three 1-hour lectures per week. Prerequisite: courses 250 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 (Sp)

249. Biochemical Engineering. (3)
Three 1-hour lectures per week. Prerequisite: Bacteriology 102; Chemistry 110B, 112E; course 150B; or consent of instructor. Application of biochemical 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 (Sp)

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. Simultaneous 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)

256. Advanced Transport Phenomena. (3)
Three 1-hour lectures per week. Prerequisite: course 230. 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 flow. Mr. Newman (Sp)

258. Chemical Technology of Polymers. (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. 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 (Sp)

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. King (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. *295A. Kinetics in Combustion. (2)
Mr. Petersen (W)

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295C. Advanced Topics in Transport Phenomena. (2) Mr. Newman (F, W, Sp)
295D. Electrochemical Energy Conversion. (2) Mr. Tobias (W)
295E. Mass and Heat Transfer. (2) Mr. King
295F. Topics in the Control of Chemical Processes. (2) Mr. Foss (F)
295G. Particulate Systems. (2) Mr. Goren (Sp)
295H. Estimation of Physical Properties for Chemical Process Design. (2) Mr. Prausnitz (W)
295J. Electrical Separation Techniques. (2) Mr. Hanscom
295K. Chemical Process Synthesis. (2) Mr. King (W)
295L. Molecular and Continuum Rheology. (3) Mr. Williams (F)
295M. Optical Methods in Chemical Engineering Research. (2) Mr. Muller (F)
295N. Polymer Science and Technology. (3) Mr. Shen (Sp)
295P. Mass Transfer and Chemical Kinetics. (3) Mr. Pigford (W)
295R. Society and the Chemical Engineer. (1) Mr. Petersen
295S. Applications of Electric Discharges to Chemical Reaction. (2) Mr. Bell (W)
295T. Chemical Reactor Engineering. (2) Mr. Vermeulen
295U. Innovations in Food Production and Processing. (2) Mr. Morgan (Sp)
295W. Engineering Analysis of Microbial Processes. (2) Mr. Wilke (F)
295Y. Control of Air Pollution for Stationary Sources. (2) Mr. Sherwood (F)

296. Special Study for Graduate Students in Chemical Engineering. (1-6)

Prerequisite: consent of instructor. Special laboratory and theoretical studies. To be graded on a passed/not passed basis.

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

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. Tobias in charge) (F, W, Sp)

299. Research in Chemical Engineering. (1-12)

To be graded on a passed/not passed basis.

The Staff (Mr. Tobias 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. Tobias 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. Tobias 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.

Chemistry

(Chemistry Department Office, 419 Latimer Hall)

Professors:
Neil Bartlett, Ph.D., D.Sc.
Leo Brewer, Ph.D.
Melvin Calvin, Ph.D., Sc.D., LL.D.
James Cason, Jr., Ph.D.
Robert E. Connick, Ph.D.
William G. Dauben, Ph.D.
William D. Gwinn, Ph.D.
Frederick R. Jensen, Ph.D.
Harold S. Johnston, Ph.D., Sc.D.
William L. Jolly, Ph.D.
George Jura, Ph.D.
Bruce H. Mahan, Ph.D.
Rollie J. Myers, Ph.D.
Donald S. Noyce, Ph.D.
Chester T. O'Konski, Ph.D.
Edwin F. Orlemann, Ph.D.
Isadore Perlman, Ph.D.
Norman E. Phillips, Ph.D.
George C. Pimentel, Ph.D.
Kenneth S. Pitzer, Ph.D., D.Sc., LL.D.
Richard E. Powell, Ph.D.
Henry Rapoport, Ph.D.
Glenn T. Seaborg, Ph.D., Sc.D., LL.D.
David A. Shirley, Ph.D. (Chairman)
Kenneth Street, Jr., Ph.D.
Andrew Streitwieser, Jr., Ph.D.
David H. Templeton, Ph.D.
Ignacio Tinoco, Ph.D.
William F. Giaquie, Ph.D., Sc.D., LL.D. (Emeritus)
Joel H. Hildebrand, Ph.D., Sc.D., LL.D. (Emeritus)
Charles W. Porter, Ph.D. (Emeritus)

Associate Professors:
Joseph Cerny, Ph.D.
Robert A. Harris, Ph.D.
John E. Hearst, Ph.D.
Clayton H. Heathcock, Ph.D.

NOTE: For key to footnote symbols, see page 78.
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 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–1C and Zoology 105, for example). With 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 science and society, in chemistry and the environment, or in other interdisciplinary areas.

Satisfaction of the American History and Institutions requirement (see page 22). 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 one 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 requirement in American History and 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, including two courses in reading and composition, and eight courses, each with a value of at least 3 units, in a field or fields outside that of the major. 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.

Letters and Science Major Advisers: Mr. Kenyon, Mr. Sauer.
Honors Program: See major adviser.

Field Major in Physical Sciences
Students interested in this major please see Natural Science page 347 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), thermochemy, 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, Sp).

The Staff (Mr. Markowitz in charge)

Contemporary Natural Science (Natural Science)

1A-1B-1C. (4-4-4) Sequence beginning (F)

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 faculty 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 (F, W, Sp)

8A-8B. Survey of 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 survey of the important classes of organic compounds, with emphasis on materials of interest to students of the biological sciences.

Two-quarter sequence beginning (F) Mr. Calvin; (Sp) Mr. Browne

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 chemistry or a closely related field such as biochemistry or chemical engineering. (12A and 12B: primarily concerned with the chemistry of simple functional groups, the laboratory takes up syntheses of aliphatic and aromatic compounds; 112: emphasizes the chemistry of multifunctional and heterocyclic compounds, in the laboratory emphasis is on identification of organic compounds.)

Three-quarter sequence beginning (F, Sp) Mr. Cason, Mr. Jensen, Mr. Kenyon, Mr. Streitwieser

12A: (F, Sp); 12B: (F, W); 112: (W, Sp)

12E-112E. Organic Chemistry, Lecture Only. (3-3)
Two 1½-hour lectures per week. Prerequisite: course 12A taken at Berkeley, with grade C or better. Intended for students in chemical engineering at Berkeley, but open to others with consent of the instructor. The lecture part of courses 12B-112. Two-quarter sequence beginning (F, W).
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 11OA-11OB. Introduction to chemical thermodynamics, colligative properties and chemical equilibria.
Mr. Lyon, Mr. Phillips, Mr. Pimentel, Mr. Fitzer, Mr. Shen (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. Powell (F); Mr. Bartlett (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, 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. Raymond (W, Sp)

109A–109B. Survey of Physical Chemistry. (3–3)
Three 1-hour lectures per week. 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. (109A: Elementary chemical thermodynamics; 109B: Molecular structure and spectroscopy, kinetics, macromolecular properties.) Two-quarter sequence beginning (F, W).
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: Molecular spectroscopy and other physical methods for determining molecular structure; 110B: Dynamic properties of chemical systems: reaction kinetics, electrochemistry. Introduction to statistical mechanics.) Two-quarter sequence beginning (F, W, Sp).
Mr. Johnston, Mr. Jura, Mr. Pimentel, Mr. Fitzer, Mr. Schaefcr, Mr. Somorjai

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. Heck, Mr. Myers, Mr. O'Konski, Mr. Wang. 111A: (F, W); 111B: (W, Sp)

114H. 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. Strauss (F); Mr. Phillips (Sp)

117H. 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. R.A. Harris (F); Mr. Miller (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. Street (W)

123. Nuclear Chemistry. (3)
Three 1-hour lectures per week. Prerequisite: senior standing.
Mr. Cerny (W)

124. Nuclear Chemistry Laboratory. (3)
One 1½-hour lecture and one 4½-hour laboratory per week. Prerequisite: course 123 and consent of the instructor. Laboratory experiments and independent projects giving both nuclear and chemical principles. Radioactive decay and beta-gamma ray detection. SECular equilibrium, decay schemes, interactions of gamma rays with matter, fission, ion exchange, nuclear activation analysis, chemical effects of nuclear transformations.

*125. Chemical Spectroscopy Laboratory. (3)
One 1-hour lecture and two 3-hour laboratories per week. Prerequisite: course 111B.

127. Physical Organic Chemistry. (3)
Two 1½-hour lectures per week. Prerequisite: course 112 and 110B, or consent of instructor. A reading knowledge of German is recommended. Applications of modern theoretical concepts to the chemical and physical properties of organic compounds.
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); Mr. Jensen (Sp)

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. Cason (W); Mr. Rapoport (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. Orlemann 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 prosecute original research under the direction of one of the members of the staff. The Staff (Mr. Orlemann 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. Orlemann in charge)

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. Orlemann in charge) (F, W, Sp)

199. Supervised Independent Study and Research.
Enrollment is restricted by regulations listed on page 79. Additional limitation: non laboratory study only. Must be taken on a passed or not passed basis.
The Staff (Mr. Orlemann in charge) (F, W, Sp)

Graduate Courses

206A-206B-206C. Organic Chemistry. (3-3-3)
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

*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)
Two 1½-hour lectures per week. Prerequisite: course 206C. The chemistry of polycyclic compounds of biological interest, with emphasis on sterols and related compounds.

216A-216B. Statistical Mechanics. (3-3)
Three 1-hour lectures per week. Prerequisite: course 114H, 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. Strauss

217A-217B. Advanced Quantum Mechanics. (3-3)
Three 1-hour lectures per week. Prerequisite: course 117H or equivalent. Matrix and group theory methods in quantum mechanics. Interaction of molecules with fields. Molecular orbital theory. Two-quarter sequence beginning (F, W).
Mr. Miller (F); Mr. R. A. Harris (W)

219A-219B. Chemical Kinetics. (3-3)
Three 1-hour lectures per week. Prerequisite: 219A, introduction to statistical mechanics, which may be taken concurrently; 219B, course 117H 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. Herm

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).

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 (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 (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 (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 pass/not passed basis.
The Staff (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 (in charge) (F, W, Sp)
CHICANO STUDIES PROGRAM

(Program Office, 3408 Dwinelle Hall)

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 1000 color transparencies of important Chicano art works.

Teacher Training  Chicano Studies staff participate in the Summer Program for Teachers. See the ANNOUNCEMENT OF THE SCHOOL OF EDUCATION.

Summer Session 1972  See the SUMMER SESSION BULLETIN for list of Chicano Studies courses offered.

The Major and the Degree Program

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, (SR 630 and A 291), Subject A (SR 636), American History, and American Institutions (SR 638).
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 basic sequence of Chicano Spanish, or its equivalent. 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 which is as follows: An introduction to Chicano Studies: one upper division course; a seminar in Chicano Studies: one upper division course; 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).

A list of recommended courses and model programs suggested for Chicano Studies majors will be published in the CHICANO STUDIES BULLETIN.

CLASSICS

(Department Office, 5303 Dwinelle Hall)

Professors:
John K. Anderson, M.A.
William S. Anderson, Ph.D. (Chairman)
W. Kendrick Pritchett, Ph.D.
Thomas G. Rosenmeyer, 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.
A. M. Henrichs, D.Phil.
W. Gerson Rabinowitz, Ph.D.
Ronald S. Stroud, Ph.D.

Assistant Professors:
John M. Dillon,† Ph.D.

NOTE: For key to footnote symbols, see page 78.
Crawford H. Greenewalt,† Ph.D.
W. Ralph Johnson, Ph.D.
James G. Keenan,‡ Ph.D.
Charles E. Murgia, 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. Keenan and Mr. Rodgers.

Departmental Graduate Adviser: (Classics) Mr. Garnsey; (Classical Archaeology) Mr. J. K. Anderson.

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.

Major in Greek  Greek 1–2 or 1A–1B–1C; 40A–40B (may be taken concurrently with upper division courses); 100, 101, 102, 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 Linguistics), Art 140A–140B, 141, History 110A–110B.

Major in Latin  Latin 1A–1B–1C, 2, or equivalent; 9A–9B (may be taken concurrently with upper division courses); 104, 105, 106, 107; 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 Linguistics), Art 144, History 111A–111B.

The Major in Classical Languages  Greek 1–2 or 1A–1B–1C; Latin 1A–1B–1C, 2, or equivalent; Greek 40A–40B or Latin 9A–9B (may be taken concurrently with upper division courses); Greek 100, 101, 102, 103; Latin 104, 105, 106, 107; one additional 4-unit course chosen from Greek 115, 120, Latin 145, 150. Recommended: courses in Classics, Sanskrit (see Linguistics), 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 5217 Dwinelle Hall, for Classical Archaeology in 5212 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 and one 1-hour section meeting per week. Against a background of Greek and Roman history the reading of several literary masterpieces, in whole, or in part, in translation.

10A. Hellenic Civilization. (F) Mr. J. K. Anderson, Mr. Greenewalt

10B. Hellenistic Civilization. Mr. Keenan (W)

10C. Roman Civilization. Mr. Johnson (Sp)

17A-17B-17C. Elementary Course in Classical Archaeology. (4-4-4)

Three 1-hour lectures per week. 17B or 17C may be taken first.

17A. The development of Greek Civilization from the Late Bronze Age to 700 B.C. as illustrated by the monuments.

17B. Monuments of Greek civilization 700–300 B.C., with particular reference to the life of the citizen. Mr. Henrichs (W)

17C. Monuments of western civilization from the Hellenistic Age to the Age of the Antonines, with particular reference to urban development and provincial organization. Mr. J. K. Anderson (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.

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 (F)

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. Garnsey (W)
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 79. Additional restriction: limited to senior honor 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.
Mr. Keenan, ——— (W)

2. Greek for Beginners. (6)
Five 1-hour class meetings per week. Second part of two-part course in elementary Greek.
Mr. Keenan (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. Pritchett, Mr. Rabinowitz (F), Mr. Pritchett, Mr. Rabinowitz (W), Mr. Pritchett, Mr. Rabinowitz (Sp)

40A–40B. Greek Prose Composition, First Course. (4–4)
Three 1-hour class meetings per week. Prerequisite: Greek 1–2 or 1A–1B–1C. An introduction to the writing of Attic Greek prose. This course may not be offered in satisfaction of the foreign language requirement in the College of Letters and Science.
Mr. Stroud (F, W)

Upper Division Courses

100. Xenophon. Anabasis. (4)
Three 1-hour class meetings per week. Prerequisite: Greek 1–2 or 1A–1B–1C.
Mr. Pritchett (F)

101. Homer. (4)
Three 1-hour class meetings per week. Prerequisite: Greek 100.
Mr. Threatte (W)

102. Plato: Apology and Crito. (4)
Three 1-hour class meetings per week. Prerequisite: Greek 100.
Mr. Rabinowitz (Sp)

103. Drama. (4)
Three 1-hour class meetings per week. Prerequisite: Greek 100.
Mr. Bundy (Sp)

115. Senior Course in Greek Poetry. (4)
Three 1-hour class meetings per week. Prerequisite: Greek 103.
Mr. Bundy (F)
Mr. Rabinowitz (Sp)
Mr. Bundy (W)

*115A. Aristophanes.
115B. Sophocles.
115C. Aeschylus.
115D. Lyric Poets.

*115E. Theocritus.
120. Senior Course in Greek Prose Authors. (4)
Three 1-hour class meetings per week. Prerequisite: Greek 103.
*120A. Demosthenes. Mr. Threatte (F)
120B. Herodotus. Mr. Fitchett (Sp)
120C. Thucydides. Mr. Stroud (W)
*120E. Plato's Republic.

125. The Greek New Testament. (4)
Two 1½-hour class meetings per week. Prerequisite: Greek 100. Readings in the gospels and epistles in Greek.
Mr. Henrichs (Sp)

139. Greek Political Institutions. (4)
Three 1-hour lectures per week. Study of Greek texts which elucidate the development of Greek political institutions.
Mr. Stroud (F)

150A-150B. Advanced Greek Prose Composition. (4-4)
Three 1-hour class meetings per week. Prerequisite: Greek 40A-40B. Advanced instruction in the writing of Attic Greek prose. Mr. Threatte (W, Sp)

H195. Honors Course in Greek. (3)
One 1-hour lecture for discussion and recitation per week. Advanced and independent study for senior honor students in Greek. 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 (Su, F, W, Sp)

198. Directed Group Study for Advanced Undergraduates. (1-5)
Prerequisite: restricted to senior honor students. Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations on page 79. Additional restrictions: limited to senior honor students. Must be taken on a passed/not passed basis. Staff (Su, F, W, Sp)

Latin

Lower Division Courses
(Courses in this group are designated Latin 1A-1B-1C, Latin 2, etc.)

1A-1B-1C. Latin for Beginners. (4-4-4)
Three 1-hour class meetings per week. Three-part course in elementary Latin beginning each quarter. (F, W, Sp)

2. Latin Poetry and Prose. (5)
Three 1-hour class meetings per week. Prerequisite: course 1A-1B-1C, or equivalent. Selections from Latin poetry and prose.
(F) Mr. Rodgers (W)

9A-9B. Latin Prose Composition. (4-4)
Three 1-hour class meetings per week. Prerequisite: Latin 2. First course in the writing of Latin prose. This course may not be offered toward satisfaction of the foreign language requirement in the College of Letters and Science. Mr. Rodgers (F, W)

Upper Division Courses

104. Vergil. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 2. Vergil's works read in sequence.
Mr. W. S. Anderson (F), Mr. Murgia (Sp)

105. Caesar. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 2. Selected readings.
Mr. Garnsey (W)

106. Horace: Odes and Epodes. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 2.
Mr. Johnson (W)

107. Cicero. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 2. Reading of a philosophic essay.
Mr. Henrichs (F)

109A-109B-109C. Advanced Latin Prose Composition. (4-4-4)
Three 1-hour class meetings per week. Prerequisite: Latin 9A-9B. Advanced instruction in the writing of Latin prose.
Mr. Johnson (W, Sp)

115. Readings in Latin Literature. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 15. Selected readings in Latin prose and poetry designed for students who have taken the Latin Workshop during the summer sessions.
Mr. Rodgers (F)

139. Roman Political Institutions. (4)
Three 1-hour lectures per week. Study of Latin texts which elucidate the development of Roman political institutions.
Mr. Garnsey (Sp)

145. Senior Course in Latin Poetry. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 104 and 106. 145A. Roman Comedy. Mr. W. S. Anderson (Sp)
145B. Lucretius. Mr. Murgia (F)
*145C. Elegiac Poets.
145D. Juvenal. Mr. Rodgers (W)
*145E. Horace: Satires and Epistles.

150. Senior Course in Latin Prose Authors. (4)
Three 1-hour class meetings per week. Prerequisite: Latin 107.
*150A. Sallust. Mr. Henrichs (F)
150B. Seneca. Mr. Henrichs (F)
150C. Cicero. Mr. Murgia (W)
150D. Tacitus. Mr. Henrichs (Sp)
*150E. Livy.

166. Latin Verse Composition. (1)
One 1-hour class meeting per week. Prerequisite: Latin 109. Practice in the writing of Latin verse in various meters.
Mr. Johnson (Sp)

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 (Su, F, W, Sp)

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 79. Additional restriction: limited to senior honor students. Must be taken on a passed/not passed basis. The Staff (Su, F, W, Sp)

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. Threatte (F) 200B. Proseminar to Latin. Mr. Murgia (W)

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. Mr. Threatte (Sp)

211. Hesiod. (4)

Two 1½-hour class meetings per week. Mr. Rosenmeyer (W)

212. Greek Lyric Poets. (4)

Two 1½-hour class meetings per week.

* A. Earlier
  B. Later. Mr. Bundy (F)

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. Mr. Stroud (Sp)

215. Greek Historians. (4)

Two 1½-hour class meetings per week.

A. Herodotus. Mr. Fritchett (W)

* B. Thucydides.
  * C. Aristotle’s Constitution of Athens.
  * D. Polybius
  E. Thucydides. Mr. Keenan (Sp)

216. Greek Philosophers. (4)

Two 1½-hour class meetings per week.

* A. Pre-Socratics.
  B. Plato. Mr. Rabinowitz (F)
  * 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.

219. Ancient (Graeco-Roman) Slavery. (4)

Two 1½-hour class meetings per week. Mr. Finley (W)

*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. Mr. Keenan (W)

*223. Introduction to Linear B. (4)

A course dealing with both the script and the language of the Linear B tablets. Selected texts will be read and discussed and there will be an introduction to the linguistic and archaeological background.

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. W. S. Anderson (W)

*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.
  * D. Tacitus
  * E. Suetonius
  F. Pliny.

*240. Latin Epigraphy. (4)

Three hours of class per week.

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. Mr. Rodgers (Sp)

*245B. Latin Literature of the High Middle Ages, 900-1300 A.D. Study of the evolution of mediæval style with special attention to lyrical and satirical poetry.
246. Roman Society and Roman Law. (4)
Two 1 ½ hour class meetings per week. The social, legal, and administrative background to the literary sources for the Roman Empire.
Mr. Garnsey (F)

*247. Roman Politics and Administration. (4)
Two 1 ½-hour class meetings per week. Select problems in Roman Imperial history from 69-235 A.D.

*248. Egypt and the Classical World. (4)
Two 1 ½-hour class meetings per week. Egypt’s impact on the Greek and Roman world and the influence of Greek and Roman domination on Egypt. Literary and papyrological sources from Herodotus to the Arab conquest.

270A–270B–270C. Seminar in Classical Archaeology. (4-4-4)
Two 1 ½-hour class meetings per week. Advanced study of ancient Greek art objects and sites.
270A. Mr. J. K. Anderson (F)
270B. Mr. J. K. Anderson (W)
270C. (W)

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)

16. Latin for Graduate Students, First Course. (No credit) (F, W, Sp)

26. 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 Linguistics.

Readings in Mediaeval Latin (English 210A–210B). (5–5)
Mr. Jones (W, Sp)

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

Adviser: Mr. 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 in society, and directs his attention specifically to the effects of communication on public policy and opinion. 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.

The Major The student must complete Rhetoric 12 and Psychology 1. Recommended: Economics 1A, 1B, History 17A, 17B, Sociology 1, Rhetoric 10, Statistics 2. Required: Journalism 141, Philosophy 104 or 108 or 128; Political Science 161A or 161B; Psychology 160; Rhetoric 109, Rhetoric 143B or 143C or 143D, Rhetoric 190; and one course from the following list, or a relevant course approved by the adviser; Journalism 190, Political Science 160, 161B or 161C, 162A, Sociology 141.

Honors Program Students accepted in the honors program will enroll in Rhetoric H197A–H197B, with emphasis on sociological aspects. In addition to class discussions and recommended readings, the student will write a thesis based on his independent research.

NOTE: For key to footnote symbols, see page 78.
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 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, 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).

NOTE: For key to footnote symbols, see page 78.
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 one 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 one introductory graduate course and one graduate seminar in Comparative Literature, and (3) work in at least two separate ancient or modern literatures (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 There is no formal course requirement beyond the M.A. Each student has the responsibility of preparing himself, in consultation with his adviser, 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 qualifying doctoral 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 meetings 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 satisfy both the English composition requirement and the foreign language option. (F, W, Sp)

41A–41B–41C. Introduction to Literary Forms. (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.
41B. Forms of the Novel.
41C. Forms of the Drama.

Upper Division Courses

Group I: Unrestricted Courses

*108. Problems of Verse Translation. (4)
Two 1½-hour meetings per week. The course will attempt to elucidate the translator's twin roles, as poet, in his own right, and as critic for his age. The course will focus on classical literature with special reference to the Carmina of Catullus. Students will produce their own work, not limited to translations from the classics, and classroom discussion will provide the basis for instruction.

*109. The Classical Tradition in Western Literature. (4)
Three 1-hour lectures per week. Examination of selected aspects of the Greco-Roman tradition and their relevance to the study of later literature.

*112A–*112B. Introduction to Modern Greek. (5–5)
Three 1½-hour class 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 (Greek 101 and either 102 or 103 at Berkeley satisfy this requirement). Modern Greek pronunciation, vocabulary, morphology, and syntax studied in comparison with Attic Greek; reading of selections of progressive length and complexity.

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.

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 fifteenth 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.

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

*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.

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.

*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.

162. Introduction to Classical Chinese Literature. (4)
Two 1½-hour lectures per week. The general characteristics, main currents and representative works of Chinese literature in the classical tradition examined in the context of world literature. Texts and references in English translation critically analyzed. (When not given, see Oriental Languages 112. Students may receive credits in either course, but not in both.)

Two 1½-hour lectures per week. An introductory presentation of the oral tradition of the American Indian.

*178. Introduction to Modern Greek Literature. (5)
Three 1½ hour class meetings per week. Prerequisite: course 112A—112B or equivalent knowledge of Classical and Modern Greek. Reading and analysis of selected masterpieces of Greek literature from the Byzantine Period to the present.

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 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)

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 two 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.

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 two 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.

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 two 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.

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 two 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 paper required.

190E. Comparison of Authors: English, Spanish, Arabic. (4)
Three 1-hour lectures and discussion period per week. Prerequisite: course 100 or equivalent, and at least two quarters in upper division literature, including at least one quarter in Spanish or Arabic. Comparison of three important authors, English, Spanish, Arabic; 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.

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

Tutorial Courses

H196. Special Honors. (1)

Prerequisite: Comparative Literature 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. Larson 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. Larson 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. Larson in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)

Enrollment is restricted to regulations listed on page 79. Must be taken on a passed or not passed basis. The Staff (Mr. Larson in charge) (F, W, Sp)

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, at least one of which must be either Greek or Latin. 204A is not prerequisite to 204B. Comparative investigation of a topic in Western literature involving the study of classical and post-classical documents.

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.

*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.

*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.

*230A-230B. Studies in Oriental-Western Literary Relations. (4-4)

One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages, one of which must be Oriental. 230A is not prerequisite to 230B. May be repeated for credit. Comparative investigation of a literary topic requiring the study of both Oriental and Western documents. Topics and texts will vary from year to year. Topics for 1971-72: China.

*231A-231B. Studies in Linguistics and Comparative Literature. (4-4)

One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages, one of which must be Near-Eastern. Comparative investigation of a literary topic requiring the investigation of both Near-Eastern and Western documents.

*235A-235B. Studies in Linguistics and Comparative Literature. (4-4)

One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages and Linguistics 105 or equivalent knowledge of linguistics. 235A is not prerequisite to 235B. Application of linguistic methods to the comparative study of literature.

*238. Aristotelian and Neoplatonic Literary Criticism: Arabic and European Poetics. (4)

One 3-hour lecture and discussion period per week. Prerequisite: a knowledge of two modern European foreign languages is required. A knowledge of Aristotle is recommended but not required. The seminar will center on medieval Arabic literary criticism, its roots in Aristotelian and Neoplatonic Philosophy, and its tendency toward conceptism. Parallel developments in Western European Literatures, both medieval and modern, will be discussed when relevant, in order to show the common roots of Western and Near Eastern poetics.

*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.

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.

*260A-260B-260C. Translation Workshop. (4-4-4)

One 3-hour lecture and discussion period per week. Prerequisite: preparation in two foreign languages. A grade of A in 260B is normally prerequisite to admission to 260C. Comparative examination of ancient and modern theories of translation in connection with practice in the literary translation of texts of increasing complexity; students admitted to 260C will undertake a sustained translation project in either English or a foreign language.

**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 (Miss Richardson in charge) (F, W, Sp)

*299. Directed Research. (5-10)

Normally reserved for students directly engaged on the doctoral dissertation. The Staff (Miss Richardson 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 (Miss Richardson 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 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 (Miss Richardson in charge)

**Teachers' Courses**

*300. Problems in Teaching Comparative Literature in Secondary School. (4)

Prerequisite: senior or graduate standing and course work in three literatures, two of which must be studied in the original languages, or consent of instructor. Examination of the proper function of ancient and modern literary masterpieces in the secondary school curriculum in the light of modern educational theories, and study of methods of teaching these works.
COMPUTER SCIENCE

(1-1-1) 360A–360B–360C. Methods of Teaching Literature and English Composition. Discussion of approaches to teaching composition at the college level in relation to the reading of masterpieces of literature. Designed primarily for teaching assistants in the freshman composition course. (F, W, Sp)

IDS 104. Sturm und Drang in Opera and Drama. (4) See Interdepartmental Studies for the complete description of this course.

COMPUTER SCIENCE

(Department Office, 575 Evans Hall)

Professors:
Martin H. Graham, Ph.D. (Chairman)
William Kahan, Ph.D.
Richard M. Karp, Ph.D.
Derrick H. Lehmer, Ph.D.

Associate Professors:
Michael A. Harrison, Ph.D.
Beresford N. Parlett,† Ph.D.

Assistant Professor:
James H. Morris, Ph.D.

Lecturers:
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, 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), 103, 106, 110, Mathematics 1A–B–C, 51A (or corresponding honors courses), 113A. The student may then choose 20 units from the following: any upper division or graduate computer science course (except 120A, 198, 199, 298, 299); Mathematics 104A–B, 113B–C, 125A–B, 128A–B, 129A–B, 185; Electrical Engineering and Computer Sciences 105, 108, 151A–B, 160A–B; Industrial Engineering 162, 167; Statistics 100A–B (or 134A–B), 135A–135B; Linguistics 106; IDS 114. Other programs for the major will require the specific approval of the major adviser.

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

1. Computers and Data Processing. (4)

Three 1-hour lectures and one 1-hour problem 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. Gould (in charge) (F, Sp)

2. Elementary Computer Programming. (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, computers, binary representation. Thorough treatment of one or more problem oriented programming languages chosen according

NOTE: For key to footnote symbols, see page 78.
100. Introductory Computer Programming. (5)
Two 1-hour small class meetings, one combined lecture, and at least two hours of program 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 a compiler language (ALGOL, BASIC, COBOL, FORTRAN, SNOBOL, PL1) and various applications. Basics of data processing.
The Staff (Mr. Meissner in charge) (F, W, Sp)

103. Basic Programming Concepts. (5)
Three hours of lecture and one 1-hour problem session per week. Prerequisite: course 2 or equivalent. Course 103 and EECS 153 may not both be taken for credit. Basic concepts and methods of non-numerical programming: machine language, simple data structures (arrays, pointers, lists, stacks, trees), searching, recursion, binding of variables, macros and conditional assembly, representation of syntax, concepts of assembly, loading, compilation/interpretation, compile time/run time.
The Staff (Mr. Meissner in charge) (F, 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)

Three hours of lecture per week. Prerequisite: course 103 or equivalent. Operating Systems: batch processing, multi-programming, time-sharing, scheduling, storage allocation, input/output. Topics from pattern recognition, question answering, problem solving, learning.

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 semi-group of a machine. Survey of other automata.
Mr. Karp (F)

132. Introduction to Algorithms and Computability. (4)
Three hours of lecture per week. Prerequisite: none. The normal, Turing, Post, and Shepherdson-Sturgis models of algorithms. The class of partial recursive functions and subclasses based on different notions of complexity. Rudimentary constructions in computability. Satisfies the prerequisite for Computer Science 230.

140. Introduction to Combinatorics. (4)
Mr. Lehmer (W)

141. Switching Theory. (4)
Three hours of lecture per week. Prerequisite: Mathematics 113A. Graph theory, its associated algorithmic problems. Combinatorial 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. Lehmer (Sp)

142. Graph Theory. (4)
Three hours of lecture per week. Prerequisite: Mathematics 113C. Graph theory, its associated algorithmic problems. Combinatorial 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.

149. Directed Group Studies for Advanced Under-Graduates. (2–5)
Prerequisite: CS 2, 100 or equivalent. Must be taken on a passed or not passed basis. Group study of selected topics in Computer Science.
The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. 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 106. 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
210. Advanced Computer Organization. (4)
Three hours of lecture per week. Prerequisite: consent 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.

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.

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. Graham (W, Sp)

*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.

*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.

233. Theorem Proving and Computational Models (4)

Mr. Karp (Sp)

234. Theory of Formal Languages. (4)

Mr. Harrison (F)

246. Special Topics in Numerical Analysis. (4)
Prerequisite: consent of instructor (since required preparation depends on the topic). Advanced work in special areas. Course may be repeated with different sections for credit.

246A. Initial Value Problems. 246B. Boundary Problems.


Mr. Kahan (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: Computer Science 130. Linear sequential machines. Minimization, finite memory property, controllability and unobservability. Behavior as linear functions and sequential relations. Algorithms for realizability 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: Computer Science 234. Advanced topics in context free languages, e.g. Farhi's theorem and bounded languages. Context sensitive languages and linear bounded automata. Phrase structure grammars and Turing machines. Stack automata. Unification of language theory through ballot 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: Computer Science 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: C.S. 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.
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, 101 Giannini Hall)

This innovative major, offered jointly by the College of Agricultural Sciences and the School of Forestry and Conservation, is designed for students motivated and concerned by public issues in the general fields of population, renewable natural resources and environment, and who prefer an approach broader than the professional one or one based on a specific science. It provides undergraduate education focused on understanding man’s environment, primarily from the viewpoint of people who will be urban dwellers, rather than direct participants in resource professions.

The major will provide a framework within which faculty and students may work effectively to develop an academic approach to the conservation of natural resources. It reflects an exploratory approach to the natural resource concept distinct from the management orientation of the existing major in the School of Forestry and Conservation and from the disciplinary orientation of the College of Agricultural Sciences. At the same time, advantage is taken of the interdisciplinary character and problem orientation of these units and of the facilities and faculties for instruction in natural resources.

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. Three quarter courses in Interdepartmental Studies designed for the major.

d. Two quarter courses in reading and composition.

II. Interdepartmental Studies 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. The primary aim of this course is not only to promote student-faculty discussions, but to assist the student in

NOTE: For key to footnote symbols, see page 78.
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

1. Course Work:

In consultation with his adviser, and based on work in IDS 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. Interdepartmental Studies 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. IDS 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.

CRIMINOLOGY

(Department Office, 101 Haviland Hall)

Professors:

Bernard L. Diamond, M.D.
Caleb Foote, M.A., LL.B.
Sheldon L. Messinger, Ph.D.
Theodore R. Sarbin, Ph.D.
Arthur H. Sherry, A.B., LL.B.
Jerome H. Skolnick, Ph.D.
Austin H. MacCormick, M.A. (Emeritus)
Orlando W. Wilson, A.B., LL.B. (Emeritus)

Associate Professors:

M. Edwin O’Neill, M.S.
Paul T. Takagi, Ph.D.

Assistant Professors:

Anthony M. Platt, D.Crim.
Herman Schwendinger, Ph.D.

Associate Professor:

Gordon E. Misner, D.Crim. (Acting)

Lecturers:

Fariborz Amini, M.D.
Bernard Bradman, M.D.
Milton Feldstein, M.A.
Kermit Gruberg, M.D.

NOTE: For key to footnote symbols, see page 78.
Students are admitted in the junior year, after completion of a 90-unit lower division precriminology curriculum, which normally includes the following subjects:

**Social Science Emphasis (General Criminology)**

*Required*: One course from the following: Psychology 5, Education 119A, Public Health 162A, Statistics 130A.

Other courses should be chosen from the natural sciences, the social sciences, and the humanities. It is, however, permissible for the student to take courses in only the social science area, provided that they be from more than one department.

*Recommended*: English 1A–1B or other reading and composition course (strongly recommended); Psychology 1 and 3, or upper division courses in personality, social pathology, or development; Political Science 1 or 5, or upper division courses in American government and comparative government; one course from the following: Sociology 109, 160, Political Science 113A; two courses from Social Science 1A–1B, Sociology 1 or 10, or other sociology courses; four courses in the natural sciences; four courses in the humanities.

**Natural Science Emphasis (Criminalistics)**

*Required*: Chemistry 1A–1B–1C, 5, and 12A–12B; Physiology 1; Physics 6A–6B–6C; Mathematics 1A or 11A; Statistics 20.

*Recommended*: English 1A–1B or other reading and composition course; two courses chosen from Social Science 1A–1B, Sociology 1 or 10, or other sociology courses; Psychology 1 or upper division course in personality, social pathology or development; one course in humanities.

**Letters and Science List.** Courses 100, 102A, 102B, 103A, 103B, 106, 108, 111, 112, 116, 117, 118A, 118B, 119, 123, 124, 129, and 180 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.

The program of the School of Criminology is being reorganized to further reflect its emphasis on the preparation of students for teaching and research on crime, criminal justice, and social policy. Some of the courses listed may not be offered during 1971–1972 or later and new courses may be added. Current information on the program and faculty may be obtained by addressing an inquiry to the Dean, School of Criminology, University of California, Berkeley 94720.

**Upper Division Courses**

**100. Introduction to Criminology. (4)**

Four lecture hours per week. *Open only to non-majors.* This course will introduce the student to the variety of subjects in criminology. It will survey research and theories of causation, the modes of identification, apprehension and adjudication, correctional institutions, and problems and possibilities of innovation. (F, Sp)


101A. Four and one-half hours per week. Organization and functions of investigative agencies, basic considerations in the investigation of crime, collection and preservation of physical evidence, elements of legal proof in the submission of evidence, investigation of specific offenses. (F)

101B. Three lecture hours and three laboratory hours. Basic concepts in the identification of persons, theory of dermatoglyphics and other criteria, investigation and identification of questioned documents. (W)

**102A. The Etiology of Crime: Psychiatric. (4)**

Four lecture hours per week. Psychopathology and psychodynamics of the psychoses, psycho-neuroses, and character disorders; mental disorders in relation to crime and delinquency. (F)

**102B. The Etiology of Crime: Psychological. (4)**

Four and 1/2 lecture hours per week. Psychological factors and processes in criminal and delinquent behavior, components of normal and abnormal personality, methods of personality measurement and clinical diagnosis. (W)

**103A. Social Origins and Characteristics of Crime. (4)**

Four lecture hours. A two-section course of study: (1) major theories of crime and delinquency in historical sequence; (2) a survey of outstanding research works. Theorists will include Durkheim, Lombroso, Freud, Merton and Sutherland. Research will range from Thrasher to current work in organized crime. (F)

**103B. Sociology of Legal and Correctional Institutions. (4)**

Four lecture hours per week. A survey course on the theories of social control. Analysis of the social organization of correctional agencies, treatment and trends. (W)
105A-105B. Fundamentals of Police Administration. (4-4)  
Four lecture hours. The police as a functional aspect of the system of criminal justice; principles of organization and personnel management; line, staff and auxiliary functions; modus operandi of arrest and detention; political controls and limitations on authority and jurisdiction; professionalization of the police.

106. The Criminal Self and Criminal Careers. (4)  
Four lecture hours. Prerequisite: 105A. The development of criminal self-conceptions, social-psychological processes of group alienation and individual estrangement, maturation and professionalization in the development of criminal careers; selected case studies.

108. History of Crime and its Treatment. (4)  
Four lecture hours. Perspectives and methods in the study and control of crime, the evaluation of correctional philosophies and programs, eighteenth- and nineteenth-century schools of criminology, contemporary correctional practices and their philosophical antecedents.

111. Scientific Methodology. (4)  
Four and one-half lecture hours. Criminalistics majors must take 111L concurrently. An exploration of the systems presently in use by the physical and social sciences for the purposes of identifying groups and characterizing individuals. Discussion of the probabilistic nature of all such systems and the elements of data evaluation employed. (F)

111L. Scientific Methodology: Laboratory. (3)  
Six laboratory hours. (F)

112. Organized Crime and the Professional Criminal. (4)  
Four lecture hours. A systematic analysis of criminal associations in their various manifestations, informal types of cliques and mobs and formal organizations of industry and area-wide racketeers, the professional criminal as a social type, varieties and modus operandi of professional criminals.

114. Prevention and Control of Crime in Metropolitan Areas. (4)  
Four and one-half lecture hours. Crime in relation to the development of metropolitan areas, incongruent patterns of criminal activity and police organization, demographic and ecological factors in the incidence and distribution of crime and delinquency, considerations of policy and planning.

115A-115B. The Criminal Law in Action. (4-4)  
Four lecture hours. Prerequisite: senior standing. 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. Sequence beginning (F). (F, W)

Four lecture hours. Prerequisite: senior standing. Constitutional and procedural restraints on law enforcement, their purpose and implementation; Federal and state relationships in the administration of criminal justice.

117. The Prison Community. (4)  
Four lecture hours. Effects of informal inmate social interaction, types of formal prison organization, latent effects of inmate culture and prisonization, antithetical processes of socialization, types of group controls, authoritarian and permissive.

118A. The Alcoholic and the Narcotic Addict. (4)  
Four and one-half lecture hours. Prerequisite: 102A-102B, 103A or comparable courses in sociology and psychology. Social and psychological problems of addiction; disorders of personality and their relationship to alcoholism and drug addiction; social and therapeutic methods of control and treatment.

118B. Sexual Offenders and Character Disorders. (4)  
Four and one-half lecture hours. Prerequisite: 102A-102B or comparable courses in sociology and psychology. Psychopathology of sexual deviation; developmental theories of sexual abnormality; legal, social, psychological and moral problems associated with sexual and character disorders.

119. Ethnic Tension and Conflict in Relation to Law Enforcement. (4)  
Four and one-half lecture hours. Race and cultural differences as a factor in differential law enforcement; variations in punitive sanctions, double standards as modus operandi, symbolic reactions of tension and conflict, positive and negative factors in the control of ethnic hostilities.

121. White-Collar Crime. (4)  
Four and one-half lecture hours. An examination of the extent and character of white-collar crime, with special emphasis upon political and financial variables as differentiating conditions.

123. Groups, Crowds and Gangs. (4)  
Four lecture hours. An examination of group dynamics and their relation to antisocial acts, especially to fighting gangs, mobs and mass disturbances as a condition of the violation of legal norms, and their implications for the law enforcement and corrective functions. (Sp)

124. Nonconformist Cultures. (4)  
Four and one-half lecture hours. An analysis of varieties of crime generating contemporary subcultures. Societal norms and legal structures, including the police, the courts and the correctional systems, are examined as they relate to deviant subcultures.

125. Group Psychotherapy in Correctional Institutions. (4)  
Four lecture hours. An analysis of alternative techniques of group therapy as currently employed in penal practice.

126. Law Enforcement Policies and Social Structure. (4)  
Four lecture hours. Prerequisite: senior standing. An examination of law enforcement systems in relation to the incidence and distribution of economic and social power, class structure, ecological patterns, subcultural developments in the community and in the police, and problems of professionalization.
127. Law and Discretion in Criminal Sentencing. (4)
Four and one-half lecture hours. Legal and constitutional factors, the principle of the rule of law and the ethical goals of the criminal law as limitations upon judicial and administrative discretion in fixing sentence and determining release on parole.

129. Social and Historical Origins of Major Theories of Criminal Behavior. (4)
Four lecture hours. Study and analysis of the interaction between social relations at given historical periods and the development of general theories of criminal behavior.

130A–130B. Some Basic Criminological Research Operations. (4–4)
Four lecture hours. Prerequisite: admission to the School with completion of courses listed under Social Science Emphasis (See page 153). This course is designed to provide a general introduction to research theory and methods of special relevance to the field of criminology. 130A (F); 130B (W)

131. An Approach to Systems Theory in Relation to Problems in Criminology. (4)
Four lecture hours. Prerequisite: admission to the School with completion of courses listed under Social Science Emphasis (See page 153). This course is designed to familiarize students with the language of systems and information theory. Illustrations of applications are taken from operations research. The importance of the “model” is stressed, and exercises are given in the design of algorithms.

132. Evaluation of Penal Measures. (4)
Four lecture hours. Prerequisite: admission to the School with completion of courses listed under Social Science Emphasis (See page 153). 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.

133. Prediction Methods in Criminology. (4)
Four lecture hours. Prerequisite: admission to the Science Emphasis (See page 153). The limitations of prediction methods will be discussed together with some of the technical and moral problems involved in the approaches. A critical analysis is developed of the work in this field. Ways in which prediction methods may be developed and extended to provide a more satisfactory framework will be considered.

134A–134B. Problems in the Study of the History of Criminology. (4–4)
Four hours of lecture per week. Survey of contributions of scholars to research and writing in the history of criminology. Focus will be on the contribution of the historical approach, either alone or in combination with other methodological techniques, as an aid to understanding the basic causes of criminal behavior.

140A–140B. Politics, Protest, and Crime. (4–4)
Three lecture hours per week, group projects and field work. The course will focus on political, economic, and legal contexts of collective protest movements: development and character, relationship to the legal system, and contacts with agencies of social control. The course will provide a critique of theories which isolate crime from political processes. Pass/Not Pass grades will be awarded upon completion of the full sequence.

151A–151B. Microanalytic Concepts. (5–5)
One lecture hour and 9 laboratory hours. Prerequisite: 111 and 111L; Chemistry 5, 12A–12B and 112, with grade of C (112 may be taken concurrently). Form and substantive pattern analyses by means of chemical and physical methods and techniques with relation to forensic purposes. Sequence, beginning (W).

152. Forensic Aspects of Separation and Purification. (5)
Two lecture hours and 6 laboratory hours. Prerequisite: 111 and 111L; Chemistry 5, 12A–12B and 112 with grade of C (112 may be taken concurrently). Principles of isolating physical constituents of samples.

154. Physiological Concepts. (5)
One lecture hour and 9 laboratory hours. Prerequisite: 151A–151B. Application of biochemical and immunological principles in the area of physiological material.

155. Comparative Evidence and Evaluation. (5)
Two lecture hours and 6 laboratory hours. Prerequisite: 101A or 101B. Comparative studies of gross and microscopic characteristics of various types of physical evidence, interpretation and evaluation as investigative aids and legal proof.

156. Forensic Toxicology. (4)
Two lecture hours and 4 laboratory hours. Prerequisite: 151A–151B. Methodology in 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.

Four and one-half lecture hours. 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.

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.

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79 of this catalogue. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

The requirements for admission to the Graduate Division are listed on page 24. The requirements for the Master of Criminology and the Doctor of Criminology are listed in the Announcement of the School of Criminology.
200A. Social Origins of Theories of Crime: Causes and Characteristics. (4)
One 3-hour seminar per week. Prerequisite 103A and 130A (or equivalent course). An historical analysis of the origins of theories of crime and delinquency with special emphasis upon eighteenth- and nineteenth-century thinkers.

200B. Social Origins of Theories of Crime: Control. (4)
One 3-hour seminar per week. Prerequisite 103A, 103B, 130A (or equivalent course). An historical analysis of theories of social control from the seventeenth-century rationalists to recent theories of social control.

210. Urban Problems: Poverty, Housing, Education. (4)
One 3-hour seminar per week. Macrosocial, political and economic factors in the prevention and control of crime and delinquency. Topics will include problems of unemployment, war on poverty, urban renewal, and federal child care programs.

214. Sociology of the Legal Profession. (4)
One 3-hour seminar. Prerequisite: an undergraduate or graduate course in the sociology of law, social control or criminal law, or a law degree. An analysis of the legal profession, focusing on stratification, occupations, and careers. Attention will be paid to ideology and occupations of criminal defense lawyers, public defenders, prosecutors, and lawyers specializing in "political" cases. Legal training and the emergence of radically oriented law students will be examined.

One 3-hour seminar. This seminar will investigate assumptions and conceptions of law, crime, and social issues. It will concentrate upon politics and the criminal justice system, the dynamics of criminal law reform, and problems in private and public morality. Credit and grade will be awarded upon completion of the full sequence.

220. Seminar in the History of the Discipline of Criminology. (4)
One 3-hour seminar per week.

230. Methods of Criminological Research. (4)
One 3-hour seminar. A treatment of criminological research methods emphasizing the logic of social inquiry, problems of research design and execution, problems of measurement and analysis.

231. Advanced Methods in Criminological Research. (4)
One 3-hour seminar per week. Topics of relevance to criminology will include: special typological problems; numerical taxonomy, smallest space; oblique cluster analysis; and problems in graph theory and structural analysis.

240. Community Structures and Social Control. (4)
One 3-hour seminar per week. Community approaches to problems of crime and delinquency.

241. Family, Socialization, and Deviant Behavior. (4)
One 3-hour seminar per week. Analysis of theories and researches on the family, socialization, and problems of deviance.

242. The Politics of Childhood. (4)
One 3-hour seminar. 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 implications for social and legal control.

250. Parameters of Common Types of Delinquent Behavior in Metropolitan Areas. (4)
One 3-hour seminar per week. Prerequisite: 103A, 130A and 200A. Theoretical controversies depending upon the parameters of delinquency in communities will be examined. Methodological variations in measuring delinquent behavior, and specific problems and solutions to the construction of measures independent of traditional sources will be surveyed.

251. Theory and Measurement of Norms, Values and Beliefs of Delinquent Youth. (4)
One 3-hour seminar per week. An analysis of current controversies on the behavioral standards and motives for delinquent groupings. Models of interaction processes and problems in measuring such interactions will be studied.

*252. Comparative Analysis of Delinquent Behavior. (4)
One 3-hour seminar per week. Prerequisite: 103A, 130A and 200A. A critical survey of variations in delinquent behavior and adolescent social structures between highly industrialized and non-developed countries. Particular reference will be made to development of research methods producing comparable data about delinquent behavior in different countries.

*253. Ethnic, Racial, and Religious Variations in Delinquent Behavior. (3)
One 3-hour seminar per week. A survey of law violating behavior among ethnic and racial groups with special attention to changing behavior patterns.

254. Instruments of Discovery in Criminal Research. (4)
One 3-hour seminar per week. A view and analysis of methodology 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.

*255. Variations in Associational Structures Among Delinquent Youth. (4)
One 3-hour seminar per week. Prerequisite: 103A, 130A, 200A and a course in social stratification. A survey and analysis of theories regarding general structures of relations in the community. The relation of delinquent groups to these structures will be discussed. Traditional and new methods of measuring groups and intergroup structures will be examined.

One 3-hour seminar. 262 or 263 must be taken concurrently. Prerequisite: 102A, 102B or equivalent courses in abnormal psychology and consent of instructor. Theory and technique of counseling and psychotherapy; emphasis will be upon treatment of individuals with social problems, character disorders, and "acting out" behavior. Sequence, beginning (F). All parts must be completed. In-progress grades will be given.

(F, W, Sp)
262. Counseling and Psychotherapy: Field Work. (2-6)
Individual conferences. May be repeated for credit. In-progress grades will be given. (F, W, Sp)

263. Community Psychiatry: Field Work. (2-6)
Individual conferences. May be repeated for credit. In-progress grades will be given.

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 theoretical, philosophical, and behavioral science aspects; contemporary ideas of individual responsibility.

266A–266B. Seminar in Social Psychological Approaches to the Study of Crime. (4-4)
One 3-hour seminar. Emphasis will be on psychological models of deviant conduct with discussion of current research and theories. Credit and grade will be awarded upon completion of the full sequence.

274. Selected Problems in Scientific Evidence. (3)
One 1-hour seminar and one 4-hour laboratory per week.

275. Seminar in Scientific Evidence. (2)
One 2-hour seminar. May be repeated for credit. Topics to vary.

276. Advanced Forensic Toxicology. (4)
One 2-hour seminar and 4 laboratory hours.

277. Advanced Forensic Instrumentation. (4)
One 2-hour seminar and 4 laboratory hours.

278. Advanced Comparative Evidence and Evaluation. (4)
One 2-hour seminar and 4 laboratory hours.

279. The Role of Scientific Evidence in the Administration of Justice. (3)
One 3-hour seminar. Advanced study of operational concepts of investigative, legal, and scientific professions as affecting discovery, preservation, and examination of physical tracings from negligent or criminal events. The specific advantages and limitations of scientific interpretations.

280. Seminar in the Juvenile Justice System. (4)
One 3-hour seminar per week. An historical and sociological analysis of the social control of juvenile offenders. The seminar will examine the development of the juvenile court system, the problem of casework vs. law, the Model Youth Act, and some problems in legal definitions and jurisdictions.

281. Seminar in Law Enforcement Systems Analysis. (4)
One 3-hour seminar per week. A systems analysis of law enforcement (police) with special emphasis upon an analysis of law enforcement as a formal organization.

282. Seminar in Sociological Theories of Correctional Systems. (4)
One 3-hour seminar per week. Probation, parole and prison will be examined as formal organizations with special emphasis upon problems of professionalism, supervisory styles, administrative vs. professional conflict, etc.

283. Seminar in Sociological Perspectives in the Criminal Justice System. (4)
One 3-hour seminar per week. A comparative analysis of agencies, such as the police, county jails, probation, prisons, etc., in the administration of criminal justice, leading to differential processing of the delinquent and criminal; factors contributing to differential outcomes will be examined.

290A–290B. Seminar in Crime Investigation. (4-4)
One 3-hour seminar. (F, W)

292A–292B. Seminar in Police Administration. (4-4)
One 3-hour seminar.

293A–293B. Seminar in the Administration of Criminal Justice. (4-4)
One 3-hour seminar.

295. Seminar in Police-Community Relations. (4)
One 3-hour seminar per week.

298. Directed Group Study. (2-6)
Individual conferences. The Staff (Su, F, W, Sp)

299A. Research and Special Study for Master Candidates. (2-6)
Individual conferences, research, internship, and supervised field study. The Staff (Su, 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 or not passed basis. The Staff (Su, 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. 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 D.Crim. 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)

Law 278. Selected Problems in Criminal Law and Administration. (2)
One 2-hour seminar. Mr. Sherry

IDS 175. A Nontechnical Introduction to Operations Research. (4)
See Interdepartmental Studies for the complete description of this course.
The study of demography deals with the determinants and consequences of population growth, and with both the biological structure and social characteristics of human populations. It is closely related to other social science fields such as economics and sociology, as well as to the biological sciences. It also involves the tools of statistics and mathematics. The demography department at Berkeley focuses the pertinent elements of kindred disciplines on the study of population, building the curriculum in an integrated fashion around a core of demographic knowledge.

**Preparation for Graduate Study**

Students usually elect to concentrate on demography only at the graduate level, and may enter the field from a diversity of undergraduate majors in the social and biological sciences or in mathematics and statistics. All students, as part of their undergraduate prerequisites, are expected to have completed a year of college-level economics, mathematics, sociology or demography, statistics, and biology. Deficiencies in these areas may be remedied after admission to graduate standing.

**Graduate Programs**

The Department of Demography offers work leading to the M.A. and Ph.D. degrees in demography. Typical areas of specialization include population theory, mathematical demography, fertility, mortality, the labor force, historical demography, population distribution and ecology, and urban demography. Further information is available from the graduate adviser in M24 Wheeler Hall.

**Upper Division Courses**

100. Contemporary Population Problems and Policies. (4)

Three 1-hour lectures and one 1-hour section meeting per week. A general introduction to present-day demographic analysis: population growth, "over-population," population problems of developing countries, the demography of minority groups, birth control and population policy, international migration, urban demography, the labor force, aging. Mr. van de Walle, Mr. Espenshade (W, Sp)

120. Population and Modernization. (4)

Three 1-hour lectures and one 1-hour section meeting per week. Analysis of the importance of population size, growth, and age composition for the process of economic development. The causes and consequences of rapid rural-urban migration. The effect of modernization on levels of fertility, mortality, and morbidity. The "low-income" trap. Mr. Preston (W)

130. Demography of American Ethnic Groups. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Uses demographic data and techniques to study ethnic groups and their relations in the United States. Population trends and differences, differentials in fertility, mortality, migration, marriage patterns, labor force participation, and urbanization, together with associated social and economic characteristics. Mr. Schoen (W)

140. Population Change in Tropical Africa. (4)

Three 1-hour lectures and one 1-hour section per week. Modern techniques for understanding the size, characteristics, and changes in sub-Saharan populations. Fertility, mortality, migration, and marriage patterns. Comparative demographic analysis of the Congo, former French and English colonies, Portuguese Africa, the Sudan, and Nigeria. Mr. van de Walle (Sp)

**Graduate Courses**

Prerequisites for graduate courses: one year each of college-level mathematics and statistics, or the consent of the instructor. Additional prerequisites for individual courses are indicated in conjunction with the course listing.

**NOTE:** For key to footnote symbols, see page 78.
200. Contemporary Demographic Theory. (3)
Three 1-hour lectures per week. Introduction to modern theory of causes, components, and effects of population change. Main topics: transition theory, economic and sociological reasoning applied to population, logic of stable and quasi-stable population analysis, demographic aspects of human evolution.
F

201. History of Demographic Theory and Analysis. (3)
Three 1-hour lectures per week. Brief critical history of population theories, including pre-Malthusian reasoning, Malthusian doctrine, Marxist views, optimum population theory, and the demographic assumptions underlying social and economic policies in the nineteenth and early twentieth centuries.
Mr. Keyfitz (W)

210A–210B. Basic Methods of Demographic Analysis. (4–4)
Three 1-hour lectures and one 2-hour laboratory per week.
210A. Prerequisite: Mathematics 1A–1B–1C, Statistics 130A–130B–130C (may be taken concurrently), or equivalents. Introduction to statistical and mathematical procedures in population analysis. Gathering, processing and evaluating registration and census data. Procedures of mortality and fertility analysis, population projections, and estimation.
Mr. Preston (F)

210B. Prerequisite: Demography 210A. Mathematics of stable populations, internal migration estimates, measurement of social characteristics and population distribution, record-matching, data banks.
Mr. Preston (W)

212A–212B. Techniques of Demographic Survey and Field Studies. (3–3)
Two 1-hour lectures and one 2-hour laboratory per week.
212A. Prerequisite: Mathematics 1A–1B–1C or equivalent. It is recommended that students will have taken Statistics 166. Basic survey techniques as applied to the study of fertility, morbidity, labor-force participation, marital history. Includes schedule construction, survey sampling, measurement, sampling and nonsampling errors. Critical review of major demographic surveys.
(W)

212B. Prerequisite: Demography 212A. Techniques of data analysis; student research projects.
(Sp)

217. Mathematical Demography for Advanced Students. (3)
One 2-hour lecture and one 2-hour laboratory per week. Prerequisite: Demography 210A–210B, Statistics 203A–203B–203C or consent of instructor. Use of computers for standardization, life table construction, intrinsic rates, projections, multiple decrement tables, period and cohort rates, the study of migration. Application of stochastic models to demographic research problems.
Mr. Keyfitz (Sp)

220. Human Fertility. (3)
Three 1-hour lectures per week. Prerequisite: Demography 210A–210B or consent of instructor. Measurement techniques applied to the determination of levels, trends, and differences in fertility.
Factors determining these aspects including age at marriage, time within unions, birth control, and fetal mortality. Effect of fertility on population growth and structure. Fertility control programs.
Mrs. Davis (F)

230. Human Mortality. (3)
Mr. Preston (Sp)

240. Population Distribution, Ecology, and Internal Migration. (3)
Three 1-hour lectures per week. Prerequisite: Demography 210A–210B or consent of instructor. Human populations analyzed from the standpoint of their spatial distribution and movement. Special attention to rural-urban migration, metropolitan structure, interregional movement, and demographic aspects of land use.
Mr. Keyfitz (W)

244. International Migration. (3)
Three 1-hour lectures per week. Prerequisite: Demography 210A–210B or consent of instructor. Types of international migration and the theory of their causation and consequences. History and analysis of major migratory movements. Migratory aspects of slavery, indentured labor, contract labor, refugee movements, and conquests. Migration related to conditions in sending and receiving countries.
Mr. Fox (Sp)

250. Population Structure and Characteristics. (3)
Three 1-hour lectures per week. Prerequisite: Demography 210A–210B or consent of instructor. Collection and analysis of census and registration data on population traits such as age, sex, marital status, family and household composition, race, education, occupation, income, religion, language, and ethnicity. Comparative international population characteristics. Population structure and economic and social development.
Mr. Keyfitz (W)

252. Demographic Aspects of the Labor Force. (3)
Three 1-hour lectures per week. Prerequisite: Demography 210A–210B, Economics 100A–100B or consent of instructor. Development of manpower, economically active, and labor-force concepts. Size and characteristics of the labor force (its age-sex, occupational, industrial, educational, familial, and racial composition) in relation to socioeconomic and demographic change; location, movement, and comparative analysis.
Mr. Preston (Sp)

260. Historical Demography. (3)
Three 1-hour lectures per week. Prerequisite: Demography 200 and 210A–210B or consent of instructor. Analytic methods of demography applied to an understanding of the structure and changes of populations where data of modern statistical type are not available. Emphasis on population in preindustrial and early industrial stages of development.
Mr. van de Walle (W)
270. Population Policy. (3)

Three 1-hour lectures per week. Prerequisite: Demography 200 and 210A–210B or consent of instructor. The nature of population policy and an evaluation of its effects on major demographic variables in the history of industrial societies. Demography of social stratification. Economic, social, and political implications of a static or declining population. Policy in developing countries.

Mrs. Davis (Sp)

274. Demographic Aspects of Social and Economic Development. (3)

Three 1-hour lectures per week. Prerequisite: Demography 200, 210A–210B, and Economics 100A–100B or consent of instructor. Comparative analysis of size, structure, movement, and distribution of populations during economic and social modernization. Demographic changes as causes and consequences of socioeconomic change. Noneconomic factors in population change. Contemporary underdeveloped countries contrasted with history of now-industrialized nations.

Mr. Fox (F)

280. Population Change and Structure in the United States. (3)

Three 1-hour lectures per week. Prerequisite: Demography 210A–210B, 220 or 230, and 240 or 244, or consent of instructor. History of demographic statistics. Vital trends compared with other developed countries. Unique aspects of migration into and within the country. Immigration and American social and economic development. American population characteristics. Projections for areas of variable size.

284. Comparative Demography of Latin America. (3)

Three 1-hour lectures per week. Prerequisite: Demography 210A–210B, 220 or 230, and 240 or 244, or consent of instructor. Trends in mortality, fertility, and migration. Special analytical problems: measurement of nonmarital reproduction; effect of changing infant mortality on fertility behavior; causes of rising fertility; unique character of Latin American urbanization; intraregional migration; population and development.

Mr. Arriaga (Sp)

292. Seminars. (2–3)

Topics: (a) Population Theory, (b) Statistical and Mathematical Applications in Demography, (c) Human Fertility, (d) Human Mortality, (e) Population Distribution and Migration, (f) Methods and Topics in Historical Demography, (g) Population Policy, (h) Additional seminars on special topics to be announced.

The Staff (Su, F, W, Sp)

295. Research. (1–8)

Individual research under the supervision of a staff member.

The Staff (Su, F, W, Sp)

299. Directed Advanced Research (leading to Ph.D.). (3–12)

The Staff (Su, F, W, Sp)

390. Professional Preparation: Teaching. (3)

The Staff (Su, F, W, Sp)

602. Individual Study. (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 M.A. and Ph.D. May not be used for unit or residence requirements for either the masters or doctoral degrees. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (Su, F, W, Sp)

DIVISION OF INTERDISCIPLINARY AND GENERAL STUDIES

Professors:
Hans J. Bremermann, Ph.D.
Alain Renoir, Ph.D. (Chairman)
Leo Lowenthal, Ph.D. (Emeritus)

Associate Professors:
Eric S. Gruen, Ph.D.
James L. Larson, Ph.D. (Vice-Chairman)

Assistant Professors:
Michael N. Nagler, Ph.D.
Kenneth Weisinger, Ph.D.

Assistant Professors:
Constance R. Aratow, CPh (Acting)
Joel B. Lidov, M.A. (Acting)
William Mullen, M.A. (Acting)

Lecturers:
James E. Knapton, M.A.
Sabina Johnson, M.A.

Instructors:
Fernando J. Levy, C.Ph. (Acting)

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 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 courses in humanities or natural science or social science for the requirement of eight courses outside the area of the major. Credit and grade are normally assigned upon completion of the entire sequence, but

NOTE: For key to footnote symbols, see page 78.
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 1972 additional majors in the Arts and the Sciences. Information concerning these may be requested from the Division of Interdisciplinary and General Studies, 29 Dwinelle Hall, University of California, Berkeley, California 94720.

The Field Majors

1. 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  
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 100A–100B and 190); (2) one course each on two major Greek or Roman philosophers (if the texts are read in the original language, a non-philosophical author may be substituted) and one course on the Bible; (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.

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 H198) 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

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, 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.

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.

The Staff

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.

The Staff

The Humanities

Lower Division Courses

1A-1B-1C-1D-1E-1F, Creation and Transmission in the Humanities. (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 humanities. Materials will be drawn primarily from philosophy, literature, and the motion pictures; 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.

Mr. Larson (in charge) (begins F)

12. Foreign Language Workshop. (4-12)

Twelve 1-hour lecture and discussion periods per week. Especially designed for students in the fourth quarter of a lower division sequence of the Division, but open to others with instructor’s permission. Intensive instruction in a foreign language. May be repeated for credit with a different language. Unit value to be assigned in view of the student’s previous preparation in the language.

Mr. Renoir (in charge) (F)

48. Special Projects in the Humanities. (1-5)

Tutorial meetings to be arranged. Prerequisite: limited to students currently enrolled in Humanities 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.

Mr. Larson (in charge) (F, W, Sp)

Upper Division Courses

103A-103B. Aims and Materials of the Humanities. (4-4)

Three 1-hour lecture and discussion periods per week. Prerequisite: Humanities 1A-1B-1C-1D-1E-1F or an approved combination of courses covering similar materials. This course attempts to determine the province and the goals of the humanities through the examination of literary, philosophical, and immediately related materials considered in relation to materials from the other disciplines.

Mr. Johnson, Mr. Mullen (F-W);
Mr. _______ (W-Sp).

190. Senior Problems in the Humanities. (4)

Three 1-hour discussion periods per week. Prerequisite: Humanities 100A-100B and at least 12 upper division units in literature and philosophy, including at least one course on a Greek or Roman author. Application of the methods of the humanities to a problem in literature, philosophy, or an immediately related area.

Mr. Larson (in charge) (W, Sp)

H198. Honors Course. (1-5)

Prerequisite: honors standing, 20 units of upper division literature and philosophy including course 100A-100B 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. Larson (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 79. Must be taken on a passed or not passed basis.

Mr. Larson (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.

The Staff

48. Special Projects in the Sciences. (1-5)

Tutorial meetings to be arranged. 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 project, regardless of the number of quarters and units involved.

The Staff (F, W, Sp)
The Social Sciences

Lower Division Courses


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.

The Staff (F, W, Sp)

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. Mr. Coale (in charge) (F, W, Sp)

103A–103B. Aims and Materials of the Social Sciences. (4–4)

Three 1-hour lectures and discussion periods per week. Prerequisite: Social Sciences 1A–1B–1C–1D–1E–1F or an approved combination of courses covering similar materials. This course attempts to determine the province and the goals of the Social Sciences through the examination of historical, social-scientific, and immediately related materials considered in relation to materials from the other disciplines.

Mr. Coale, Mr. Lowenthal (F–W)

Mr. ——, Mr. —— (W–Sp)

190. Senior Problems in the Social Sciences. (4)

Three 1-hour discussion periods per week. Prerequisite: 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.

Mr. Gruen, Mr. —— (W, Sp)

H198. Honors Course. (1–5)

Prerequisite: honors standing, 20 units of upper division history and other social sciences including course 100A–100B 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.

The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)

Class hours to be arranged. Enrollment is restricted by regulations on page 79. Must be taken on a passed or not passed basis. Mr. Gruen (F, W, Sp)

DRAMATIC ART

(Department Office, 120 Dwinelle Annex)

Professors:

Travis Bogard, Ph.D.
Robert W. Goldsby, M.F.A.
Henry May, B.A. (Chairman)
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:

Charles R. Lyons, Ph.D.

Dunbar H. Ogden, III, Ph.D.

Assistant Professors:

Jean-Bernard Bucky, I² M.F.A.
Douglas A. Johnson, M.F.A.
John Warren Travis, M.F.A.

Lecturers:

George Ulnic, B.A.
Jane Mazzone-Clementi, B.F.A.

The Major

Lower Division Dramatic Art 10, 20A–20B–20C, 45A–45B.

Upper Division Forty-five units of upper division courses in the Department of Dramatic Art including: 120, 181; 10 units chosen from courses 122, 123A, 123B, 123C, 124, 125, 126, 127; at least 2 and not more than 5 units of 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.

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

NOTE: For key to footnote symbols, see page 78.
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.

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 (190, 290) may be earned by work in production. For further information, inquire at the office of the Department of Dramatic Art. Undergraduate majors and graduate students are required to participate in General Tryouts, held during the academic year for faculty-directed performances.

Graduate Programs

Preparation for Graduate Study The background of a student undertaking work toward an advanced degree should approximate the undergraduate major in the Department of Dramatic Art at Berkeley. Applicants for admission who have serious deficiencies may be required to take the necessary work by enrolling as students in limited status in the College of Letters and Science until the deficiencies have been remedied.

Requirements for the M.A. Degree Forty-five units of graduate and upper division work in the Department of Dramatic Art, including one of the following first-year courses: 222A–B–C, 223A–B–C, 224A–B–C, 225A–B–C; one of the following second-year courses: 210A–B–C, 239A–B–C, 250A–B–C, 260A–B–C; a language examination in either French or German; the M.A. qualifying examination.

Requirements for the Ph.D. Degree Graduate work in the Department of Dramatic Art, including one of the following first-year courses: 222A–B–C, 223A–B–C, 224A–B–C, 225A–B–C; the following second-year course: 260A–B–C; two language examinations, each in a language where there is a major body of dramatic literature, including French and/or German; the Ph.D. qualifying examination; a Ph.D. dissertation.

For further details on the requirements for the M.A. and Ph.D. degrees, consult the Graduate Division Section of this catalogue, and the Department Office in 120 Dwinelle Annex.

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

Acting

Unless cast during General Tryouts, each student in 11A–11B or in an upper division acting class 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.

Lower Division Courses

10. Introduction to Acting. (5)

Five 1-hour sessions per week. Prerequisite: consent of instructor. Mr. Bucky (F)

11A–11B. Beginning Scene Study and Voice Work. (5–5)

A sequence course. 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.

Mrs. Carlin, Mrs. Mazzone (W, Sp)


Courses to be taken consecutively, beginning fall quarter. Five 2-hour sessions per week. Prerequisite: one year of undergraduate work in acting or the equivalent, including voice training, and consent of instructor. 110A is prerequisite to 110B; 110B is prerequisite to 110C. Mrs. Carlin, Mrs. Mazzone, Mr. Johnson (F, W, Sp)
Upper Division Courses

111A—111B—111C. Advanced Problems of Acting. (5-5-5)

Courses to be taken consecutively, beginning fall quarter. Five 11/2-hour acting sessions per week. Prerequisite: 110A—110B—110C and consent of instructor. Performance examination is required at end of each quarter. 111A is prerequisite to 111B; 111B is prerequisite to 111C. Characterization and interpretation and preparation of scenes; stage makeup; problems of oral interpretation.

112A—112B—112C. Advanced Study of Voice and Speech. (4-4-4)

Five 11/2-hour lectures per week. Prerequisite: consent of instructor.

112A: Problems of voice and speech in the theatre and methods of correction and direction.

112B: Problems of speaking verse and prose in the theatre.

112C: Study of dialect for use in theatre.

Graduate Course

210A—210B—210C. Advanced Acting: Company Class. (5—5—5)

Five 2-hour sessions per week. Prerequisite: two years of undergraduate work in acting or the equivalent, including voice and speech training, and consent of instructor. May be repeated for credit.

Mr. Lyons (F); Mr. Goldsby (W); Mr. Oliver (Sp)

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.

Upper Division Courses

129A—129B. Dance History. (5-5)

Three 1-hour lectures, two 1-hour studios per week. Prerequisite: consent of instructor.

129A: Primitive to Renaissance.

129B: Renaissance to Twentieth-Century.

129A, Mr. Wood (F); 129B, Mr. Wood (W)

140A—140B—140C. Beginning Dance Technique. (1-1-1)

Five 11/2-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. (F, W, Sp)

141A—141B—141C. Intermediate Dance Technique. (1-1-1)

Five 11/2-hour studios per week. Prerequisite: 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. (F, W, Sp)

142A—142B—142C. Advanced Dance Technique. (1-1-1)

Five 11/2-hour studios per week. Prerequisite: 141A—141B—141C or consent of instructor. Refinement of movement techniques and qualitative analysis of movement with regard to rhythm, dynamics and style. Must be taken on a passed/not passed basis.

Mr. Wood (F, W, Sp)

143A—143B—143C. Company Class. (1—1—1)

Five 11/2-hour studios. Prerequisite: 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.

Mr. Wood (F, W, Sp)

144A—144B. Sources of Movement. (3—3)

One 11/2-hour lecture and two 11/2-hour studios. Prerequisite: 144A—144B—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. Mr. Wood (W, Sp)

146A—146B—146C. Choreography. (5—5—5)

Two 11/2-hour lectures and three 11/2-hour studios. Prerequisite: 144A—144B—140C. 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)

162A—162B—162C. Repertory and Production. (5—5—5)

Five 11/2-hour studios. 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.

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

262A—262B—262C. Repertory and Production. (5—5—5)

Five 11/2-hour studios. 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.

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

Design and Lighting

Upper Division Courses

154A—154B. Theory of Stage Costume. (5—5)

Three 1-hour lectures and two 1-hour laboratories per week.

Mr. Travis (F, W)

155A—155B. Theory of Design for the Theatre. (5—5)

Three 11/2-hour lectures per week. Prerequisite: 155A is prerequisite to 155B.

Mr. May (W, Sp)

156A—156B. Theory of Lighting Design. (5—5)

Three 11/2-hour lecture/laboratories per week.

Mr. Travis (W, Sp)
Related Courses in Other Departments

Form in Drawing (Art 2A).
The Classic Myths (Classics 28).
Greek Tragedy (Classics 35).
Mythology (Classics 178).
Drama (Classics: Greek 103).
Romantic Comedy (Classics: Latin 145A).
Historic Costume (Design 146A–146B).
Shakespeare (English 117A–117B, 117E).
The English Drama to 1603 (English 114A).
The English Drama, 1603–1700 (English 114B).
British and American Drama, 1860 to the Present (English 114C).
Nineteenth-Century German Drama (German 115A–115B).
Twentieth-Century German Drama (German 121A–121B).
Italian Literature of the Eighteenth Century (Italian 114).
Italian Literature of the Twentieth Century (Italian 117A–117B).

DUTCH

For courses in the Dutch language and literature see listing under Department of German.

ECONOMICS

(Department Office, 250 Barrows Hall)

Professors:
Joe S. Bain, Jr., Ph.D.
George F. Break, Ph.D., (Chairman)
Carlo M. Cipolla, † Laurea
Malcolm M. Davison, J.D., Ph.D.
Gerard Debreu, † D.Sc.
Albert Fishlow, Ph.D.
David Gale, Ph.D.
Robert A. Gordon, Ph.D.
Gregory Grossman, Ph.D.
Bent Hansen, Ph.D.
John C. Harsanyi, Ph.D.
Charles J. Hitch, M.A., LL.D. (hon.), D.Sc. (hon.)
Sidney S. Hoos, Ph.D.
Clark Kerr, Ph.D., LL.D.
Frank L. Kidner, Ph.D.
George M. Kuznets, Ph.D.
John M. Letiche, Ph.D.
Daniel L. McFadden, Ph.D.
Roy Radner, Ph.D.
Earl R. Rolph, Ph.D.
Lloyd Ulman, Ph.D.
Benjamin N. Ward, Ph.D.
John B. Condiffe, Sc.D., LL.D., L.Litt, (Emeritus)
Ira B. Cross, Ph.D., LL.D. (Flood Professor, Emeritus)
Howard S. Ellis, Ph.D., LL.D. (Flood Professor, Emeritus)
Ewald T. Grether, Ph.D., LL.D., ekon. dr. (hon. c.), (Flood Professor, Emeritus)
Charles A. Gulick, Ph.D., (Emeritus)
Emily H. Huntington, Ph.D., LL.D. (hon.), (Emeritus)
Melvin M. Knight, Ph.D., (Emeritus)
Carl Landauer, Ph.D., LL.D., Dr. rer. pd. h. c., (Emeritus)
Abba P. Lerner, Ph.D., (Emeritus)
Paul S. Taylor, Ph.D., LL.D. (hon.), (Emeritus).

Associate Professors:
George A. Akerlof, † Ph.D.
Steven M. Goldman, Ph.D.
Thomas J. Rothenberg, † Ph.D.

Assistant Professors:
Darius W. Gaskins, Jr., Ph.D.
Lovel S. Jarvis, Ph.D.
Frank S. Levy, † Ph.D.

NOTE: For key to footnote symbols, see page 78.
The Major

Students will be admitted to the major who have satisfactorily completed Economics 1A–1B 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 100C; (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 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

1A–1B. Elementary Economics. (5–5)
(Formerly numbered 1 and 3)
Three hours of lecture and two hours of lab per week. Introduction to issues concerning resource allocation, macroeconomics and public policy, with applications. The Staff (F, W, Sp)

Upper Division Courses

Prerequisite: for 103A–103B, junior standing. For all other courses, unless otherwise specified in the individual course description: Economics 1A–1B or 103A–103B. Students who complete 103A may not receive credit for 1A; those who complete 103B may not receive credit for 1B.

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)

100C. Quantitative Data and Methods. (5)
Four and one-half hours per week. Prerequisite: course 100A and Statistics 2. An introduction to the sources and uses of economic data, illustrated by typical empirical studies. Recommended for economics majors in the junior year. Mr. Rothenberg

Four and one-half hours per week. Prerequisite: four quarters of undergraduate mathematics and
102. Capital and Economic Growth. (5)
Four and one-half hours per week. Prerequisite: course 100A or 101A and 100B or 101B. Production over time, capital, and interest. Theories of economic growth in advanced economies.

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. Mr. Therkildsen (F, 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 (W)

*106. Economics of Marxism. (5)
Four and one-half hours per week. The economic thought of Marx and his followers.

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 (F)

*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. (Su, F)
112B. A general survey of the economic history of Europe, beginning with the Industrial Revolution and ending with World War I. (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 (W); Mr. Sutch (Sp)

*114. Economic Development and Problems of Latin America. (5)
Four and one-half hours per week. Evolution of Latin-American economies in terms of basic institutions and international influences; standards of living; problems of monocultures; land tenure systems; problems of improving agricultural methods; foreign investment; industrialization and related problems. (Sp)

*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.

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 (F)

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 (W)
118B. The Soviet economy (advanced topics); other East European economies; the Communist bloc as a whole.

130. Government Finance. (5)
Four and one-half hours per week. Budget-making, expenditures, public debt, taxation, and fiscal policy at federal, state and local levels. Primarily for students not majoring in economics. Mr. Davisson (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 (W)

135. Money and Banking. (4)
Four hours of lecture and discussion 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. Gordon (F)

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. Sutch (W)

*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.

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 154. Mr. Ulman (W)

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. Mrs. Strober (Sp)
195A–195B. Seminar in Economics. (5–5)

(Formerly numbered H195A–H195B–H195C)

Four and one-half hours per week. Prerequisite: 100A or 101A or 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 discussion of topics in economic policy and economic theory. 195B will be devoted to discussion of papers prepared by students for presentation to the seminar.

Mr. Jarvis, Mr. Rolph (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.

Mr. Akerlof (W, Sp)
tainty; 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.

Mr. Hansen (W)

202D. Capital, Investment, and Optimal Growth.

The nature of capital; formal models of production possibilities in time; techniques of intertemporal 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.

Mr. Goldman (F)

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.

Mr. Letiche (F, W)

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 as wide a 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: ——— (F)

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.

—— (F); Mr. Radner (W); ——— (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. Fishlow (F)

210B. European Economic History. Major issues in European Economic History. — (F)

210C. United States Economic History. Major issues in United States economic history. ——— (Sp)

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.


Three hours per week.

216A. Prerequisite: course 116 or consent of instructor. Economic systems.

Mr. Ward (F)

216B. Prerequisite: course 115A. Economies 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 (Sp)

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.


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. 230A: Mr. Break (F); 230B: Mr. Rolph (W); 230C: Mr. Rolph (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.

Mr. Rolph (F); Mr. Break (Sp)

234A–234B. Monetary Theory. (5–5)

Three hours per week. Analysis of monetary theory and institutions. Mr. Sutch (W); Mr. Akerlof (Sp)

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. (W)
EDUCATION

(Department Office, 1501 Tolman Hall)

Professors:
Millie Almy, Ph.D.
Charles S. Benson, Ph.D.
Eli M. Bower, Ed.D.

NOTE: For key to footnote symbols, see page 78.

236A–236B–236C. Aggregate Economics. (5–5–5)
(Formerly numbered 233, 236, 237)
Three hours of lecture per week. Prerequisite: Economics 201A–201B–201C. Theories of growth and cyclical 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. Hanson (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. Gaskins (Sp)

241A–241B. Econometrics. (5–5)
Three hours per week. Prerequisite: Statistics 133B or equivalent and one course in linear algebra.

Sequence beginning 241A: Mr. Zarembska (F);
241B: Mr. Rothenberg (W)

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 (F); Mr. McFadden (W)

250A–250B–250C. Advanced Labor Economics.
(3–1–1)
Prerequisite: economics graduate students who wish to take 250A after 250B–250C should consult the instructor. Analysis of labor market behavior. 250A: letter grade will be awarded. Credit and grade for 250B–250C will be awarded upon completion of full sequence. 250B–250C will be taught partly in conjunction with Interdepartmental Studies 260.

Mr. Ulman (F, W, Sp)

251. Labor 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. Ulman (F, W, Sp)

Three hours of lecture per week. Prerequisite: Economics 201A–201B–201C. In addition Economics 202A is required for 280C. Facts and theory related to development of poor countries. Aggregated models for development, External economics and economics of scale. Development problems in foreign trade, agriculture, industry and public sector. Mone-


280A, 280B: Mr. Jarvis, Mr. Fishlow (F, W);
280C: Mr. Radner, Mr. Hansen (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. Hansen, Mr. Jarvis (W); Mr. Fishlow (Sp)

288. Population and Economic Development. (5)
Three hours per week. Population and migration problems in economic development.

Mr. Wiseman (F)

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. Zarembska (W);
290B: Mr. Nadel (Sp)

291. 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.

Mr. Nadel (F); Mr. Letiche (Sp)

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. 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.

The Staff (F, W, Sp, Su)

299. Individual Study. (3–5)
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.

IDS. 290A–290B–290C. Economics of Decision, Information, and Organization. (5–5–4)
See Interdepartmental Studies for complete description of this course.

IDS. 260. Patterns in Collective Bargaining. (3)
See Interdepartmental Studies for complete description of this course.
Arthur R. Jensen, Ph.D.
Henry F. Kaiser, Ph.D.
Frederic Lilge,† Ph.D.
Walter D. Loban, Ph.D.
Jack London, Ph.D.
Leland L. Medsker, Ed.D.
John U. Michaelis, Ph.D.
Theodore L. Reller, Ph.D. (Chairman)
William D. Rohwer, Jr., Ph.D.
Lloyd F. Scott, Ph.D.
Lawrence H. Stewart, Ed.D.
James C. Stone, Ed.D.
Dale Tillery, Ph.D.
Desbold B. Van Dalen, Ph.D.
Staten W. Webster, Ph.D.
Alan B. Wilson,† Ph.D.
Edna W. Bailey, Ph.D. (Emeritus)
William A. Brownell, Ph.D., LL.D. (Emeritus)
Guy T. Buswell, Ph.D., LL.D. (Emeritus)
Harold D. Carter, Ph.D. (Emeritus)
Luther C. Gilbert, Ph.D. (Emeritus)
Mary C. Jones, Ph.D. (Emeritus)
George C. Kyte, Ed.D. (Emeritus)
S. E. Torsten Lund, Ph.D. (Emeritus)
Thomas R. McConnell, Ph.D., LL.D., D.H.L. (Emeritus)
Edgar L. Morphet, Ph.D. (Emeritus)
J. Cecil Parker, Ed.D. (Emeritus)
J. Chester Swanson, Ph.D. (Emeritus)

guy Benveniste, Ph.D.
Shirley S. Chater, Ph.D.
Geraldine Joncich Clifford, Ed.D.
Donald A. Hansen, Ph.D.
Curtis D. Hardyck,† Ph.D.
John G. Hurst, Ph.D.
Kenneth R. Johnson, Ed.D.
Nadine M. Lambert,† Ph.D.
Leonard A. Marascuilo, Ph.D.
Richard D. Mosier, Ph.D.
Virginia L. Olesten, Ph.D.
Robert B. Ruddell, Ed.D.
William A. Watts, Ph.D.

James W. Guthrie, Ph.D.
C. Marshall Lowe, Ph.D.
Lawrence F. Lowery, Ed.D.
John David Miller, Ph.D.
Rodney J. Reed, Ph.D.
Herbert D. Simons, Ph.D.
M. I. Charles E. Woodson, Ph.D.

Lecturers:
Charles C. Collins, Ph.D.
Glen H. Grant, Ed.D.
Lavinia G. Hammond, Ph.D.
Barbara Kirk, M.A.
John P. Matlin, Ed.D.
William H. Riggle, Ed.D.
Herbert E. Salinger, Ed.D.

Supervisors:
J. Oswaldo Asturias,† M.A. (Foreign Languages)
Neva Aubin, M.A. (Elementary)
Chester H. Case, Ph.D. (Social Sciences)
Marilyn H. Cutright, M.A. (Elementary)
Enoch Dumas, Ed.D. (Elementary)
James R. Gray, M.A. (English)
Donald M. Hatfield, Ph.D. (Science)
Margaret C. Jackson, M.A. (Foreign Languages)
George H. Kyne, Ph.D. (Music)
Kenneth S. Lane, B.A. (English)
Constance C. L'Aventure, A.B. (Social Sciences)
Mark C. Luca, Ph.D. (Art)
Barbara J. Lufkin, M.A. (Elementary)
Ronald W. Lundeberg, M.A. (Elementary)
Eugene McCreary, M.A. (Social Sciences)
Grace M. Maertins, M.A. (English)
Arnold R. Pagano, Ed.D. (Elementary)
Gérard A. Poirier, Ph.D. (Foreign Languages)
Michael B. Preston, M.A. (Social Sciences)
Leo R. Ruth, M.A. (English)
Karl E. Schevill, Ph.D. (Foreign Languages)
Philip J. Sinnott, M.A. (Elementary)
Harry B. Stehr, Jr., M.A. (Social Sciences)
Alvin H. Thompson, Ed.D. (Social Sciences)
Thomas C. Walker, M.A. (Social Sciences)

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. Ammon (F); Mr. Hurst (F, W, Sp);
Mr. Jensen (F, W)

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. ——— (F)
118B. Foundations of Educational Research. (3)
One 3-hour lecture per week. Prerequisite: course 118A or equivalent, or consent of instructor. 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. (W); Mr. Watts (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. Kaiser (F, W); Mr. Marasculo (F)

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. Marasculo (W)

130. The School in America. (1-3)
One 1-hour lecture per week; two 1½-hour lectures, or three 1-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. May be repeated for 1 unit with credit and grade assigned upon completion of 3 units. Mr. Poirier (F, W, Sp); Miss Almy, Mr. Matlin, Mr. Webster (F); Mrs. Clifford (W)

131. The Elementary School Curriculum. (3-3-3-3-3)
Purposes, content, organization, instructional materials, and evaluation of subjects in the curriculum.

131A. Arithmetic.
Two 1½-hour lectures per week. Prerequisite: consent of instructor. (F, W)

131B. Music.
Two 1½-hour lectures per week. Prerequisite: consent of instructor. Mrs. Aubin (F, Sp)

131C. Reading and Language Arts.
Two 1½-hour lectures per week. Prerequisite: consent of instructor. (F, W)

131D. Social Sciences.
Two 1½-hour lectures per week. Prerequisite: consent of instructor. (F, W)

131E. Foreign Languages.
Two 1½-hour lectures per week. Prerequisite: consent of instructor. Mr. Poirier (Sp)

131F. Science.
One 1½-hour lecture and one 1½-hour laboratory per week. Prerequisite: consent of instructor and one year of laboratory science. Mr. Lowery (F, W, Sp)

131H. Art.
One 3-hour lecture per week. Prerequisite: consent of instructor. Mr. Luca (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 (F, Sp)

191. Experimental Courses.

191F. Teaching the Language Arts to Speakers of Nonstandard Dialects. (3)
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, and language arts and teaching strategies to correct interference. Mr. Johnson (W, Sp)

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. Mrs. Clifford (F); Mr. Hansen (Sp)

193. Psychological Foundations of Education. (3)
Two 1½-hour lectures per week. Mr. Hurst (F)

194. Humanistic Foundations of Education. (3)
Two 1½-hour lectures per week. A history of educational thought with concentration on the epistemological, logical, and ethical foundations of major educational theories from Plato to the present. Mr. Jarrett (F, Sp)

197. Field Studies. (1-6)
Prerequisite: Upper division standing and consent of instructor, division spokesman, and community agency. Written proposal must be approved by the advisory committee. University organized and supervised field projects involving experiences in school and school-related activities. Projects will be reviewed twice each quarter and evaluated in terms of success or failure in reaching stated objectives. 197A. Policy Planning and Administration. The Staff (F, W, Sp)

197B. Counseling Psychology. The Staff (F, W, Sp)

197C. Curriculum and Instruction. The Staff (F, W, Sp)

197D. Educational Psychology. The Staff (F, W, Sp)

197E. Higher Education. The Staff (F, W, Sp)

197F. Social and Humanistic Foundations. The Staff (F, W, Sp)

197G. Teacher Education. The Staff (F, W, Sp)

198. Directed Group Study for Undergraduates. (1-5)
Prerequisite: consent of instructor. Group studies of selected topics which will vary from quarter to quarter. The Staff (F, W, Sp)

199. Supervised Independent Study and Research for Undergraduates. (1-5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

Graduate course numbers which end in 0-4 are introductory courses; numbers which end in 5-9 are advanced courses.

*211A–211B. Proseminar in Educational Psychology. (3-3)
Two 1½-hour seminars per week. Lectures and discussion with staff covering concepts related to and areas of contemporary research.
212. Education and the Psychology of Learning. (3-3-3)
Two 1½-hour lectures per week.

212A. The Learning Process. Mr. Jensen (F)

*212B. The Psychology of Reading. (3)
One 3-hour seminar per week. Prerequisite: courses 119A, 119B, and 219 topic on analysis of variance. A seminar concerned with intensive examination of research problems in reading and the development of suitable experimental methods.

*212C. Topics in Education and Psychology of Learning. Prerequisite: course 212A or equivalent. Topics vary; suggested topics: social psychology of the classroom; programmed instruction; human variability and classroom learning; learning theories; theories of reading; social class influences on learning.


*213A. Standard Tests in Education. (3)
One 2-hour lecture and one 2-hour laboratory per week.

*213B. Informal Classroom Evaluation. (3)
One 2-hour lecture and one 2-hour laboratory per week. Prerequisite: consent of instructor.

213C. Individual Appraisal. (4)
Three hours of lecture and five hours of 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.

Mrs. Lambert (W)

213D. Individual Appraisal. (4)
Three hours of lecture and five hours of 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.

Mrs. Lambert (Sp)

214. Human Development and Education. (3-3-3)
Two 1½-hour lectures per week.

214A. Cognitive Development. Prerequisite: course 193 or equivalent. Mr. Ammon (W)

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)

215. Education of Exceptional Children. (3-3)

*215A. The Exceptional Child. Two 1½-hour lectures and one hour of field work per week. Prerequisite: course 193 or equivalent.

215B. Advanced Topics of Exceptional Children. Two 1½-hour seminars 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: (F) special problems in exceptional children.

Mr. Bower (F)

216. Advanced Educational Psychology. (3-3-3)

216A. Advanced Study in Learning. One 2-hour seminar and one 1-hour discussion per week. Prerequisite: consent of instructor. Topics vary; learning theory, social class influences on learning, theories of reading, programmed instruction and teaching machines. Topic: (Sp) individual differences in learning ability and intelligence.

Mr. Jensen (Sp)

*216B. Principles and Theories of Psychological Measurement. Two 1½-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.

216C. Advanced Studies in Development. Two 1½-hour seminars per week. Prerequisite: consent of instructor. Topics on advanced work in language, intellectual, social, emotional, and physical development. Topics vary from quarter to quarter: (W) Sec. 1, existential methodology in developmental research; Sec. 2, communication and attitude change; (Sp) to be announced.

Mr. Hurst, Mr. Watts (W); Mr. Ammon (Sp)

*217A. Experimental Education. (3)
One 3-hour seminar per week and laboratory to be arranged Prerequisite: courses 119A and 119B or consent of instructor. Lectures on principles of experimentation and discussions of published research. Students submit critical evaluations of published research and prepare research proposals for discussion and evaluation.

*217B. Experimental Education. (3)
One 3-hour seminar per week and laboratory to be arranged. Prerequisite: course 217A. A continuation of course 217A, in which the student is expected to carry out and complete a research project.

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. Topics: (F) multivariate analysis; (Sp) Sec. 1, nonparametric methods, Sec. 2, factor analysis, Sec. 3, analysis of variance.

Mr. Marascuilo (F, Sp); Mr. Kaiser, Mr. Woodson (Sp)

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. Mosier (W)

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. Mosier (F, Sp)

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.

Mr. Jarrett (W)

*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.

Mrs. Clifford (W)
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.
Mrs. Clifford (Sp)

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.

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.

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.

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.
Mr. Jarrett (F, Sp); Mr. Lilge (W)

225. Philosophy of Education: Advanced Study. (3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor. Topics on selected educational theorists and trends in educational thought. Topics vary from quarter to quarter: (F) the humanities and humanistic education; (W) philosophy and education in The Enlightenment (18th century); (Sp) existentialism and education.
Mr. Chancellor (F); Mr. Hansen (W)

*226. History of Education: Advanced Study. (3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor.

227. Comparative Education: Advanced Study.
(3-3-3-3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor. 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.
*227D. Latin America. Mr. Hansen (W)
227E. Africa. Mr. Lilge (F)

228. Sociology of Education: Advanced Study. (3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor. Perspectives of contemporary sociology applied to selected topics in education. Mr. Hansen (W)

*229. Economics and Politics of Education: Advanced Study. (3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor. An analysis of intergovernmental relations in education.

with special attention to the consequences for the economy of changes in structure of school government.

230. Curriculum Development.
(3-3-3-3-3-3-3-3-3) 230A. Reading.
Prerequisite: course 131C or equivalent, and consent of instructor.
Mr. Ruddell (F); Mr. Simons (W)

230B. Speaking, Listening, and Writing.
Prerequisite: course 131C or equivalent, and consent of instructor.
Mr. Loban (F)

230C. Literature.
Prerequisite: consent of instructor. Critical analysis of the literature curriculum.
Mr. Loban (F)

230D. Mathematics.
Prerequisite: consent of instructor.

230E. Social Sciences.
Prerequisite: consent of instructor.

230F. Science.
Prerequisite: teaching credential and Physics 11A-11B-11C or Zoology 11A-11B, or consent of instructor.
Mr. Lowery (F)

230G. Foreign Languages.
Prerequisite: consent of instructor.
Mr. Schevill (Sp)

*230H. Art.
Prerequisite: consent of instructor.

230I. Music.
Prerequisite: consent of instructor. Mr. Kyme (Sp)

231. Research in Curriculum and Instruction.
(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. Simons (F, Sp)

231B. Speaking, Listening, and Writing.
Prerequisite: course 230B.
Mr. Simons (Sp)

231C. Literature.
Prerequisite: course 230C.
Mr. Loban (Sp)

231D. Mathematics.
Prerequisite: consent of instructor.

231E. Social Sciences.
Prerequisite: consent of instructor.

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.

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. Ruddell (F, Sp)

232. Preschool Programs. (3)
One 2-hour seminar and one 1-hour conference per week. Critical consideration of programs for the preschool child in terms of the home and social background.
Miss Almy (F, W, Sp)
233. The Media in Education. (3)
One 3-hour lecture per week. A survey of new developments in media on the educational process, administration and curriculum planning, with evaluation of current research, and theory. Mr. Hatfield (W)

235. Theory and Practice in Curriculum and Instruction. (3-3-3-3)
Mr. Webster (F); Mr. Edwards (Sp)
Mr. Webster (W)

235C. Supervision of Instruction. One 2-hour seminar and one 1-hour conference per week. Prerequisite: teaching credential, two years of teaching experience, teaching supervision and experience, and consent of instructor. Research into the supervisor-teacher relationship, and practice with classroom visits, faculty meetings, and individual conferences will provide the basis for criticism and analysis of supervisory techniques.
Mr. Edwards (W)
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. Mosier (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: consent of instructor. Advanced studies of topics and problems in elementary education.
Mr. Matlin (Sp)
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.
Mr. Loban (W)
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 the principles worked out in course 235A.
Mr. Edwards (W)
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. Michaelis (F, W)
Sec. 2. Secondary schools. Mr. Webster (W)
236E. The Socially Disadvantaged Learner. (4) (Formerly numbered 291B) One 3-hour lecture and one 1½-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. Johnson (F)
236F. Problems in Urban Education. (4) (Formerly numbered 291C) 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.
Mr. Webster (Sp)

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. Mosier (F, 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.
Mr. Webster (W)

240. Student Personnel and Counseling Psychology. (3-3-3-3-3)
One 2-hour lecture and one 2-hour laboratory per week. Primarily for students working for graduate degrees in this field or for the pupil counseling credential.
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.
Mr. Stewart (F)
240B. Theoretical Foundations of Counseling. Prerequisite: consent of instructor. Pertinent theoretical and empirical developments in the social sciences for counseling theories and practices.
Mr. Lowe (F)

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.
Mr. Bandt (Sp)
Mr. Stewart (Sp)

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.
Mr. Low (W)
245B. Case Analysis. Prerequisite: course 245A. Illustration of counseling theories and principles through intensive case analysis, evaluation of counseling.
Mr. Lowe (Sp)

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.
Mr. Bandt (F); Mr. Stewart (W); Mr. Lowe (Sp)
251. Foundations of Educational Administration. (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)
251B. The Administration of School Personnel, Educational Programs, and School Plant Programs. Policies and procedures in the administration of professional and classified personnel, student personnel services, programs of instruction, and school plant programs and facilities.
Mr. Riggle, Mr. Salinger (W)

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. Edwards, 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 (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. Benveniste (F)
255C, Introduction to Systems Analysis in Education. (4)
One 3-hour lecture and one 1-hour conference per week. Introduction to systems theory and its applications 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.
Mr. Benson (W)
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.
(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.
(Sp)
255F. Seminar in Computers and Education. (3)
One 3-hour lecture per week. Prerequisite: course 255C or consent of instructor. A study of the implications of the computer for education. Topics may vary from time to time to include: educational information systems, complex information processing, the simulation of human thinking and problem solving, the computer as a teaching device, and others.

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 sectorial planning; economic aspects of innovation.
Mr. Benson (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, Mr. Benveniste (W)
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 emphasized.
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.
Mr. Benson (Sp)

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, Mr. Reller (F)
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 influences; (2) concepts of formal bureaucracies; and (3) administration of national government policy.
Mr. Guthrie (W)
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. Guthrie (Sp)

258B. Advanced Seminar in Educational Planning and Administration. (4)
One 3-hour lecture and one 1-hour conference per week. Prerequisite: course 258A or equivalent and consent of instructor. Sociological approaches to policy formation and planning in education, Planning within the formal organization. Planning for many organizations, Administrative aspects of planning. Planning and centralization or decentralization, Sociological aspects of planning and implementation. Mr. Benveniste (F)

258C. Comparative Educational Administration. (3)
One 3-hour lecture per week. The styles and functions of educational administration in various types of national systems and cultures. The response of bureaucracies to changes in environment. Use of the comparative approach in theory building in organizational analysis in education. Mr. Tillery (W)

258D. Theory and Field Methods in Educational Organizational Analysis. (3)
One 3-hour lecture per week. Prerequisite: course 258A and consent of instructor. 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. ——— (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. Mr. Reed (W)

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. Mr. Collins (F, W, 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. Mr. Collins (F, W, Sp)

261. Higher Education in The United States. (3–3)

261A. Higher Education: Historical and Philosophical Bases. (3)
One 3-hour lecture per week. Prerequisite: master's degree or equivalent, or consent of instructor. Historical analyses of the roots and development of American higher education, an examination of the changing philosophical bases, and a review of the origins of major issues and problems. Mr. Grant (Sp)

261B. Higher Education: Contemporary Perspective and Issues.
One 3-hour lecture per week. Prerequisite: course 261A or consent of instructor. A comprehensive review of major areas, aspects, or segments of higher education and their functional interrelationship, with a critical appraisal of the changing issues and problems currently developing in colleges and universities. Mr. Heist (W)

264. College Teaching. (3)
One 2-hour seminar per week and one 1-hour conference. Prerequisite: master's degree or equivalent, or consent of 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)
Prerequisite: courses 261A and 261B, or consent of instructor.

268A. The Student in Higher Education.
One 3-hour seminar per week. Intensive study of research on student characteristics, cultures, performance, and impact of educational institutions. Mr. Heist (F, 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 (W, 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 (W), Mr. Medsker (Sp)
290. Problems in Adult Education. (3)
One 3-hour seminar per week. Prerequisite: consent of instructor. Topics vary; suggested topics: students, curriculum, administration, financing, leadership, teacher training, education and aging.

275. Advanced Study in Adult Education. (3–3–3)
One 2-hour seminar and one 1-hour conference per week. Prerequisite: consent of instructor.

290F. Financing Higher Education.
Two 1.5-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)

290E. Higher Education. Mr. Heist, Mr. Tillery (F)

290D. Educational Psychology. Mr. Jensen (W)

290C. Curriculum and Instruction.

290B. Counseling Psychology.
Mr. Guthrie (F, Sp)

290A. Policy Planning and Administration.
Mr. Woodson (Sp)

291. Experimental Courses.

291G. Computer-Assisted Instruction. (4)
One 3-hour lecture and one 2-hour laboratory per week. Prerequisite: consent of instructor. Lectures, discussions, and readings regarding the nature and use of computers with emphasis on their present and potential application to the instructional process. Students are expected to prepare a simple instructional program and use a computer to evaluate its effectiveness.
Mr. Woodson (F, W)

291H. Play and Games in Human Learning. (3)
Three hours of lecture per week. 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 (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. Hurst, Mr. Woodson (F)

295. Special Topics in Education. (3)
One 3-hour seminar per week. Sections of this course will deal with the exploration of new subjects in education. Topics will vary from quarter to quarter. Topics: (F) to be announced; (W) Sec. 1, survey of educational research; Sec. 2, international education; (Sp) Sec. 1, survey of educational research; Sec. 2, images of man and social change: Marx, Weber, and Mead; Sec. 3, history of education in Africa and Black America; Sec. 4, planning in higher education.
Mr. Rohwer (F), Mr. Watts, (W, Sp); Mr. Hansen, Staff in Higher Education (Sp)

296. Special Study. (1–4)
Prerequisite: consent of instructor and graduate adviser. Open to qualified graduate students who wish to pursue special studies and research under the direction of a member of the staff.

298C. Curriculum and Instruction.

298B. Student Personnel and Counseling Psychology.
Prerequisite: courses 240A, 240B, and consent of instructor.

298A. Sociology of Adult Education.
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.
Mr. London (F)


290A. Policy Planning and Administration.
Mr. London (F)

290B. Counseling Psychology.
Mr. Guthrie (F, Sp)

290C. Curriculum and Instruction.

290D. Educational Psychology.
Mr. Jensen (W)

290E. Higher Education. Mr. Heist, Mr. Tillery (F)

290F. Social and Humanistic Foundations.
Mr. Hansen (F)

291. Experimental Courses.

291G. Computer-Assisted Instruction. (4)
One 3-hour lecture and one 2-hour laboratory per week. Prerequisite: consent of instructor. Lectures, discussions, and readings regarding the nature and use of computers with emphasis on their present and potential application to the instructional process. Students are expected to prepare a simple instructional program and use a computer to evaluate its effectiveness.
Mr. Woodson (F, W)

291H. Play and Games in Human Learning. (3)
Three hours of lecture per week. 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 (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. Hurst, Mr. Woodson (F)

295. Special Topics in Education. (3)
One 3-hour seminar per week. Sections of this course will deal with the exploration of new subjects in education. Topics will vary from quarter to quarter. Topics: (F) to be announced; (W) Sec. 1, survey of educational research; Sec. 2, international education; (Sp) Sec. 1, survey of educational research; Sec. 2, images of man and social change: Marx, Weber, and Mead; Sec. 3, history of education in Africa and Black America; Sec. 4, planning in higher education.
Mr. Rohwer (F), Mr. Watts, (W, Sp); Mr. Hansen, Staff in Higher Education (Sp)

296. Special Study. (1–4)
Prerequisite: consent of instructor and graduate adviser. Open to qualified graduate students who wish to pursue special studies and research under the direction of a member of the staff.

298C. Curriculum and Instruction.

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298A. Sociology of Adult Education.
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.
Mr. London (F)


290A. Policy Planning and Administration.
Mr. London (F)

290B. Counseling Psychology.
Mr. Guthrie (F, Sp)

290C. Curriculum and Instruction.

290D. Educational Psychology.
Mr. Jensen (W)

290E. Higher Education. Mr. Heist, Mr. Tillery (F)

290F. Social and Humanistic Foundations.
Mr. Hansen (F)

291. Experimental Courses.

291G. Computer-Assisted Instruction. (4)
One 3-hour lecture and one 2-hour laboratory per week. Prerequisite: consent of instructor. Lectures, discussions, and readings regarding the nature and use of computers with emphasis on their present and potential application to the instructional process. Students are expected to prepare a simple instructional program and use a computer to evaluate its effectiveness.
Mr. Woodson (F, W)

291H. Play and Games in Human Learning. (3)
Three hours of lecture per week. 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 (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. Hurst, Mr. Woodson (F)

295. Special Topics in Education. (3)
One 3-hour seminar per week. Sections of this course will deal with the exploration of new subjects in education. Topics will vary from quarter to quarter. Topics: (F) to be announced; (W) Sec. 1, survey of educational research; Sec. 2, international education; (Sp) Sec. 1, survey of educational research; Sec. 2, images of man and social change: Marx, Weber, and Mead; Sec. 3, history of education in Africa and Black America; Sec. 4, planning in higher education.
Mr. Rohwer (F), Mr. Watts, (W, Sp); Mr. Hansen, Staff in Higher Education (Sp)

296. Special Study. (1–4)
Prerequisite: consent of instructor and graduate adviser. Open to qualified graduate students who wish to pursue special studies and research under the direction of a member of the staff.

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Mr. London (F)


290A. Policy Planning and Administration.
Mr. London (F)

290B. Counseling Psychology.
Mr. Guthrie (F, Sp)

290C. Curriculum and Instruction.

290D. Educational Psychology.
Mr. Jensen (W)

290E. Higher Education. Mr. Heist, Mr. Tillery (F)

290F. Social and Humanistic Foundations.
Mr. Hansen (F)

291. Experimental Courses.

291G. Computer-Assisted Instruction. (4)
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Mr. Woodson (F, W)

291H. Play and Games in Human Learning. (3)
Three hours of lecture per week. 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 (W)
332. The Sequence in Supervised Teaching in

Only candidates who meet established criteria can be
accepted; enrollment is limited to available
facilities. The sequence in supervised teaching nor-
mally 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 supervi-
sed 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 Minor
Field. (4)

One 1-hour lecture and five hours of field work
per week. Conferences, observation, and supervi-
sed teaching. Supervisory Staff (W)

Professional Courses

310A—310B—310C. Field Work in School
Psychology. (3–6)

One 2-hour lecture per week plus supervised field
experience. Prerequisite: consent of instructor. The
student will observe and assess problems of learning
and behavior in schools and participate in planning
school programs for pupils with educational handi-
caps.
Mrs. Lambert (F, W, Sp)

311. Field Work in Special Education. (3)

Hours to be arranged. Mr. Bower (F, W, Sp)

331A. Introduction to Elementary Supervised
Teaching. (3)

One 3-hour lecture and six hours of field work
per week. Lectures, conferences, laboratory, and
field work. Observations and participation in
public school work.
Supervisory Staff (F)

331B. Elementary Supervised Teaching. (4)

One 3-hour lecture and 8 to 10 hours of labora-
tory and field work per week. Prerequisites:
Music 10A–10B, Mathematics 15, Physical Edu-
cation 12 (sections on elementary school activi-
ties), or equivalent courses; two quarters of lab-
aratory science; and course 331A. Seminars,
conferences, observation, and supervised teach-
ing.
Supervisory Staff (W)

331C. Elementary Supervised Teaching. (8)

One 3-hour lecture and 16 to 20 hours of field
work per week. Prerequisites: courses 110 and
130, or equivalents; three or more courses from
131A, 131C, 131D, 131E, 131F, or equivalents;
and course 331B. Seminars, conferences, observa-
tion, and supervised teaching.
Supervisory Staff (F, W, Sp)

333. Practicum.

This is an extra-session course which is scheduled
to coincide with the calendar of the public schools.
Enrollment is limited to available facilities.

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.
Supervisory Staff (F, W, Sp)

333C. Directed Practice in School Libraries.

One 1-hour lecture and 10 to 12 hours of field
work per week. Prerequisite: consent of instructor.
Mrs. Durham (F, Sp)

333D. Practicum in College Reading. (3)

One 2-hour lecture and eight hours of field work
per week. Prerequisite: consent of instructor.
Supervised work experience in the University of
California Reading and Study Skills Service.
Students will work individually with high school
and college students. Tasks will include diag-
nosis, planning individualized remedial programs,
and evaluating individual programs.

340. Field Work in Student Personnel and
Counseling Psychology.

340A. Counseling Practicum. (3)

One 2-hour case conference plus a 1-hour in-
dividual 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); Mr. Lowe (W);
Mr. Bandt (F, W, Sp)

340B. Internship in Student Personnel and Coun-
seling. (3–8)

One 2-hour seminar plus supervised field experi-
ence. 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.
The Staff (F, W, Sp)
350. Internship in Educational Administration. (3-6)
One 2-hour seminar per week plus supervised field experience. Prerequisite: consent of instructor. Conferences and supervised field experiences.
Mr. Collins, Mr. Reller, 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.
Mr. Case (F)

391A. Team Learning: Diagnostic and Individualized Teaching. (3)
Orientation towards the theoretical aspects of team learning with demonstration of several of its operational features. Offers guidelines and activities for practitioners at any level across the curriculum.
Mr. Poirier (F, 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.

Related Courses in Other Departments

Business Administration 291A. Systems of Labor-Management Relations in the Public Sector. (4)

Interdepartmental Studies 175. A Nontechnical Introduction to Operations Research. (4)

Law 220. Education Law. (2)

**ENGINEERING**
(Office of the Dean, 315 McLaughlin Hall)

Deans:
George J. Maslach, B.S.

Associate Dean:
Victor F. Zackay, Ph.D.

Civil Engineering
(Office of the Dean, 315 McLaughlin Hall)

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.
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)
Charles G. Hyde, B.S., LL.D. (Emeritus)
Wilfred F. Langelier, M.S., D.Eng. (hon.) (Emeritus)

Assistant Professors:
Percy H. McCauhey, M.S. (Emeritus)

Associate Professors:
Hugo B. Fischer, Ph.D.
David Jenkins, Ph.D.
Robert E. Selleck, Ph.D.

Assistant Professors:
David T. Mason, Ph.D.
Pat Wilde, Ph.D.

Lecturer:
Clarence Golueke, Ph.D.

NOTE: For key to footnote symbols, see page 78.
STRUCTURAL ENGINEERING AND STRUCTURAL MECHANICS

(Division Office, 721 Davis Hall)

Professors:
Frank Baron, D.Sc.
Vitelmo Bertero, Sc.D.
Jack G. Bouwkamp, C.I.
Boris Bresler, M.S.
Ray W. Clough, Jr., Sc.D.
Nestor J. Distefano, Ing. Civ.
Howard D. Eberhart, M.S.
William G. Godden, Ph.D.
Tung-Yen Lin, M.S.
Hugh D. McNiven, Ph.D.
Joseph Penzioni, Sc.D.
David Pirtz, M.S.
Karl S. Pister, Ph.D. (Chairman)
Milos Polivka, M.S. (Vice-chairman)
Egor P. Popov, Ph.D.
Jerome M. Raphael, S.M.
Jerome L. Sackman, Eng. Sc.D.
Alexander C. Scordelis, M.S. (Vice-chairman)

Associate Professors:
James M. Kelly,† Ph.D.
Jacob Lubliner, Ph.D.
Robert L. Taylor, Ph.D.
R. Brady Williamson, Ph.D.
Edward L. Wilson,† D.Eng.

Assistant Professors:
Anil K. Chopra, Ph.D.
Graham H. Powell, Ph.D.

TRANSPORTATION ENGINEERING

(Division Office, 215 McLaughlin Hall)

Professors:
Harmer E. Davis, M.S.
Dan M. Finch, 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.
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.
Tor Langfeldt Brekke, Lic.Tech.
James M. Duncan, Ph.D.

Assistant Professors:
William N. Houston, Ph.D.
John Lysmer, Ph.D.

Associate Professor:
Keith C. Crandall, Ph.D. (Acting)

Electrical Engineering and Computer Sciences

(Department Office, 231 Cory Hall)

Professors:
Diogenes J. Angelakos, Ph.D.
Herbert B. Baskin, M.S.
Charles K. Birdsall, Ph.D.
Charles A. Desoer, Sc.D.

Assistant Professors:
Thomas E. Everhart, Ph.D.
Arthur Gill, Ph.D.
Arthur M. Hopkin, Ph.D.
Eliahu I. Jury, Sc.D.

Associate Professor:
Ernest S. Kuh, Ph.D. (Chairman)
Industrial Engineering and Operations Research

(Department Office, 4135 Etcheverry Hall)

Professors:
Edward R. F. W. Crossman, Ph.D.
E. Paul DeGarmo, M.S.
David Gale, Ph.D.
Raymond G. Grassi, M.S.
William S. Jewell, Sc.D.
Richard M. Karp, Ph.D.
Robert M. Oliver, Sc.D.
Ronald W. Shephard, Ph.D., (Chairman)

Associate Professors:
Richard E. Barlow, Ph.D.
Stuart E. Dreyfus, Ph.D.
C. Roger Glassey, Ph.D.
Edward C. Keachie, Ph.D.
James T. Lapsley, M.S.

Assistant Professors:
Sheldon M. Ross, Ph.D.
Donald M. Topkis, Ph.D.
Ronald W. Wolff, Ph.D.

Mechanical Engineering

(Department Office, 6193 Etcheverry Hall)

Robert F. Steidel, Jr., D.Eng. (Chairman)

AERONAUTICAL SCIENCES

(Division Office, 6105 Etcheverry Hall)

Professors:
Stanley A. Berger, Ph.D.
Gilles M. Corcos, Ph.D.
Maurice Holt, Ph.D.
Franklin C. Hurlbut, Ph.D.
Edmond V. Laitone, Ph.D.
George J. Maslach, B.S.
Antoni K. Oppenheim, Ph.D.
Samuel A. Schaaf, Ph.D.
Frederick S. Sherman, Ph.D.
Lawrence Talbot, Ph.D.  
(Chairman of the

APPLIED MECHANICS

(Division Office, 6143 Etcheverry Hall)

Professors:
Cyril P. Atkinson, M.S., M.E.
Werner Goldsmith, Ph.D.
Chieh S. Hsu, †Ph.D.
George Leitmann, Ph.D.  (Chairman)
Paul Lieber, †Ph.D.
Paul M. Naghdi, †Ph.D.
Reinhardt M. Rosenberg, M.S., Ph.D., (hon.)
Walter W. Soroka, Sc.D.

Associate Professors:
David B. Bog, Ph.D.
Michael M. Carroll, †Ph.D.

Professor:
Albert E. Green, Sc.D.  (Visiting Russell S.
Springer Professor)

Assistant Professor:
John A. Trapp, Ph.D.  (Acting)

MECHANICAL DESIGN

(Division Office, 5144 Etcheverry Hall)

Professors:
G. Wayne Brown, M.S.
Don M. Cunningham, M.S.
E. Paul DeGarmo, M.S.
Iain Finnie, Sc.D.  (Chairman)
Joseph Frisch, M.S.
Frank E. Hauser, Ph.D.
Thomas H. Hazlett, M.S.
Shiro Kobayashi, Ph.D.
Charles W. Radcliffe, M.S., M.E.
Lawrence Stark, M.D.
Robert F. Steidel, Jr., D.Eng.  (Chairman of
the Department of Mechanical Engineering)

Associate Professors:
Yasundo Takahashi, Ph.D.
Herman Thal-Larsen, M.S.
Erich G. Thomsen, Ph.D.
Alexander S. Levens, M.S.  (Emeritus)

Associate Professor:
Clayton D. Mote, Ph.D.

Assistant Professor:
David M. Auslander, Sc.D.

Lecturer:
Milton R. Pickus, Ph.D.

THERMAL SYSTEMS

(Division Office, 6187 Etcheverry Hall)

Professors:
Israel I. Cornet, Ph.D.
Leonard Farbar, M.S.
Irving Fatt, Ph.D.
Francis W. Hutchinson, M.S., M.E.
Harold W. Iversen M.S.
Harold A. Johnson, M.S.
Alan D. K. Laird, Ph.D.
Ralph A. Seban, Ph.D.
Wilhus H. Somerton, Pet.E.
Ernest S. Starkman, M.S.
Chang-Lin Tien, Ph.D.  (Chairman)
Everett D. Howe, M.S.  (Emeritus)
Leonid M. Tichvinsky, D.E.M.  (Emeritus)

Associate Professors:
Ralph Greif, Ph.D.
Robert F. Sawyer, Ph.D.
Paul B. Stewart, Ph.D.
George J. Trezek, Ph.D.

Assistant Professor:
Patrick J. Pagni, Ph.D.

Professor:
Kurt S. Spiegler, Ph.D.  (In-Residence)

Assistant Professor:
George F. Oster, Ph.D.  (Acting)
Materials Science and Engineering
(Department Office, 210 Hearst Mining Building)

Professors:
Robert H. Bragg, Ph.D.
John E. Dorn, Ph.D.
Douglas W. Fuerstenau, Sc.D. (Chairman)
Ralph R. Hultgren, Ph.D.
Earl R. Parker, Met.E.
Joseph A. Pask, Ph.D.
S. Frederick Ravitz, Ph.D.
Alan W. Searcy, Ph.D.
Gareth Thomas, Ph.D., D.Sc. (hon.)
Jack Washburn, Ph.D.
Victor F. Zackay, Ph.D.
Donald H. McLaughlin, Ph.D., D.Eng.
(Emeritus)

Associate Professors:
Marshall Merriam, Ph.D.
Frank H. Morrison, Ph.D.

Assistant Professors:
Thomas S. Mika, D.Eng.
Peter W. Rodgers, Ph.D.

Naval Architecture
(Dean's Office, 202 Naval Architecture Building)

Professors:
J. Randolph Paulling, Jr., D.Eng.
John V. Wehausen, Ph.D. (Chairman)
Henry A. Schade, Dr. Ing. (Emeritus)

Associate Professor:
William C. Webster, Ph.D. (Acting)

Lecturers:
George M. Gordon, Jr., M.S.
Kenneth K. Kelley, Ph.D.
Robert B. Langston, Ph.D.

Nuclear Engineering
(Dean's Office, 4105 Etcheverry Hall)

Professors:
Harvey J. Amster, Ph.D.
Paul L. Chambre, Ph.D.
Laurence M. Grossman, Ph.D. (Chairman)
Thomas H. Pigford, Sc.D.
Lawrence Ruby, Ph.D.
Virgil E. Schrock, M.S., M.E.

Associate Professors:
Selig N. Kaplan, Ph.D.
Donald R. Ölander, Sc.D.

Assistant Professors:
Stanley G. Prussin, Ph.D.
George Yadigaroglu, Ph.D.

Senior Lecturer:
Robert V. Pyle, Ph.D.

Lecturer:
Roger W. Wallace, Ph.D.

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, intends 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 ANNOUNCEMENT OF THE COLLEGE OF ENGINEERING (available without charge from the College of Engineering, University of California, Berkeley, California 94720), and includes the following:

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. 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.

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 now encompasses many new areas in addition to the traditional fields of radio communication and large scale or power systems. Among these areas are: solid-state devices, integrated circuits, plasmas, microwave electronics, quantum and optical electronics, radiation and propagation, active and passive circuits, control systems, communication systems, pattern recognition, information theory, computer systems, computer programming, heuristic programming and artificial intelligence, switching and automata theory, symbol manipulation, information retrieval, bioelectronics, and ecological systems.

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.

* 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, Biology 5A–5B, Engineering 41, Physiology 1. If a sequence is substituted, the sequence must be completed to satisfy the Engineering 45 requirement.
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 work out 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, and mathematics and statistics so as to strengthen and broaden the background and to possibly 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, and quantum mechanics.

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, integrated circuits, plasmas, electron beams, microwave electronics, quantum electronics, and optical electronics.

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. 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, 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.

Detailed listing of courses recommended for both depth and breadth in each of these programs will be found in the ANNOUNCEMENT TO THE COLLEGE OF ENGINEERING.

GRADUATE PROGRAM

To prepare the graduate student for work in the rapidly developing fields of electrical engineering, the department’s program emphasizes fundamentals, yet with 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. The student is
urged, however, to consult with his graduate adviser to determine what courses are necessary to a particular field of specialization. A detailed description of the available fields of graduate study in electrical engineering 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 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 and the natural sciences or mathematics or statistics or medicine closely interact. Students are encouraged 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

(Administered by the Engineering Science Committee)

All students must complete a total of 180 units and must maintain a grade-point average of 2.75 or better in the lower division and 2.5 or better in the upper division. Admission to the engineering science curriculum requires a grade-point average of 2.75 or better.

Lower Division

Required: (for all upper division programs in engineering science) Mathematics 1A-1B-1C, 51A-51B-51C; Chemistry 1A-1B-1C, Physics 4A-4B-4C-4D-4E; English 1A or Rhetoric 1A; technical electives, 9 units which must include Biology 1A-1B-1C for those in bioengineering, Geology 5A-5B for those in engineering geoscience; units are unrestricted for engineering mathematics or mathematical statistics and engineering physics; electives, 21 units, must include sufficient total units of social science and humanities so that the total of such units from the lower division and upper division is 27 of which at least 4 units must be of upper division level.

Upper Division

Bioengineering. Required: Chemistry 8A-8B, 14; Biochemistry 102 or Molecular Biology 111; Electrical Engineering and Computer Sciences 101B; Mathematics 121A-121B; Mechanical Engineering 159; Medical Physics 102A-102B; electives, 50 units which must include: (a) 20 units of upper division courses in engineering, science, mathematics, or statistics of which at least 16 units must be in engineering; (b) an upper division course in mechanics (Physics 105A, Mechanical Engineering 104A, Mechanical Engineering 185, or Civil Engineering 139); (c) sufficient total units in social science and humanities so that the total of such units from the lower division and upper division is 27 of which at least 4 units must be of upper division level; (d) premedical students must take Zoology 105. Note: Students completing this program of study and who plan to enter medical school should take foreign language entrance requirements into account.

Engineering Geoscience. Required: Physics 105A-105B, 110A-110B-110C; Mathematics 121A-121B; Geology 150 (Geology 103 or 105 is acceptable in lieu of Geology 150 for students who elect to take Geology 102A-102B or 102C as technical electives); Geophysics 122A-122B; Mechanical Engineering 159; Civil Engineering 139; electives, 47 units which must include: (a) 16 total units of upper division courses in engineering; (b) 4 units of upper division courses in geology or geophysics; (c) an upper division course in statistics; (d) 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 such as Physics 140 or 141A, Electrical Engineering and Computer Sciences 130, Geology 102A--102B, or any upper division course in materials science and engineering or chemistry; (e) a course in thermodynamics (Chemistry 14, Physics 112, Mechanical Engineering 105A, or Chemical Engineering 141A); (f) sufficient total units in social science and humanities so that the total of such units from the lower division and upper division is 27 of which at least 4 units must be of upper division level.

**Engineering Mathematics or Mathematical Statistics.** Required: Mathematics 112, 120A--120B--120C or three courses from Mathematics 104A--104B, 105, 185, Statistics 134A--134B; electives, 68 units which must include: (a) 38 units of upper division courses in engineering, science, mathematics, or statistics. These units must include at least four upper division courses in mathematics or statistics and at least 24 units in engineering. Not acceptable: Mathematics 111, 190A--190B--190C or Statistics 130A--130B--130C, 131, 132, 133; (b) sufficient total units in social science and humanities so that the total of such units from the lower division and upper division is 27 of which at least 4 units must be of upper division level.

**Engineering Physics.** Required: Mathematics 120A--120B--120C; Physics 105A--105B, 110A--110B, 110C or 124 or 129A, 112, 137A--137B--137C; Civil Engineering 139 or Mechanical Engineering 185, Mechanical Engineering 159 or Electrical Engineering and Computer Sciences 170 or Physics 142; Nuclear Engineering 102 (Physics 111A, 111B or Electrical Engineering and Computer Sciences 171 may be taken as a substitute. Students enrolling in one of these will be required to take an extra units of upper division technical elective—laboratory); electives, 38 units which must include: (a) sufficient units of upper division courses in engineering so that the program includes a total of 24 units in upper division courses in engineering; (b) a course dealing with materials such as Physics 140 or 141A, any upper division course in materials science and engineering or chemistry, or Electrical Engineering and Computer Sciences 130; (c) sufficient total units in social science and humanities so that the total of such units from the lower division and upper division is 27 of which at least 4 units must be of upper division level.

**Programs for Graduate Degrees in Engineering Science**

All departments in engineering offer the M.S. and Ph.D. degree in engineering science. These degrees are awarded for programs of study and research that emphasize the fundamental natural sciences which form the background material for engineering analysis and design. Graduate programs in engineering science are open to all graduate students in engineering and to those who have a B.S. degree in fields other than engineering. Examples of engineering science programs which can be categorized as applied science in nature, are bioengineering, computer science, engineering geoscience, physical metallurgy, nuclear processes in reactors, and ocean 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 which is suitable for those 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. However, the student is required to select electives in a meaningful way, based on his particular professional and research objectives.

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: Industrial Engineering and operations Research 120, 160, 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.*

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 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 191L.

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 and service system design, analysis and operation, thus preparing students for administrative positions in modern industry.

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* 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, 167, or Statistics 169; (3-c) (primarily for students interested in human factors in technology) Industrial Engineering and Operations Research 172, one of Industrial Engineering and Operations Research 174 or 176; and one of Physiology 132 or Psychology 163; (3-d) (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.
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 system, sociotechnical system 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 Operations Research Center.

The department requires all graduate applicants to submit Verbal and Quantitative Appitude scores of the Graduate Record Examination. Further information on graduate programs may be obtained from the Industrial Engineering and Operations Research Office, 4135 Etcheverry Hall and in the ANNOUNCEMENT OF THE COLLEGE OF ENGINEERING.

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 credits is required, including:

Lower Division Mathematics 1A–1B–1C, 51C; Chemistry 1A–1B; Physics 4A–4B–4C–4D; Engineering 1, 28 or 29, 36, 45; 36 units of electives.


Mechanical Engineering Options The following groups of technical electives are

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 must include 20 units of upper division technical electives in engineering, physical sciences, mathematics, or statistics. It is further recommended that in order to provide added depth in one or more areas of mechanical engineering, all students complete at least 12 units of upper division mechanical engineering courses (out of the 20 units required).
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.

**Aerospace.** Mechanical Engineering 116, 117, 133, 134, 147, 151, 161, 162, 164, 175; Civil Engineering 138; Physics 132; Astronomy 101.

**Applied Mechanics.** Mechanical Engineering 175, 182, 185, 115, 116, 117, 133, 134, 137, 162, 172A–172B, 173, 174; Mathematics 104A.

**Automatic Controls.** Mechanical Engineering 134, 135, 137, 116, 133, 172A–172B, 175; Electrical Engineering and Computer Sciences 119, 128A–128B.

**Biomechanical Engineering.** Biology 11A–11B; Physiology 1; Mechanical Engineering 110, 131, 134, 151, 153, 159, 198; Physiology 108A–108B, 132; Biology 150.

**Energy Conversion.** Mechanical Engineering 110, 145, 146, 147, 158, 117; Physics 132.

**Environmental Engineering.** Mechanical Engineering 110, 142, 146, 173, 174, 198; Civil Engineering 140, 141; Geography 146; Architecture 110.

**Fluid Mechanics.** Mechanical Engineering 116, 117, 159, 161, 162; Civil Engineering 166A.

**Heat and Mass Transfer.** Mechanical Engineering 151, 155, 159, 117.

**Manufacturing Management.** Mechanical Engineering 110, 121, 122, 123, 198; Industrial Engineering and Operations Research 120, 154, 160, 176, 180; Business Administration 140, 141, 142, 154; Economics 103A–103B, 121A–121B.

**Materials Processing.** Mechanical Engineering 121, 122, 123, 124, 125, 129, 133, 151.


**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, 157, 158, 159.

**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) aeronautical sciences, (2) applied 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.

**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. (For undergraduate curriculum in engineering geoscience see Engineering Science, page 191). 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 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 directs the discoveries and knowledge of mathematics, statistics, physics, chemistry, and the geosciences toward applications in our total environment including the solid earth, the oceans, the atmosphere, and space. While serving the needs of the minerals industries, the program is purposely kept free of occupational constraints. The program therefore 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 nonmetallics 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 those industries—such as aerospace, nuclear, and electrical—which make extensive use of ceramic materials.

METALLURGY

Metallurgy is the science and art of processing and utilizing metals and alloys. The field has two main areas of specialization.

Extractive Metallurgy This is concerned with the study 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 The physical metallurgist is concerned primarily with 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 or chemistry or engineering aspects. Because of the ever-increasing demand for improved or better characterized materials and because the relationships between thermal mechanical history and structure and between structure and properties are complex and only partly understood, 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, 51C; Chemistry 1A–1B; Physics 4A–4B–4C–4D; Engineering 1, 36, 45; 19 units of electives. Note: Physics 4D, and 4 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 101B**; Materials Science and Engineering 100, 101, 103, 104, 142, 107, 108, 109, 109L, 121, 121L, 141, 141L; and 42 units of electives.*

* The program includes 61 units of elective courses at least 25 of which must be in upper division 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.
The following are sequences of courses selected to aid the student in the choice of technical electives in some possible fields of interest.

**Ceramic Engineering**  All students electing the ceramic engineering option must take Materials Science and Engineering 122, 128 is also appropriate for most students. The suggested courses listed below are intended to represent a basis for developing a program according to different areas of interest for ceramic engineers:

- **Automatic Control.** Mechanical Engineering 134, 135, 137.
- **Electronic Materials.** Physics 105A, 137A, 140; Electrical Engineering and Computer Sciences 130, 131A–131B, 126A–126B.
- **Engineering Analysis.** Mathematics 120A–120B–120C or 121A–121B or Mechanical Engineering 116,117; Electrical Engineering and Computer Sciences 119, 166.
- **Physics of Solids.** Physics 105A, 137A–137B, 141A–141B.
- **Production Management.** Statistics 133, Business Administration 140, 141, 142, Industrial Engineering and Operations Research 170, 176.
- **Industrial Organization.** Economics 103A–103B, 121A–121B.
- **Industrial Relations.** Business Administration 150, 151, 154, 152.
- **Statistics.** Statistics 134A–134B, 135A–135B.

**Metallurgy.** It is appropriate for students electing to follow the metallurgy option to take Materials Science and Engineering 130. The following suggested courses are intended to provide a basis for developing a program in different areas of interest to metallurgy majors:

- **Mechanical Metallurgy.** Civil Engineering 139 or Mechanical Engineering 129, Mechanical Engineering 135, 182, 121.
- **Chemical Engineering.** Chemical Engineering 142, 150B, 155, 156, 158.
- **Metals Processing.** Mechanical Engineering 121, 122, 123, 124, 129.
- **Automatic Control.** Mechanical Engineering 134, 135, 137; Industrial Engineering and Operations Research 154.
- **Electronic Materials.—** Physics 105A, 121 or 137A; Electrical Engineering and Computer Sciences 130, 131A–131B.
- **Engineering Analysis.** Mathematics 120A–120B–120C or 121A–121B or Mechanical Engineering 116, 117; Electrical Engineering and Computer Sciences 119, 166.
- **Physics of Solids.** Physics 105A, 137A–137B, 141A–141B.
- **Chemistry.** Chemistry 12A, 104A–104B, 110A–110B.
- **Production Management.** Business Administration 140, 141, 142.
- **Industrial Relations.** Business Administration 150, 151, 154, 152.
- **Industrial Organization.** Economics 103A, 121A–121B.
- **Statistics.** Statistics 134A–134B, 135A–135B.

**GRADUATE STUDY IN MATERIALS SCIENCE**

Research on materials is a broad field ranging from engineering to fundamental physics and chemistry. For this reason 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-probs 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

The program leads to the M.S. and Ph.D. degrees. The course of study is sufficiently broad and flexible to allow students with a great variety of undergraduate backgrounds—in engineering science, geology, geophysics, physics, applied mathematics, statistics, or a variety of engineering fields—to earn the M.S. within one to two years, or the Ph.D. within three to five years. Those who terminate at the master's level will have an excellent groundwork of fundamental subjects and the preliminary qualifications for professional activity and research. The emphasis, however, is on the Ph.D. program, which is designed to provide necessary experience for advanced research. For further details on the graduate programs and regulations, please consult the Announcement of the College of Engineering and the Graduate Division section of this catalogue.

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 194.

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 programs in naval hydrodynamics and 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.

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 thermionic 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 ANNOUNCE-
MENT OF THE COLLEGE OF ENGINEERING and the Colleges and Schools section of this
catalogue.

Engineering

Lower Division Courses


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 technol-
ogy. The place of technology in general education.
Introduction to technical literature.

Mr. Susskind (F)

2B. Resources Management and Engineering.
Earthquakes, ocean resources, pesticides, water
quality and supply, space exploration and con-
struction, geologic hazards, urban planning, public
response to engineering problems.

Mr. Seed (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 radio-
 isotopes in medicine and industry; radiation effects
and dosimetry; reactor principles; licensing and eff-
fuse level in power reactors; non-military applica-
tions of nuclear explosives; controlled fusion research;
particle accelerators; nuclear energy in the future.

Mr. Prussin, Mr. Ruby (F, Sp)

17. Introduction to Electronics. (4)

Three hours of lecture and two hours of recitation
per week. Prerequisite: Physics 4B. Principles of elec-
tric circuits; techniques for solution of circuits prob-
lems; conduction of electric currents in semicon-
ductors; the semiconductor p-n junction; the transistor;
principles and applications of analog and digital
 electronic circuits.

Mr. Schwarz (F, W, Sp)

28. Engineering Graphics and Introduction to
Conceptual Design. (4)

Three 1-hour lectures and one 3-hour laboratory
per week. Prerequisite: Mathematics 1A which is
taken concurrently. The fundamental principles of
orthogonal projection and their application to the
analysis and solution of space problems arising in
various fields of engineering; graphical presentation
of data; graphical, numerical, mechanical, and com-
puter solutions and computations; freehand pictorials
and orthographics; and an introduction to conceptual
design.

Mr. Steidel, Mr. Cunningham (F, Sp)

29. Introduction to Engineering Systems. (4)

Three hours of lecture 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. Mote (F, W)


Three hours of lecture per week. Prerequisite:
Physics 4A and Mathematics 1C. A vectorial treat-
ment 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.

The Staff (Mr. Rosenberg in charge) (W, Sp)

41. Machine and Assembly Languages. (4)

Three hours of lecture per week plus individual
computer usage. Prerequisite: Engineering I 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 pro-
graming, Assembly language programming. Rudi-
mentary compiling. Loaders. File processing. Rudi-
mentary I/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 selec-
tion and use of engineering materials, with specific
emphasis on mechanical behavior of metals, concrete,
and ceramics and upon the electrical properties of
semiconducting materials.

Mr. Parker, Mr. Fritz, Mr. Muller (F, W, Sp)

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 re-
peated for credit.

Mr. Zackay (F, W, Sp)
Upper Division Courses

100. Materials and Methods Used in Manufacturing. (3)

Three 1-hour lectures per week. Prerequisite: not open to students in Engineering. Introductory study of the materials and production processes of importance in contemporary technology, with demonstration of basic processes such as machining, forming, casting, and welding.

Mr. Pickus (F, W)

101. Applications of Computers. (4)


The Staff (F, Sp)

110. Computers, Technology and Society. (4)


Mr. Bremermann (W, Sp)

113. Introduction to the Professional Aspects of Engineering. (3)

Two 1½-hour lectures per week. Prerequisite: senior standing in engineering. Development of understanding of the professional responsibility of the engineer; discussion of topics pertinent to the activities of the practicing engineer; preparation of papers and engineering reports.

Mr. Finch (F)

140. Optical Radiation (Illumination). (2)

Two 1-hour lectures per week. Prerequisite: Physics 4D. Light: the spectrum from the ultraviolet, visible to the infrared treated as an engineering subject. Photometric and radiometric concepts, calculations, measurements, color specification, preliminary design problems.

Mr. Finch (F)

140L. Optical Radiation (Illumination) Laboratory. (2)

One 3-hour laboratory per week. Prerequisite: course 140 (may be taken concurrently). Laboratory experiments in the fundamental concepts and quantities used in optical radiation: intensity, luminance, irradiation, illumination, radiant flux, reflection, transmission, absorption, light distribution, visibility, color, measuring instruments, measuring techniques.

Mr. Finch (F)

142. Lighting Design. (3)

Three 1-hour lectures per week. Prerequisite: course 140 (may be taken concurrently). Lighting and illumination requirements for job performance and comfort. Conditions for effective seeing for specific tasks. Lighting design and layouts for interior and exterior installations. Utilization of daylight. Interreflection calculations, paneled and lowered ceilings, wiring and control requirements for lighting.

Mr. Finch (W)

1DS 180. Economic and Biological Feedback Systems. (3)

See Interdepartmental Studies for the complete description of this course.

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

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, Mr. Pask (F) even years only.

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. Holt, Mr. Schaaf, Mr. McNiven 230A (F, Sp); 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. Willis (Sp)

230E. Engineering Analysis. (3)

Three 1-hour lectures per week. Prerequisite: course 230A or Mathematics 165 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. Rodgers (F)

241. Optical Radiation Sources. (4)

Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: course 140. Sources of ultraviolet, visible, infrared and thermal radiation considered from atomic and molecular excitation viewpoint. Luminescence, fluorescence, phosphorescence and electroluminescence, as light-producing phenomena. Infrared and solar radiation calculations. Photocathodivity and photoelectric effects. Laboratory experiments on the characteristics of light sources including fluorescence, gaseous discharge, incandescent and electroluminescent sources.

Mr. Finch (Sp)

280A. Radiation Effects in Semiconductors. (2)

Two hours of lecture per week. Prerequisite: Electrical Engineering and Computer Sciences 230

Mr. Olander, Mr. Oldham (F)

299. 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. Fusk (F, W, Sp)

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. 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 Civil Engineering 15. Introduction to digital computer programming. Computer solution of civil engineering problems. Use of standard programs, subroutines and interpretive languages.

Mr. Chopra, Mr. Taylor, Mr. Wilson (F, W)

21. Plane Surveying. (4)
Two 1/2-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, alidade; 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)
(To be offered in even-numbered years)
Two 1/2-hour lectures per week. Prerequisite: course 10. 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)
(To be offered in odd-numbered years)
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. Fritz (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 and chemical composition 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. Proportioning 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 (W, Sp)

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 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. Witherspoon, Mr. Brekke, Mr. Goodman (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)
Prerequisite: Civil Engineering 130. Three hours of lecture and one 3-hour laboratory per week. Soil formation and identification, Physical and mechanical properties of soils. Bearing capacity of soils and lateral earth pressures on structures. Site investigations, design of structures, construction problems in foundation engineering.
The Staff (Mr. Mitchell in charge) (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)

124. Introduction to Structural Behavior. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisites: Physics 2A and Mathematics 1B or 16B (or as previously required for the former semester course Engineering 18A—Physics 2A and 3A, or 4A and Mathematics 3A). Open only to students in architecture. Introduction to types of architectural structures; forms of structures; forces on structures and their resulting behavior; load transmission; statics; properties of sections; stress and strain; and structural materials.
Mr. Godden, Mr. Taylor (F, W, Sp)

125. Structural Systems. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisites: course 124 or former semester course Engineering 18A. Open only to students in architecture. Introduction to various structural systems and the analysis of forces and stresses in them; beams, trusses, simple arches and suspensions; deflections; approximate analysis of statically indeterminate systems.
Mr. Eberhart, Mr. Polivka, Mr. Scordelis (F, W, Sp)

126. Structural Elements. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisites: course 125 or former semester course Engineering 18B. Open only to students in architecture. Design of structural members under bending, under axial load, and under combined axial load and bending; concepts of safety and behavior; introduction to properties of materials and testing of materials; supports; introduction to plastic behavior.
Mr. Bresler (F, W, Sp)

127. Structural Design of Buildings. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisites: course 126 or former semester course 125 or 126. Open only to students in architecture. Structural design of single-story and multi-story buildings and special structures; proportioning of slabs, beams, frames, and columns; building systems; prefabrication; economics.
Mr. Godden, Mr. Lin (F, W, 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 (Su, 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: Civil Engineering 131. The analysis and design of reinforced concrete structures.
Mr. Baron, Mr. Raphael (F, Sp)

134. Elements of Metal Structures. (4)
Three lectures and one 3-hour laboratory per week. Prerequisite: course 130. Introduction to design of metal structural members and connections.
Mr. Bresler (F, Sp)

135. Reinforced Concrete and Prestressed Concrete Design. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisites: courses 131, 133. Advanced

136. Advanced Structural Analysis. (3)
Three 1-hour lectures per week. Prerequisite: course 131. Elastic and plastic analysis of statically indeterminate 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. Powell, Mr. Scordelis (F)

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. Sackman (Sp)

140. Water Resources Engineering. (4)
Three hours of lecture and one 3-hour laboratory per week. Prerequisite: Civil Engineering 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)

141. Water Quality Management. (3)
Three 1-hour lectures per week. Prerequisite: course 140. Chemical, physical and biological aspects of water and waste water. Theory and design of water and waste water treatment plants. Special water conditioning problems including taste and odor removal, desalinization and corrosion control. Water-pollution control and its relation to process design Mr. Pearson, Mr. Kaufman, Mr. Jenkins (F, W)

142. Design of Water Quality Management Systems. (3)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 141. 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 (Sp)

143. Applied Ecology. (3)
Two hours of lecture and one 2-hour laboratory per week. Prerequisite: none. An introductory course in applied ecology organized around the concepts of natural ecosystemic succession, evolution, and energy flow; with a continuing examination of the disruptive interactions of man in these processes. Mr. Mason (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 (F, W)

145. Chemistry of Waters. (3)
One 1-hour lecture and two 3-hour laboratory periods 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 (Su, 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. Monismith (F, W)

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.
Mr. Layton (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.

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: Civil Engineering 10 and 15 or equivalent. Objectives, characteristics, policy, economics, location, design, and operation of transportation systems. Mr. Monismith (F, W, Sp)

171. Introduction to Traffic Engineering. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 170. Street and highway traffic problems; principles of design of thoroughfares on the basis of operational characteristics; traffic regulation and control.
Mr. Kennedy (Sp)

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.
Mr. Monismith, Mr. Layton (Sp)

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.
Mr. Polivka (F)

181. Engineering Construction. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 194 (may be taken concurrently). 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.
Mr. Polivka (F, W, Sp)

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.
Mr. Snowden (W)

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.
Mr. Seed (W)

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.
Mr. Crandall, Mr. Horonjeff (F, Sp)

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.
Mr. Seed (in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 79. 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. Seed 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 dy-
Courses 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 in 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. Nonsteady flow 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.

Mr. Wiegel (Sp)

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.

Mr. Johnson (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 practice of treatment of municipal waste waters by engineered systems of unit operations and
processes such as flotation, sedimentation, activated sludge, oxidation ponds, filters, digestion, elutriation. Mr. Pearson, Mr. Kaufman, Mr. Jenkins (Sp)

213A. Sanitary Chemistry: Advanced Laboratory. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 146A, 146B. The theory and application of electrochemistry and spectrophotometry to problems of sanitary engineering. Included are experiments on redox potential measurements, corrosion control, heavy metal analysis, infrared and ultraviolet analysis of organic pollutants, flame analysis of major cations in water, fluorescent tracer analysis.
Mr. Thomas (F)

213B. Sanitary Chemistry: Advanced Laboratory. (2)
One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: course 146B, 213A. The theory of column, paper, thin layer and gas chromatography and electrophoresis and application to problems of sanitary engineering. Included are experiments on ion mobility, pesticide analysis, trace pollutational analysis.
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. 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 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)

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 solution. 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 Stress Analysis. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Lectures and laboratory in the principal experimental methods for stress analysis, including mechanical and electrical strain gauging, instrumentation for dynamic strain measurements, stress-coat analysis, analogy methods, photoelasticity, photo-stress and Moiré.
Mr. Eberhart, Mr. Godden (W)

223. Experimental Model Analysis. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 222 or consent of instructor. Lectures and laboratory in the principal methods for experimental model analysis, including the theory of models and similitude, direct and indirect model techniques, and extrapolation procedures.
Mr. Bertero, Mr. Godden (W)

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 earthquakes, 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 loadings.
Mr. Clough, Mr. Penzien, (Sp)
226. Random Vibrations of Structural Systems. (4)

Four and one-half hours of lecture per week. Prerequisite: 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. Penzien (F)

227. Structural Design for Dynamic Loads. (3)

Two 1/2-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 1/2-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, alumina cements and special portland cements.

Mr. Mehta (W)


Three 1/2-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 1/2-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 1/2-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 (W)

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 (Sp)

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 1/2-hour lectures per week. Prerequisite: course 231 and Engineering 230A. Extension, flex-
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. Bertero (W)

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 frameworks for collapse and serviceability. Limit-design of slabs—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 243A 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 1½-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 1½-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)
Four and one-half hours of lecture per week. Prerequisite: course 140 or consent of instructor. Lecture and design course. Loads on dams, selection of location and type; stability analysis; stress analysis of gravity, arch, multiple-arch, dome and slab-buttress dams; 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 220 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 generalized 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 or consent of instructor. 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)

252. Traffic Flow on Transportation Networks. (3)
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 assignment.

Mr. Newell (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 (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 (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. Peaking problems, choice of mode, and efficient prices for transport services.

Mr. Dygert (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. Kennedy (W)

256. Traffic Flow Theory. (3)
Three hours of lecture per week. Prerequisite: Statistics 133, course 251, or consent of instructor. Logical foundations and mathematical representation of traffic flow; interaction 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)

257. Applications of Queuing Theory to Transportation. (3)
Three hours of lecture per week. Prerequisite: Statistics 133. Deterministic queueing models. Strategies 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, interchanges, multilane expressways and freeways, and arterial highways in urban areas.
Mr. May (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 (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. Davis, Mr. Dygert (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.
The Staff (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. Design of Transportation Facilities. (3)
One hour of lecture and two 3-hour laboratories per week. Prerequisite: consent of instructor. Comprehensive design of a transportation facility. Design project can be selected by a student or group of students which is concerned with the overall design of a surface or air transportation facility.
The Staff (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)

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 Stabilization. (3)

Three 1-hour lectures per week. Prerequisite: graduate standing. Purposes of soil stabilization, stabilization using compaction, aggregate addition, cement, asphalt, and chemicals; design, construction and economic considerations using stabilized soils for highways and airfields; principles of pavement design and pavement design methods; special applications and methods of stabilization. Mr. Mitchell (W)

273A. Physicochemical Principles and Soil Behavior. (3)

Three 1-hour lectures per week. Prerequisite: course 114, 121, or consent of the instructor. Clay mineralogy, soil formation and composition, sediments, identification of soil minerals, colloidal phenomena in soils, swelling, ion exchange, soil water. Mr. Mitchell (F)

273B. Physicochemical Principles and Soil Behavior. (2)

Two 1-hour lectures per week. Prerequisite: course 273A. Analysis of the mechanical behavior of soils in terms of physicochemical principles, conduction phenomena, deformation mechanisms and strength, compaction, frost action, rate processes such as secondary compression, creep and thixotropy. Mr. Mitchell (W)

275. Soil Dynamics. (4)

Three 1-hour lectures, and two 1½-hour laboratories per week. Vibrations of simple oscillators. Wave propagation in elastic media. Dynamic behavior of soils, Dynamic tests, Blast effects. Analysis of dynamically loaded foundations. Earthquakes and earthquake resistant design of slopes and foundations. 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. (3)

Two 1-hour lectures and two 1½-hour computational laboratory per week. Prerequisite: knowledge of FORTRAN programming. Theories and numerical methods for consolidation processes. Computer program for consolidation of layered systems. The mechanics of discrete particles and theories of stress-dilatancy. The theory of subgrade reaction. Laterally loaded piles. Mr. Lysmer (F)

278. Stress Analysis in Soil Mechanics. (2)

Two hours of lecture per week. Analysis of stresses and deformations in plane problems in soil mechanics. Elastic systems are studied by the finite element method and plastic systems by the theory of perfect plasticity (limit analysis). Mr. Lysmer (W)

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 anistropic 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 sites. Prerequisite: course 280A. 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 geo-logic 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 coplanarity 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. Prerequisite: 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. Lubliner, Mr. Taylor (F)

290G. Applications of Digital Computers to Structural Problems. (3)
Two 1½-hour lectures per week. Prerequisite: graduate standing in civil engineering and knowledge of FORTRAN coding. Numerical methods and digital computer coding techniques appropriate to solution of problems in structural engineering. Computer programs are developed for matrix operations, solution of equilibrium equations, and static and dynamic analysis of frames, trusses and finite element systems.
Mr. Powell, Mr. Taylor (F)

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. Witherspoon, Mr. Goodman (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. Davis (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)

290Z. Models Related to Air Transportation. (2)
Mr. Newell (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. Seed (F, W, Sp)

299. Individual Research. (1-12)
Prerequisite: graduate standing. Research or investigation in selected advanced subjects.
Mr. Seed 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. Seed (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. Seed (F, W, Sp)

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.

Mr. Whinnery, Mr. Wiesner (F, W, Sp)

100B. Electronic circuits and models; amplifiers, feedback, and oscillators; analog and digital instrumentation and systems; associated laboratory experiments.
Mr. Whinnery, Mr. Wiesner (W, Sp)
101A. Circuits, Electronics, and Electrical Machines. (4)

Two 2-hour lectures per week. **Prerequisite:** Physics 4B. Theory and applications of electronics and electrical circuits. Single-phase and polyphase circuits, electric-mechanical energy conversion. Vacuum-tube and semiconductor devices; amplifiers. Designed for students in civil and mining engineering.

Mr. Woodyard (F, W)

101B. Electronic Circuits and Instrumentation Systems. (4)

Two 2-hour lectures per week. **Prerequisite:** Physics 4B. Theory and applications of electronics and electrical circuits. Vacuum-tube and semiconductor devices. Basic concepts of electronic instrumentation systems. Designed for students in chemical engineering and in mineral technology except mining engineering, and for students in the physical sciences.

Mr. Woodyard (W)

103. Particle Accelerators. (3)

Three 1-hour lectures per week. **Prerequisite:** course 100A–100B or 105 or Physics 110B or Physics 121 (any may be taken concurrently). Theory, design, and application of particle accelerators such as cyclotrons, d.c. accelerators, betatrons, r.f. linear accelerators, synchrotrons, and strong-focusing machines; orbit stability; storage rings; colliding beams; ion sources and vacuum systems; recent developments.

Mr. Woodyard (W)

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. 104A. Network elements and equations. Response of simple circuits for several excitations. Simple nonlinear and time-varying circuits. Tellegen's theorem. Mr. Desoer, Mr. Kuh (F, W, Sp) 104B. General methods of analysis. Duality. Elements of Laplace transforms. Impedance, transfer functions, natural frequencies, frequency response, 2-ports. Network theorems: substitution, superposition, Thevenin, reciprocity.

Mr. Desoer, Mr. Kuh (W, Sp)

105. Digital and Analog Electronic Circuits. (4)

Three hours of lecture and one 3-hour laboratory per week. **Prerequisite:** Engineering 17. Introduction to digital circuits, switching algebra, Karnaugh maps, logic implementation using functional (NAND, NOR) gates. The realization of integrated logic gates, basic logic families. Flip-flops, counters, shift registers. Introduction to analog circuits; the differential pair, integrated operational amplifiers, feedback concepts, frequency compensation.

Mr. Pederson (F, W, Sp)

105L. Digital and Analog Electronic Circuits. (1)

One hour of lecture per week. **Prerequisite:** Engineering 17. Course 105L to be taken concurrently with 105. 105L is intended to accompany 105 and is designed for those students who need additional studies in electronics.

Mr. Pederson (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. Electronics and Circuits Laboratory. (3)

(Formerly numbered 108A–108B)

Two 4-hour laboratories per week. **Prerequisite:** course 105 and course 104B (the latter may be taken concurrently). Experimental investigation of fundamentals of electronic devices and circuits.

Mr. Bergen (W, Sp)

114A–114B. Power Systems Analysis. (3–3)

Three hours of lecture per week. **Prerequisite:** course 100B or 104B, 114B prerequisite: course 114A. 114A. Power system analysis: steady-state network and devices. Analysis of steady-state operation with emphasis on techniques of load flow solution by digital computation. Short circuit analysis by method of symmetrical components. 114B: Power system stability analysis including analysis of synchronous generator excitation systems, related governor systems, load variations and techniques of stability solution by digital computation. Introduction to economic dispatch and coordination of generation, and techniques of solution. (Sequence beginning F)

Mr. Jones, Mr. Smith

115. Semiconductor Circuits Laboratory. (2)

One 4-hour laboratory per week. **Prerequisite:** course 105. 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. The theory of electromagnetic fields and power flow. Plane waves 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. Waves on 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

Mr. Polak, Mr. Wong, Mr. Sakrison (F, W, Sp)

123. Passive Network Synthesis. (4)

Four hours of lecture per week. Prerequisite: course 104A–104B. The basic theory and techniques of passive network description, approximation, and synthesis. One- and two-port synthesis for three element and two element kind networks including computer techniques.

Mr. Kuh (F, Sp)


Four hours of lecture. Prerequisite: course 104A (may be taken concurrently). Signal descriptions, Fourier series, integral and spectrum, principles of amplitude, angular and pulse modulations; representative examples of communication systems including circuits; analysis of the effects of noise on communication, comparisons of systems.

Mr. Sakrison, Mr. Turin, Mr. Wong (F, W, Sp)

126A–126B. Physical Electronics. (3–3)

Two 1-hour lectures and one 3-hour laboratory per week.

126A. Prerequisite: Physics 4C, Mathematics 1C. A unified treatment of the physical principles and theory underlying electron devices and measurements in physical electronics, including recent developments.

Mr. Woodyard (F)

126B. Prerequisite: course 126A or permission of the instructor. A continuation of 126A with emphasis on specific topics within the field of physical electronics, including quantum electronics and relativistic effects.

Mr. Woodyard (W)

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, 157A; 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 Device Physics. (3)

Three hours of lecture per week. Prerequisite: course 130 or Physics 141A–141B or Physics 140. Electrons and holes in semiconductors. Thermal equilibrium and non-equilibrium conditions. Generation and recombination, the continuity equation. P-n junction theory. Introduction to transistors. Physics of diffusion and oxidation.

Mr. English, Mr. Muller, Mr. Oldham (F, W)

131B. Semiconductor Devices. (3)

Three hours of lecture per week. Prerequisite: course 131A. Physics of practical junction transistors, field-effect transistors, Schottky-barrier, and tunnel diodes, semiconductor-controlled rectifiers and photoconductors.

Mr. Muller, Mr. Oldham (Sp)

132. Communication Electronics 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)

133A. Power System Laboratory. (2)

One 4-hour laboratory per week. Prerequisite: course 114A. (133A is not prerequisite to 133B). Techniques for measuring physical parameters and observing and interpreting fundamental phenomena in solid-state materials and devices.

Mr. Muller, Mr. Oldham, Mr. White, Mr. English (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. Angelakos (W, Sp)

136. Quantum Electronics and Magnetism. (3)

Two 1½-hour lectures per week. Prerequisite: Physics 4D, 4E, Mathematics 51C. Quantum electronics in solid materials. Theory of magnetic properties, magnetic resonance, maser and laser phenomena, electroluminescence, with discussion of applications.

Mr. Wang (Sp)

140. Nonlinear Electronic Circuits. (4)

Three hours of lecture and one hour of discussion per week. Prerequisite: courses 104B, 105. Nonlinear models of electronic devices; distortion in amplifiers and its reduction power relations in class A, B, C; bipolar and FET mixers; linear, piecewise-linear and nonlinear analyses of near-harmonic and relaxation electronic oscillators; oscillator design and performance; waveform and timing calculations.

Mr. Meyer (F, Sp)
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)

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)

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 train, gating units, registers; assembly of simple systems from standard high-speed components. Mr. Baskin, Mr. Morton, Mr. Su, Mr. Walsh (F, W, Sp)

150X. Logic Design and Components of Digital Computers. (5)

Four hours of lecture and one 3-hour laboratory per week. Prerequisite: Engineering 1 or equivalent knowledge of FORTRAN or ALGOL. (Intended for students who have not had 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. Supplementary review for those unfamiliar with electric circuits. Mr. Baskin, Mr. Morton, Mr. Su, Mr. Walsh (F, W, Sp)

IDS 114. Elements of Digital Computers. (4)

See Interdepartmental Studies for the complete course description.

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; techniques and considerations of design. Mr. Morton, Mr. Walsh (W, Sp)

152A. Computer Systems. (3)

Three hours of lecture per week. Prerequisite: course 105* or 150. 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 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, Mr. Su (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, Mr. Su (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 both Computer Science 103 and course 153. 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 (F, W, Sp)


Three hours of lecture per week. Prerequisite: course 153. 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 (F, W, Sp)

159. Language Processing Laboratory. (2)

(Formerly numbered 191L)

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. Mr. Maurer (F, W)

160A–160B. Communication of Continuous and Digital Information. (4–4)

160A. Three hours of lecture and one hour of recitation per week. Prerequisite: Statistics 134A–134B. 134B may be taken concurrently. Students will not be given credit for both courses 124 and 160A. Methods of analysis of communication in the presence of noise, emphasizing existing continuous and digital systems, Fourier analysis, description of random processes, the sampling

* Course 105 will be a prerequisite through June 1971.
162. Algorithms and Machines. (4)
Mr. Blum, Mr. Gill, Mr. Spira (F, W)

163. Finite-State Machines. (3)
Mr. Blum, Mr. Gill, Mr. Spira (F, W)

166. Introduction to Optimization Techniques. (4)
Three hours of lecture per week. Prerequisite: course 119. Description of specific optimization problems arising in control and programming. Necessary and sufficient conditions for optimality. Elementary notions of linear, quadratic, and dynamic programming. The maximum principle for linear system and the elements of the calculus of variations.

170. Plasma and Beam Dynamics. (3)
Two 1½-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, accelerator confinement. Fluid approximations; applications to MHD, space-charge flow, electron and ion guns.
Mr. Birdsall, 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. Birdsall, Mr. Lieberman, Mr. Lichtenberg (F, Sp)

181A—181B. Animal Control Systems. (3-3)
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. (2—2)
183A: four hours of laboratory per week; 183B: six hours of laboratory per week. Prerequisite: course 181A or consent of instructor. For electrical 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.
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 neural 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 79. 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. Kuh in charge (F, W, Sp)

IDS 201. Cellular Mechanism Underlying Nervous Activity. (3)
See Interdepartmental Studies for the complete course description.

IDS 201L. Laboratory in Cellular Mechanisms Underlying Nervous Activity. (3)
See Interdepartmental Studies for the complete course description.

Graduate Courses

204. Electron Optics. (3)
Two 1½-hour lectures per week. Prerequisite: course 170 or equivalent. Electron optics of low-density electron beams. Electron guns, lenses, deflection yokes, and their aberrations. Thermal velocity limitations. Design of sub-micron diameter beams.
Mr. Everhart (F)
205. High-Density Electron Beams. (3) Three 1-hour lectures per week. Prerequisite: course 117A, 170 or equivalent, and Mathematics 185. Modern methods for analysis and synthesis of electron flows and structures for focusing, where fields are static and space charge is important. Theoretical methods for finding exact flows and paraxial approximations of various orders. Theoretical methods for calculating electrode shapes.

Mr. Everhart, Mr. Van Duzer (W)


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 Networks. (4) Two 1½-hour lectures per week. Prerequisite: course 210A–210B or Physics 210A–210B–210C. A study of the application of network theory, including the general theorems, the methods of analysis, and the measurement techniques to microwave waveguides, cavity resonators, coupling systems and networks of these components.

Mr. Whinnery (Sp)

222. Techniques of Linear System Theory. (4) Four hours of lecture and two hours of recitation per week. Prerequisite: course 119. Mathematics 112 recommended—may be taken concurrently. Basic system concepts: systems, models, representations; dynamical system representation; state, equivalence, linearity, time-invariance. Linear systems with finite-dimensional state spaces and their properties. Stability, Controllability, Observability. Minimal representation. Examples from circuits, control and other fields.

Mr. Desoer (F, W, Sp)

223. Foundations of Network Theory. (4) Three hours of lecture and one hour of discussion per week. Prerequisite: course 129. Basic techniques of network theory, graph theory, state variables, port characterizations of networks, scattering matrices, integral theorems, and network limitations.

Mr. Rohrer (F, W)


Mr. Rohrer (Sp)

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. Rohrer (W)


Mr. Polak (F)

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, generation of families of feasible directions algorithms. Miscellaneous topics in optimal control.

Mr. Polak (W)

227A. Optimization and Control. (3) Three 1-hour lectures per week. Prerequisite: course 222. Finite-dimensional optimization problems. Introduction to Calculus of Variation. Variational approach to optimal control: necessary conditions; fixed-time and free-time problems, transversality conditions; Hamilton-Jacobi Theory. Feedback control of linear systems: minimum time, quadratic cost.

Mr. Varaiya (W)


Mr. Varaiya (Sp)

228. Digital Control. (3) Three 1-hour lectures per week. Prerequisite: courses 129 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 PFM feedback systems. Application of discrete theory of biocontrol 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 Liapunov and functional analysis methods.

Mr. Bergen, 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 classical equations of van der Pol, Duffing, Mathieu, etc., and to obtain counter examples to Aizerman's conjecture.

Mr. Bergen (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. Equilib­
rium in binary compounds. Diffusion. Phase diagrams.
Mr. English, Mr. Oldham (W)

231. Solid-State Devices. (4)
Two 1½-hour lectures per week. **Prerequisite:**
course 131; Physics 137A–137B or Physics 115. The
fundamental principles of solid-state device opera­
tion. Typical topic: a discussion of the implications
of the Bloch-wave representation for electrons and
of the Boltzmann transport equation to device be­
havior and design. Devices usually considered are
junction and metal-semiconductor diodes; bipolar
and field-effect transistors; thermoelectric elements;
electromechanical transducers and masers and lasers.
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, car­
nier waves in semiconductors, transferred electron
effect, avalanche multiplication of carriers. Appli­
cations to high-frequency solid-state devices includ­
ing 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:**
course 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
opptic and magneto-optic effects; second-harmonic
generation and parametric amplification; diffraction
of laser beams by acoustic and spin waves; energy­
band structure and optical properties of semicon­
ductors; semiconductor lasers; crystal symmetry and
application of group-theoretical considerations.
Mr. Wang (F)

240. Nonlinear Electronic Circuits. (3)
(Formerly numbered 240B)
Three hours of lecture per week. **Prerequisite:**
course 140. Analysis, theory, and design of oscil­
lators, output stages, class C amplifiers, mixers and
multipliers; high frequency problems; nonlinear and
computer-aided analyses; discrete component and
integrated circuit realization.
Mr. Meyer (Sp)

241. Linear Integrated Circuits. (3)
Three hours of lecture per week. **Prerequisite:**
course 141. Circuit element and active device prop­
erties and constraints in analog integrated circuits.
New design and synthesis procedures to achieve
prescribed performance. Limiting and optimum
bounds of performance of lowpass amplifiers, opera­
tional amplifiers, and frequency selective circuits.
Mr. Pederson (W)

242. Linear Active Networks. (3)
Three hours of lecture per week. **Prerequisite:**
course 223. Fundamental properties of linear active
circuits, passivity, activity, oscillation, gain-band­
width limitations and optimum matching, negative
impedance, parametric and feedback amplifiers.
Mr. Rohrer (Sp)

243. Analysis and Design of Discrete-State
Circuits. (3)
Three hours of lecture per week. **Prerequisite:**
course 140 or 145. Device modelling, charge con­
trol; transient analysis of transistor switching; an­
alysis 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. Meyer (F)

245. Digital Integrated Circuits. (3)
Three hours of lecture per week. **Prerequisite:**
course 145. Advanced studies of digital circuit de­
sign and performance with emphasis on integrated
logic families and their characteristics. Noise, trans­
mission delays, speed and reliability. The design of
A/D and D/A conversion circuits and semicon­
ductor memory cells.
Mr. Hodges (Sp)

247. Processing and Design of Integrated
Circuits. (3)
Three hours of lecture per week. **Prerequisite:**
course 141 or 145. Fabrication of monolithic inte­
grated circuits, mask layout and diffusion processing.
Integrated circuits components, device structure and
characterization, parasitic effects. Design of inte­
grated circuits with emphasis on device-circuit in­
teraction, monolithic design constraints, advantages
and limitations of monolithic realization.
Mr. Meyer, Mr. Pederson (F)

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 equip­
ment. Analysis of problems in reliability and signal
propagation. Design automation and the use of com­
puters as design tools.
Mr. Morton 251A (F); 251B (W)

252. Digital Computer Systems. (4)
Two 1½-hour lectures per week. **Prerequisite:**
course 152. The organization and logical design of
digital data processing and control systems. Con­
ventional stored program computers, highly parallel
modular computers, digital differential analyzers.
Computers for computation, information processing,
and control.
Mr. Baskin (F, Sp)

Two 1½-hour lectures per week. **Prerequisite:**
(1) Algebraic and machine languages (e.g., Electrical
Engineering and Computer Sciences 153 or Com­
puter Science 102) (3) Automata or language theory
(e.g., Electrical Engineering and Computer Sciences
162, 163, 263, or 267). Analysis and synthesis of
programming languages and computer operating sys­
tems. Syntax and semantics of programming langu­
ages. The use of procedure, iteration, replication, and
recursion. List processing techniques. Monitor and
executive systems. The special problems of multi­
program and real-time systems.
Mr. Maurer (F, Sp)
265. 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. Karhunen-Loeve expansion. Prediction and filtering. Mr. Turin (F, W)

260B. Stochastic Processes in Electrical Engineering. (3)


261. Communication of Digital Data. (3)

Three hours of lecture per week. Prerequisite: course 260A. Statistical decision formulation of digital communication and radar detection. Bayes nonsequential and sequential decision rules; Neyman-Pearson and sequential probability ratio tests. Digital communication through the Gaussian channel: optimum receiver structure and signal design, channel capacity. Radar detection. Mr. Turin (Sp)

262. Communication of Continuous Data. (3)

Three hours of lecture per week. Prerequisite: course 260A. Statistical decision formulation of analog communication and radar estimation. Bayes and maximum-likelihood estimation. Radar ranging and signal design. Geometric interpretation of parameter modulation. Analog communication through the Gaussian channel; optimum demodulation, comparison of performance with the rate-distortion bound. Mr. Turin (Sp)

263. Sequential Machine Theory. (4)

Three hours of lecture per week. Prerequisite: course 163. Unified treatment of sequential machines. Regular events. Some special classes of machines, Decomposition theory. Turing machines. Mr. Gill, Mr. Spira (W)

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. Deuel, Mr. Gill (Sp)

265A–265B. Information Theory. (3–3)

Two 1½-hour lectures per week. Prerequisite: Statistics 134 or 200A. Course 265A is prerequisite to 265 B.

265A. Coding for reliable transmission over discrete and continuous channels with noise; channel capacity. Introduction to error-correcting codes. (W)

265B. Prerequisite: 265A. Analysis of the probability of error obtainable with optimum encoding. Topics such as decoding methods, channels with input constraints, feedback, unknown parameters, memory.

Mr. Thomasian (Sp)

266. Error-Correcting Codes. (3)

Two 1½-hour lectures per week. Prerequisite: Mathematics 113A–113B. A general treatment of algebraic coding theory and its implementational aspects. Development of pertinent aspects of the theory of Galois fields, Bose-Chaudhuri and burst-error correcting codes. Topics such as algebraic decoding, convolution codes, design of experiments.

Mr. Gill, Mr. Thomasian (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 theorem. Priority arguments. Machine-independent theorems on speed of computation. Mr. Blum beginning (W)

270A–270B–270C. Plasmas. (3–3–3)

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. Birdsell, Mr. Lieberman, Mr. Lichtenberg. Sequence beginning (F)

282. Molecular Bioelectronics. (2)

Two hours of lecture per week. Prerequisite: courses 130, 181A. An analysis of molecular charge transport phenomena, protonic semiconductors, and molecular control phenomena existing in living systems, emphasizing the solid-state electronics concepts extendable to biological systems.

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 (F)

290C. Advanced Circuit Theory. (1–3) One to
three hours of lecture per week. Prerequisite: course 225 and 227A. Application of the techniques of dynamic optimization and the digital computer to practical design problems which arise in conjunction with linear, time-variable, and nonlinear circuits and circuit devices.

Mr. Kuh (Sp)

290D. System Stability. (3) Three hours of lecture per week. Prerequisite: course 229B. Selected topics in stability theory: frequency domain conditions; Lyapunov theory; methods of functional analysis.

Mr. Dzer (W)

290E. Operating Systems for Digital Computers. (4) Three hours lecture per week. Prerequisite: course 153 and permission of the instructor. 253 is recommended. Design and implementation of systems which provide a framework for the application of digital computers to various specific problems. Batch-processing monitors, multi-programming systems, time-sharing systems and real-time systems. Scheduling, storage allocation, input/output and response time.

Mr. Cheng (Sp)

290F. Boundary Value Problems in Electromagnetic Theory. (3) Three hours lecture per week. Prerequisites: courses 210A-210B-210C.

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 analysis programs; effective active device modeling; sparse matrix techniques; basic components and performance of automated design packages for integrated circuits.

Mr. Pederson, Mr. Rohrer (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, neuro-muscular control system analysis, sensory communication, or similar topics.

Mr. Lewis (W)


Mr. Van Duzer (W)

290L. Theoretical Cryogenic Electronics. (3) Three hours of lecture per week. Prerequisite: course 130 and Physics 115 or equivalent. Recommended: course 290K. Theoretical foundations of cryogenic electronics. BCS theory and Cooper pairs. Many-body formulation of fermion and boson systems. Comparison with the treatments of London, Pippard, Ginzburg and Landau. Derived electrodynamic results and the application to superconducting device physics.

Mr. Van Duzer (Sp)

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. (3) 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)

290P. Topics in Solid-State Electronics. (2) Two hours of lecture per week. Prerequisites: 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. Magnetic Field Effects in Solids. (3) Two hours of lecture per week. Prerequisite: EECS 130 or Physics 141 or consent of instructor. A survey of many of the unique phenomena occurring in solids in the presence of a magnetic field. Emphasis on their use in better understanding the interactions of matter with the magnetic field and in containing better measurements of physical parameters in solids.

Mr. Wang (W)

290R. Microwave Acoustics. (4) Three hours of lecture per week. Prerequisite: courses 117B, 1178 and 117S. 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. Quantum and Optical Electronics II. (4) Three hours lecture per week. Prerequisite: course 117B and Physics 115. Magnetic resonance, modulation and detection of lasers, nonlinear optics. Suitable as a continuation of EECS 290Q but may be taken independently.

Mr. Schwarz, Mr. Singer (Sp)


Mr. Raphael (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. Everhart (Sp)

290V. Adaptive and Identification Systems. (3) Three hours of lecture per week. Prerequisite: Statistics 200A and course 229A or equivalent. Adaptive, control and measurement systems responsive to changes in commands, disturbances, components and models, time-varying systems.
Identification of unknown systems by use of adaptive models, error steepest descent and instrumental variables. Nonlinear identification by adjustable decision functions. Convergence with noisy and noiseless state variables.

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)

290X. Radio Telescopes. (4) Three hours lecture per week. Prerequisite: course 117A. Synthesis of celestial brightness distribution from measurements on the ground. Parabolic, spherical, cruciform and interferometric antennas. Occulation and scintillation measurements. Polarization and partial coherence. Atmospheric effects and intensity interferometers. Mr. Welch (W)

290Y. Deterministic and Random Communication Nets. (3) Three hours of lecture per week. Prerequisite: course 222; Statistics 134A or consent of instructor. Deterministic and random network models of communication systems which emphasize parameters as connectivity, reliability and vulnerability of communication systems. Optimum synthesis of networks with both deterministic and probabilistic constraints and objectives. Mr. Lawler (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. 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 1½-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 methods. Mr. Degarmo

Mr. Lapsley, Mr. Keachie (F, W, Sp)

150. Production Systems Analysis. (4)

Two 1½-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 1½-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 material 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 1½-hour lectures and one 1-hour laboratory session per week. Prerequisite: Engineering 164. 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)

160. Introduction to Operations Research. (4)

Two 1½-hour lectures and one 2-hour problem session per week. Prerequisite: Statistics 134A. Formulation of mathematical models and the determination of optimal policies for inventory, production, replacement and allocation systems. Mr. Dreyfus (Su, W)

162. Linear Programming. (5)

Three 1-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. Jewell, Mr. Topkis, 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. Barlow (Sp)

167. Introduction to Queueing Theory. (4)

Two 1½-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 intermittent 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. Wolff, Mr. Ross (F, W)
170. Human Performance Mechanisms. (4)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: mathematics 51C. Introduction to the study of man as a component in engineering and industrial systems. An outline of the main anatomical, physiological, psychological, and social performance mechanisms, their quantitative properties and limitations. Laboratory experiments on analytic and measurement techniques.
Mr. Crossman (F)

171. Social Organization of Work Systems. (3)
Two hours of lecture and one 2-hour project meeting per week. Prerequisite: Mathematics 51C. 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 Measurement and Methods. (3)
Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: course 170, Statistics 134A. Process and operation analysis; work systems analysis and design: plant layout; time standards and predetermined motion-time systems; work-sampling; laboratory and field exercises.
Mr. Lapsley, Mr. Keachie (W)

174. Human Factors Design. (4)
Two hours of lecture and one 2-hour laboratory per week. Prerequisite: course 170, Mechanical Engineering 134 (may be taken concurrently). Introduction to design of manned systems using scientific data and models of human performance. Interface design for control and communication; assignment of functions between men and machines; system performance measurement; effects of environment. Computer simulation methods. Design projects.
Mr. Crossman (W)

176. Work, Incentives, and Organization. (4)
Two 2-hour lectures per week. Prerequisite: Mathematics 51C. Theory and design of jobs and corresponding organizations, with emphasis on motivation and adaption to the currently changing structure of our industrial society. Lecture, cases and discussion. Topics include influence of technology, socio-economic factors, specific aspects of labor relations.
Mr. Keachie (Sp)

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. Glassy (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 79. For students in good standing who wish to undertake a program of individual inquiry initia-

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Mr. Crossman (W)

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Mr. Lapsley, Mr. Keachie (W)

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ed 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. DeGarmo, Mr. Grassi, Mr. Keachie (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 practicable technology and the cultural-economic characteristics of the area or country.
Mr. Keachie (W)

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 programming, Mathematical and computer methods for planning, scheduling, and control of production and service systems; statistical techniques in forecasting; optimization of facilities utilization. Mr. Glassy (Sp)

262A. Linear Programming. (4)
Three hours of lecture at 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 decompostion and upper-bounded variables. Introduction to matrix games and quadratic programming.
Mr. Gale, Mr. Glassy, Mr. Topkis (F, W, Sp)

262B. Nonlinear Programming. (4)
Three hours of lecture per week. Prerequisite: Mathematics 104A, course 262A or 162 and Mathematics 111. Basic graduate course in nonlinear programming. Properties of convex sets and functions, Separation theorems. Lagrange multipliers. Kuhn-Tucker theory, duality, and saddle-point problems. Feasible direction algorithms, cutting plane algorithms, and penalty function methods. The Staff (Sp)
263A. Applied Stochastic Processes. (4)
(Formerly numbered 263)
Two 1 1/2-hour lectures and one 1-hour discussion per week. Prerequisite: Statistics 134B (may be taken concurrently) or Statistics 100A, advanced calculus or Mathematics 104A. Study of methods of renewal theory and Markov chains with application to applied problems in replacement and other stochastic systems. Emphasis on asymptotic behavior. Mr. Jewell, Mr. Wolff, Mr. Ross, Mr. Barlow (F, Sp)

263B. Applied Stochastic Processes. (4)
Two 1 1/2-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. Wolff, Mr. Ross (W)

264. Inventory Theory. (4)
Two 1 1/2-hour lectures and one 1-hour problem sessions per week. Prerequisite: course 263A. Structure of optimal inventory policies, methods for finding such policies in deterministic and stochastic models. Planning horizon theorem, stochastic ordering, single critical level policies, (S, s) policies, myopic policies, Bayesian models, dependence of optimal policies on various parameters. Mr. Topkis, Mr. Shepard (W)

265. Reliability Theory. (4)
Two 1 1/2-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. Barlow, Mr. Ross (Sp, W)

266. Network Flows and Graphs. (5)
Two 1 1/2-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. Max-flow min-cut theorem. Minimum cost flows, Multiterminal and multicommodity flows. Relationship with linear programming, transportation problems, electrical networks and critical path scheduling. Mr. Jewell, Mr. Karp, Mr. Oliver (W, Sp)

267. Advanced Queueing Theory. (4)
Two 1 1/2 hour lectures and one 1-hour discussion per week. Prerequisite: course 263A. Review of elementary queueing models; Markovian and M/G/1 queues. "L=λW" and other conservation laws. Fluctuation theory and G1/G/1 queues. Approximations and bounds for single and multiple channel queues. Priorities. Mr. Wolff (Sp)

268. Applied Dynamic Programming. (4)
Two 1 1/2-hour lectures and one 1-hour discussion per week. Prerequisite: graduate standing. Dynamic programming formulation of deterministic decision process 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. Dreyfus (F, Sp)

270. Engineering Psychology. (4)
Two 1 1/2-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. Mr. Crossman (W)

272. Human Aspects of Industrial Organization. (4)
Two 1 1/2-hour lectures and one 2-hour projects laboratory per week. Prerequisite: course 171 and consent of instructor. Impact of technology on task performance, operator-product interaction, supervision, communication, 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 (F, Sp)

Two 1 1/2-hour lectures and two hours of laboratory per week. Prerequisite: course 170, Mechanical Engineering 134. Allocation of function between man and machine; manual control and human operator theory; display and interface design; simulation and allied techniques; experimental and/or design projects. Mr. Crossman (Sp)

290A. Theory of Production. (4)
(Formerly numbered 220)
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. Shephard (W)

2906. Nonlinear Programming Algorithms. (3)
One 2-hour lecture per week. Prerequisite: course 262B or Electrical Engineering 226. Survey of various algorithms of nonlinear programming: Frank-Wolfe, Zoutendijk feasible direction, Rosen gradient projection, Kelley cutting plane, Griffith-Stewart approximation programming, Fiacco-McCor- nick penalty function, Huard method of centers, Altman reduced gradient, and other promising algorithms. Mr. Glasser, Mr. Topkis (W)

2901. Advanced Theory of Reliability with Applications. (3)
Two 1 1/2-hour lectures per week. Prerequisite: course 265. Statistics 200C. Exponential life testing procedures; robustness against monotone failure rate alternatives. Tests for monotone failure rate. Nonparametric maximum likelihood estimation. Conservative tolerance limits. Reliability growth, system debugging, and accelerated life testing models. Mr. Barlow (Sp)

2901. Integer Programming and Combinatorial Optimization. (3)
Three hours of lecture per week. Prerequisite: course 162 and 262A. Course 266 is also recommended as preparation for the course. 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 (W)
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. Finnie, Mr. Hauser (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. 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.

The Staff (Mr. Rosenberg in charge) (F, Sp)

104A. Engineering Mechanics—I. (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.

The Staff (Mr. Goldsmith in charge) (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.

The Staff (Mr. Goldsmith in charge) (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.

The Staff (Mr. Tien in charge) (105A: F, Sp) (105B: 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.

(105A, 105B: (W, Sp)

106B: Conective and convective transport of material and energy in the single phase; thermal radiation interchange.

(F, Sp)

The Staff (Mr. Tien, Mr. Talbot in charge)

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. Farber 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. Stewart (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—I. (4)

Three 1½-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. Macroscopic formulation of thermodynamics, elementary kinetic theory of gases, an introduction to classical and quantum statistical mechanics, applications to engineering systems.

Mr. Robben (Sp)
115. Methods of Linear Algebra. (3)
Mr. Bogy, Mr. Carroll, Mr. Naghdi (F, Sp)

116. Application of Complex Variables. (3)
Three 1-hour lectures per week. Prerequisite: Mathematics 51C. Methods of theoretical engineering analysis; application of complex variable theory to the design and analysis of engineering systems.
Mr. Laitone, Mr. Holt (F, W)

117. Methods of Engineering Analysis. (3)
Three 1-hour lectures per week. Prerequisite: Mathematics 51C. Methods of theoretical engineering analysis; techniques for analyzing partial differential equations and the use of special functions related to engineering systems.
Mr. Schaaf, Mr. Tien, (W, Sp)

121. Plasticity and Metal Forming. (3)
Three 1-hour lectures per week. Prerequisite: Civil Engineering 130. The theory of plasticity and the forming of metals.
Mr. Kobayashi (F)

122. Material Processing Laboratory. (1)
One 3-hour laboratory per week. Prerequisite: course 121 (may be taken concurrently). Experimental investigation and analysis of plastic deformation in metal forming processes. Laboratory part of ME 121.
Mr. Kobayashi (F)

123. Designing for Weldments and Castings. (3)
Three 1-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. Hazlett (Sp)

124. Molten Metals Laboratory. (1)
One 3-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.
Mr. Hazlett (Sp)

125. An Introduction to the Mechanical Behavior of Materials. (3)
Two 1½-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. Finnie (W)

127. Advanced Methods in Mechanical Design. (3)
Three 1-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: Civil Engineering 130, Mathematics 51C. Solution of practical stress analysis problems related to the design of static and dynamic machine elements. Classical theoretical solutions and various experimental techniques will be brought to bear on real problems.
Mr. Cunningham (W)

131. Kinematics of Mechanism. (3)
Two 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)

132. Dynamics of Machinery. (3)
Three 1-hour lectures per week. Prerequisite: course 103 or 104A. Kinematic and dynamic analysis of rigid body mechanism using graphical and analytical-computer 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)
Three 1-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. Mote, Mr. Steidel (F, Sp)

134. Automatic Control Systems. (4)
Mr. Thal-Larsen, Mr. Takahashi, Mr. Auslander (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. AND, OR, AND, NOR, and NAND logic elements. Introduction to design and analysis of switching control systems.
Mr. Thal-Larsen, Mr. Takahashi, Mr. Auslander (W, Sp)

137. Controls Laboratory. (1)
One 4-hour laboratory period per week. Prerequisite: course 134. Experiments with control systems such as might be encountered in mechanical, chemical, mining and metallurgical engineering. Dynamics of level, temperature, pressure, and other control systems. Studies of control-loop components, switching and digital control.
Mr. Thal-Larsen, Mr. Takahashi (W, Sp)

141. Cryogenics. (4)
Three 1-hour lectures per week and one discussion section. Prerequisite: courses 105B 106A. Thermodynamics of producing low temperature fluids and regions and their application in system design.
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)

45. 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 thermoelectric, photovoltaic, thermionic, magnetohydrodynamic and electrokinetic devices, fuel cells, and nuclear power sources.
Mr. Trezek (F)

46. Combustion Engines. (4)
Three 1½-hour lectures. Prerequisite: courses 105B, 106B. Application of thermodynamic and transport process fundamentals to combustion engines including system performance.
Mr. Oppenheim (W)

47. Jet Propulsion. (4)
Three 1½-hour lectures per week. Prerequisite: courses 105B, 106B, course 161 recommended. Fundamentals and applications of thermodynamics, fluid mechanics, and transport processes to jet propulsion systems. Analysis of the performance of jet, ramjet, and turbojet engines for space and atmospheric flight.
Mr. Sawyer, Mr. Starkman (Sp)

48A. Petroleum Development Engineering. (4)
Three 1½-hour lectures per week. Prerequisite: senior in engineering. Mechanics of rock breakdown; rock drilling mechanics; circulation hydraulics; core evaluation; well completion; completion analysis.
Mr. Somerton (F)

48B. Petroleum Reservoir Engineering. (4)
Three 1½-hour lectures per week. Prerequisite: senior in engineering. Flow through porous media (Darcy's law); capillary behavior; multiphase flow; fluid displacement processes-miscible-immiscible; transient flow behavior.
Mr. Fatt (W)

51. 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. Johnson, Mr. Seban (F, Sp)

53. 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)

55. Statistical Thermodynamics. (4)
Three hours of lecture 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 valuation of thermodynamic properties of gases, liquids and solids. Elementary kinetic theory of gases and evaluation of transport coefficients.
Mr. Greif, Mr. Tien (F, W)

159. Viscous Flow. (4)
Three 1-hour lectures per week. Prerequisite: course 106A, Mathematics 51C. Theoretical and empirical bases of laminar and turbulent flows.
Mr. Laird, Mr. Sherman (F, W)

161. Gas Dynamics. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 105B. Dynamics and thermodynamics of compressible fluid flow. Application to flow in ducts and nozzles.
Mr. Oppenheim, Mr. Talbot (F, Sp)

162. Elementary Hydrodynamics. (4)
Three 1½-hour lectures per week. Prerequisite: Mathematics 51C; course 116 recommended. Kinematics and dynamics of inviscid, primarily incompressible, fluid flow.
Mr. Laird, Mr. Talbot (F, Sp)

164. Engineering Aero- and Hydrodynamics. (4)
Three 1-hour lectures and one 1-hour 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)

172A. Application of Analog Computers. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Mathematics 12B. 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. Atkinson (F)

172B. Application of Digital Computers to Engineering Problems. (3)
Two 1-hour lectures and three hours of laboratory per week. Prerequisite: Mathematics 51C. Application of digital computers to solution of engineering problems. Solution, by compiler languages, of linear algebraic equations, roots of polynomials, interpolating polynomials, ordinary and partial differential equations, error analysis. Digital computer time available for course work.
Mr. Atkinson (W)

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 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. Leitmann, Mr. Goldsmith, Mr. Rosenberg (F, W)

182. Theory of Elasticity. (3)
Three 1-hour lectures per week. Prerequisite: course 105. 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. Bogy, Mr. Hsu (Sp)

185. Introduction to Continuum Mechanics. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Physics 41E and Mathematics 12B. Kinematics of deformation, concepts of stress vector and stress tensor. Principles of conservation of mass, momentum, and energy. Constitutive equations for compressible viscous fluid and linear elastic solid. Some simple solutions, including torsion of elastic bars.
Mr. Carroll, Mr. Naghdi (F, Sp)

198. Group Studies for Advanced Undergraduates. (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 79. 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 (Mr. Tien for Thermal Systems)
(Mr. Finnie for Mechanical Design)
(Mr. Talbot for Aeronautical Sciences)
(Mr. Leitman for Applied Mechanics)
(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, Mr. Finch (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 (F)

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. Modeling 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 (W)

213. Physiological Fluid Mechanics. (4)
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 hour lectures 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. Fatt (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 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. Thomsen, 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 theoretical and experimentally determined material properties for quantitative prediction of service performance.
Mr. Hauser (F, W)

226 / ENGINEERING: MECHANICAL
225. Mechanical Behavior of Engineering Materials. (3)
Two 1½-hour lectures per week. Advanced treatment of plastic deformation, fatigue, creep, and fracture. Case studies to illustrate the application of these topics to design.
Mr. Finnie (F)

226. Reliability in Mechanical Design. (3)
Three hours of lecture 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 (F)

227. Optimal Design of Mechanical Elements. (3)
Three 1-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 1-hour lectures per week. Prerequisite: course 105B. Fluid mechanics of thin films, Reynolds' equation. Analysis and design of liquid and gas film journal and thrust bearings for externally pressurized and self-acting operation. Introduction to boundary lubrication and rolling element bearings.
Mr. Donaldson (F)

229. Experimental Mechanics. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 129, 152 or 185; 133 or 134 (two courses total). Exposé 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 (F)

231. Advanced Kinematics and Mechanism. (3)
Three 1-hour lectures per week. Prerequisite: course 131. Analysis and synthesis of plane and space mechanism. Constraint criteria. Complex variable methods in motion analysis. Advanced analytical and graphical techniques for the design of mechanism to guide a plane or point through multiple positions.
Mr. Radcliffe (W)

232. Dynamic Systems in State Space. (3)
Two 1½-hour lectures per week. Modeling of real systems as a set of static elements and integrators. Dynamic behavior, controllability, observability and stability of linear deterministic systems. Examples are chosen from mechanical and chemical engineering with emphasis on application of modern theory.
Mr. Takahashi (F)

233. Dynamic Systems and Control. (3)
Two 1½-hour lectures per week. Prerequisite: course 134. Design and analysis of single and multi-variable feedback control systems in scalar and vector variable formulation for deterministic and stochastic signals. Integrated approach to conventional and modern control viewpoints. Application to mechanical and chemical engineering systems.
Mr. Takahashi (W)

234. Dynamic Systems and Multivariable Control. (3)
Two 1½-hour lectures per week. Design and analysis of direct digital control systems, nonlinear systems, adaptive and optimal control systems, with emphasis on realization by closed and open loop configurations in mechanical and chemical engineering.
Mr. Takahashi (Sp)

235. Switching Control. (3)
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 (F)

237. Advanced Control Laboratory. (1)
One 3-hour laboratory per week. Prerequisite: course 134. Experimental methods in the analysis and synthesis of dynamic systems and controls. 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 (W, Sp)

243. Valuation of Oil and Gas Producing Properties. (3)
Two 1½-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 1½-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 thermodynamic and phase behavior of the fluids and the mechanics of multiphase flow through porous media.
Mr. Somerton (Sp)

251. Heat Conduction. (3)
Three 1-hour lectures per week. Prerequisite: courses 117, 151. Analytical and numerical methods for the determination of the conduction of heat in solids.
Mr. Trezek (F)

252. Heat Convection. (4)
Three 1-hour lectures, one 1-hour discussion per week. Prerequisite: course 117, 151, 159, or 162. The transport of heat in fluids in motion; free and forced convection in laminar and turbulent flow over surfaces and within ducts.
Mr. Seban (W)
253. Thermal Radiation. (4)
Three 1-hour lectures per week. Prerequisite: course 151, 117. Thermal radiation properties of gases, liquids and solids; the calculation of radiant energy transfer.
Mr. Tien (Sp)

254. Equilibrium Thermodynamics. (4)
Three 1-hour lectures, one 1-hour discussion per week. Prerequisite: course 155 or equivalent. Axiomatic formulation of classical thermodynamics. Statistical mechanics of pure substances and of mixtures.
Mr. Pagni (W)

255. Thermodynamics of High Temperature Gases. (4)
Three 1-hour lecture, one 1-hour discussion per week. Prerequisite: course 155. Ideal and non-ideal gases at high temperatures. Thermodynamics of dissociating and ionizing gases. Spectroscopic properties. High temperature systems.
Mr. Greif (Sp)

290A. Fracture of Engineering Materials. (3)
Two 1½-hour lectures per week. Advanced treatment of fracture from engineering point of view. The topics treated will include: Linear Elastic Fracture Mechanics, Statistical Aspects of the Strength of Brittle Solids, Ductile Fracture, Fracture of Composites, Fatigue and Creep-Rupture. Mr. Finnie (W)

290B. Advanced Welding Metallurgy and Processes. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 123 and 124. The fundamental factors important to the utilization of various welding processes will be reviewed in light of their effect on the properties of the metals being joined. Principles will be elucidated to permit the analysis of and probable consequences of using any new process or new alloy.
Mr. Hazlett (W)

290C. Photoelasticity. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 139 or equivalent. Two and three-dimensional photoelasticity, photoelastic coatings. Use of the conventional polarscope and a gas laser for scattered light photelasticity.
Mr. Brown (W)

290I. Techniques in Discrete Dynamic Systems. (4)
Three hours of lecture per week. Prerequisite: Civil Engineering 225A or course 233 or Applied Mechanics 273A, knowledge of computer programming. Analytical and numerical methods useful for analyzing complex discrete dynamical systems will be discussed. Emphasis upon the use of modern computational techniques to obtain eigenvalues, response and stability, system response. Damped discrete systems and integration methods are included.
Mr. Mote (Sp)

290J. Techniques in Continuous Dynamic System Analysis. (4)
Three hours of lecture per week. Prerequisite: Civil Engineering 225A or course 233 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 examined.
Mr. Mote (W)

290N. Corrosion. (4)
Mr. Cornet (Sp)

290O. 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. Johnson (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. Psychrometric Systems Synthesis. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 116 or equivalent. Specialized techniques for transient psychrometric loads and cycles.
Mr. Hutchinson (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. Witherspoon (Sp)

290U. Combustion. (4)
Four 1-hour lectures per week. Prerequisite: course 155. Atomic and molecular structure, reaction mechanisms and rates, chemical equilibrium, flame temperatures, nonequilibrium phenomena, ignition limits, diffusion flames and droplet burning, premixed flames, spectral properties of flames, experimental techniques, combustors.
Mr. Sawyer (W)

290V. Advanced Problems in Jet Propulsion. (4)
Four hours of lecture per week. Prerequisite: course 155 or equivalent. Topics in fluid mechanics, physics and chemistry of particular interest to jet propulsion systems.
Mr. Sawyer (F)

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)
261A-261B. Compressible Fluid Flow. (4-4)

262. Theoretical Hydrodynamics. (4)
Three 1-hour lectures per week. Prerequisites: Mechanical Engineering 162 and Engineering 230A. Development of the theoretical methods for solving some of the classical problems in hydrodynamics with emphasis on the applications to current research work in fluid mechanics.

263A-263B. Viscous Fluid Flow. (4-4)
Three 1-hour lectures per week. Prerequisites: Engineering 230A, Mechanical Engineering 159 or 162. 263A prerequisite for 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.

264. Wing Theory. (4)
Three 1-hour lectures per week. Prerequisites: Engineering 230A and Mechanical Engineering 162. Incompressible airfoil theory for steady flow in two and three dimensions. Cavitation and noncavitating hydrofoils. Introduction to airfoils in compressible flow, and in unsteady motion.

265. Introduction to Rarefied Gas Dynamics. (4)
Three 1-hour lectures 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.

266. High Temperature Gas Dynamics. (4)
Three 1-hour lectures per week. Prerequisites: courses 261B, 263A. Behavior of gas flows at unusually high temperatures, including effects of dissociation, ionization and vibrational relaxation. Calculation of nonequilibrium and equilibrium flow fields by linearized and numerical methods.

267. Magnetohydrodynamics. (4)
Three 1-hour lectures per week. Prerequisite: Course 261A. The continuum theory of the interaction of conducting fluids and magnetic fields.

268. Gas Dynamics of Reactive Fluids. (4)
Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 161A. Studies of processes involving mutual interaction between fluid-dynamic, chemico-kinetic, heat- and mass-transfer phenomena.

269. Experimental Methods of Aerodynamics. (4)
Three hours of lecture and laboratory (approximately 1/2 each). 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 gas dynamics.

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 the 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 flows; 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.

290B. Kinetic Theory of Transition Flow. (3)
Three 1-hour lectures 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.

290C. Turbulence. (4)

290E. Gasdynamics of Explosions. (4)
Three 1-hour lectures per week. Prerequisite: course 263 or equivalent background in gasdynamics and physical chemistry. Theory of phenomena involving the interaction between rate processes that
result in the deposition of a significant amount of specific power in a gaseous medium and its concomitant nonsteady motion, as exemplified by explosion processes. Mr. Oppenheim (W)

2906. Aircraft Stability and Control. (3)
Three 1-hour lectures per week. Prerequisite: course 264 or 164; Engineering 230A. A theoretical study of the aerodynamic control and the dynamic stability of aircraft and missiles. The dynamics of a spacecraft reentering a planetary atmosphere. Mr. Laitone

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 projects, or group research on complete problems for analysis and experimentation. The Staff (F, W, Sp)

299. Individual Study or Research. (1-12)
Investigation of advanced problems in aeronautical sciences.
The Staff (Mr. Talbot 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 in 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. Talbot in charge) (F, W, Sp)

APPLIED MECHANICS

271. Methods of the Calculus of Variations and Applications. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 115 or 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)

272. Application of Digital Computer Methods to Problems in Mechanical Engineering. (3)
Two hours of lecture and one 3-hour laboratory per week. Prerequisite: knowledge of Fortran and basic numerical methods (ME 172B or equivalent). Application of digital computer techniques to the numerical solutions of ordinary and partial differential equations with special emphasis to equations related to mechanical engineering, e.g., vibration studies, trajectories, aerodynamics, heat flow, elasticity; error analysis; stability of numerical methods. Mr. Atkinson (Sp)

273A. Oscillations in Linear Systems. (4)

273B. Random Oscillations. (3)
Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 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. Soroka (W)

275. Advanced Dynamics. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 175. Axioms of mechanics. Statics of constrained systems, holonomic, nonholonomic, finite, infinite-dimensional 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. Leitman, Mr. Rosenberg (F)

277. Oscillations in Nonlinear Systems. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 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)

278A. The Dynamics of Projectiles. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 104B or 175. Projectile (shell and unpowered rocket) exterior ballistics, particle trajectories in vacuum and air with constant gravity, equations of motion, Siaci method, numerical integration, differential correction theory, effects of wind, etc., motion of spinning projectile, stability criteria. Mr. Leitmann (W)

278B. The Dynamics of Rockets. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 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. Leitmann (W)

281. Methods of Tensor Calculus and Differential Geometry. (3)
Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 115 or 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. Hsu (F)

282A. Theory of Elasticity—I. (4)
Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 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, Mr. Carroll, Mr. Hsu, Mr. Naghdi (Sp)

282B. Theory of Elasticity—II. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisites: course 281 and Mechanical Engineering 185. The general theory of bending of elastic shells with small displacements. Various approximate theories and methods of solution with application to shallow shells and shells of revolution. Nonlinear theories of shells.

Mr. Naghdi, Mr. Hsu (W)

283. Wave Propagation in Elastic Media. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 185. Propagation of mechanical disturbances in unbound and bounded elastic media. Stress waves due to periodic and transient sources. Waves reflection and transmission at bounding surfaces. Pulses in infinite and finite rods and plates.

Mr. Goldsmith, Mr. Carroll (F)

284. Nonlinear Theory of Elasticity. (3)


Mr. Carroll, Mr. Naghdi (Sp)

285. Foundations of the Theory of Continuous Media. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisites: Mechanical Engineering 185 and course 281. Multipolar kinematics and principles of conservation of mass, momentum, moment of momentum, and energy in the presence of multipolar stresses, entropy production inequality. Memory functional, basic invariance principles, nonlinear constitutive equations for special type of continua with application.

Mr. Green (W)

286. Theory of Plasticity. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 185. Fundamentals of plasticity, concept of field and associated constitutive equations in the hardening-plastic solids including those for perfectly plastic, and elastic-perfectly plastic solids. General theorems. Application to torsion and plane problems of plasticity.

Mr. Bogy (F)

287. Impact. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 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)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 182 or 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 (Sp)

*290A. Topics in Nonlinear Oscillations. (4)

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)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 285. Selected topics from recent developments in continuum mechanics, e.g., nonlinear theory of diffusion, theory of electrified and magnetized continua, and nonlinear theory of elastic-plastic continua.

Mr. Naghdi (Sp)

290C. Acoustic Wave Propagation. (3)

Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 175 or 185. Acoustic wave propagation in isotropic and in nonhomogeneous media. Refraction, diffraction and scattering of waves. Radiation pressure. Moving sound source. Sound waves of finite amplitude.

Mr. Soroka (Sp)

290G. Self-Excited Oscillations and Flutter. (3)


Mr. Soroka (Sp)

*290E. Selected Topics in Wave Propagation in Anelastic Materials. (4)


Mr. Goldsmith (W)

*290F. Relativistic Mechanics. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 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 (Sp)

*290G. Topics in Dynamical Systems. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 175. Qualitative treatment of dynamics following Painleve, Birkhoff, Hill, Sundman, Whittaker, Hadamard and Levi-Civita. Study basic in bridging micromechanics 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 (F)
*290H. Variational Principles of Fluid Dynamics and Thermodynamics. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: Mechanical Engineering 175 and 185 is 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)

*290I. Topics in Linear Continuum Theories. (4)

Three 1-hour lectures and one 1-hour discussion period per week. Prerequisite: course 282A. 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. Naghdi (W)

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 (Mr. Hsu in charge) (F, W, Sp)

299. Individual Study or Research. (1-12)

Prerequisite: graduate standing in engineering, physics, or mathematics. Investigations of advanced problems in applied mechanics.

The Staff (Mr. Leitmann 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 units or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

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

MATERIALS SCIENCE AND ENGINEERING

Upper Division Courses

100. Field Trips. (2)

One 4-hour laboratory per week. Prerequisite: junior standing in ceramics or metallurgy. Selected plant visitations, lectures by practicing metallurgical and ceramic engineers, and reports on industrial organizations engaged in the manufacture or use of ceramic and metallurgical products. Mr. Pask (Sp)

101. Crystal Chemistry and Diffraction. (4)

Three hours of lecture and three hours of laboratory per week. Prerequisite: Chemistry 1B. Prediction of crystal structures and properties on the basis of atomic sizes and bonding characteristics. Introduction to X-ray, neutron, and electron diffraction techniques for the characterization of crystalline materials. Laboratory work on applications of powder and single crystal diffraction techniques.

Mr. Thomas, Mr. Washburn (F)

103. Phase Diagrams and Microstructures. (4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Chemistry 14. Phase diagrams through ternary systems; relation to equilibrium-nonequilibrium effects; relation to microstructures.

Mr. Hultgren (Sp)

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. Ravitz (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 (F)

109. Physical Metallurgy. (3)

Three 1-hour lectures per week. Prerequisite: senior standing in engineering or a physical science. Microstructures of alloys; typical structures of cast and wrought metals; effect of thermal mechanical treatments on strength, ductility, fracture toughness and corrosion resistance.

Mr. Parker, Mr. Washburn (Sp)

109L. Physical Metallurgy Laboratory. (1)

One 3-hour laboratory per week. Prerequisite: course 109 is a prerequisite and can be taken concurrently. Laboratory work on preparation of alloy specimens for optical and electron microscope observation; interpretation of electron micrographs.

Mr. Parker, Mr. Washburn (Sp)

121. Glass and Crystalline Ceramic Materials. (3)

Three hours of lecture per week. Prerequisite: senior standing in engineering or a physical science. 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 exercises to supplement lectures on compounding of glass properties of glasses; and interfacial bonding in glass-metal systems.

Mr. Fulrath, Mr. Pask (W)

122. Ceramic Processing. (4)

Three hours of lecture and one 3-hour laboratory per week. Prerequisite: course 141. Characterization of ceramic bodies; forming and firing processes; sintering in presence and in absence of liquid phase; problems in obtaining desired microstructures.

Mr. Fulrath, Mr. Pask (Sp)
128. Seminar in Ceramic Science and Engineering. (2)
Two 1-hour lectures per week. Prerequisite: senior standing in ceramics or metallurgy. Seminar discussions of recent scientific and technical literature pertaining to ceramics. Specific assignments on individual problems involving engineering analysis and design as related to ceramic engineering practice.
Mr. Fulrath, Mr. Searcy (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, W)

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. Fuerstenau (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. Fuerstenau (F)

142. Materials Process Engineering. (4)
Four 1-hour lectures per week. Prerequisite: Chemistry 144. Material and energy balances in metallurgical and ceramic systems; fuels and combustion; fluid flow; heat transfer.
Mr. Ravitz (Sp)

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 79. 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. Fuerstenau in charge (F, W, Sp)

Graduate Courses

202. Bonding and Crystal Structures. (3)
Three 1-hour lectures per week. Prerequisite: Chemistry 110A. Bonding models and semi-empirical correlation schemes are applied to analyzing and predicting structures, bond distances, and bond energies in inorganic compounds and alloys.
Mr. Hultgren, Mr. Searcy (W)

203. Advanced Thermodynamics. (3)
Three 1-hour lectures per week. Prerequisite: course 104 or equivalent. Thermodynamics is used to predict reactions and interpret phase transitions for inorganic materials; solid solutions; the estimation of missing data.
Mr. Searcy, Mr. Kelly (F)

205. Diffusion in Crystals. (4)
Four hours of lecture per week. Prerequisite: graduate status in engineering, chemistry, physics, mathematics or geology. Solid-state diffusion; analyses of diffusion in solids; thermodynamics of diffusion; thermally activated mechanisms of atomic migration; uncorrelated and correlated random walk processes.
Mr. Dorn (W)

206. Kinetics of Phase Transformations. (4)
Four hours of lecture per week. Prerequisite: graduate status in engineering, chemistry, physics, mathematics or geology. Kinetics of nucleation and growth of phases in solid state reactions; role of surfaces, stacking faults, dislocations, coherency stresses and strain energy; diffusion-controlled and diffusionless transformations.
Mr. Dorn (Sp)

207. Defects in Crystals. (3)
Three hours of lecture per week. Characterization of point, line and area defects in crystalline solids; formation and motion of elementary point defects and point defect complexes; properties of dislocations and their interactions with other defects; theories of yielding, strain hardening, fracture; effects of radiation damage.
Mr. Washburn (F)

208. Dislocation Mechanics. (4)
Four hours of lecture per week. Prerequisite: graduate status in engineering, chemistry, physics, mathematics or geology. Introduction to dislocation theory with emphasis on applications to mechanical metallurgy. Dislocation statics; dislocation reactions. Theories of strength. Dislocation dynamics; application of reaction rate kinetics to thermally activated dislocation motion.
Mr. Dorn (F)

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. Merriman (Sp)

213. Electron Microscopy and Diffraction. (4)

Three hours of lecture per week. Prerequisite: course 101. Significance and interpretation of electron diffraction patterns and images of perfect and imperfect crystals; kinematical and dynamical theories; adsorption; Kikuchi diffraction; characterization of structure; applications in Materials Science and Engineering.

Mr. Thomas (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. Solid-State Phase Transformations. (3)

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 200) 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 (F)

*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. Fuerstenau, 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 heat treatment of metallic or nonmetallic inorganic powder compacts; evaluation of the influence of process variable such as externally applied pressure, liquid phase development, and secondary phases.

Mr. Furtuth (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.

Mr. Ravitz (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. Pask (W)

*242. Synthesis of Complex Materials. (3)

Three hours of lecture per week. Prerequisite: at least one quarter of graduate study. Design of engineering materials from basic principles involving the characterization of structure and properties; maximizing the usefulness of existing materials; designing new materials from basic principles. Syntheses of complex materials in terms of alloy theory, phase transformations, thermal and thermomechanical processes and physical properties.

Mr. Thomas, Mr. Zackay (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, Mr. Furtuth (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. Furtuth (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. Bearn (Sp)

290. 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 assemblies, 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 (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)

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 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

105. Geochemical Prospecting. (1)
One 3-hour laboratory per week. Prerequisite: Geology 150, 106 (concurrently). The principles and practice of geochemical methods of prospecting for deposits of metallic minerals.

The Staff (F)

106. Applied Geophysics. (3)
Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Physics 4E and Geology 150. An introductory course in geophysical techniques used for the solution of geological mapping problems. Intended for geologists, civil engineers, geological engineers, and other nongeophysics majors.

The Staff (F)

107. Analysis of Mineral Operations and Processing. (3)
Three hours of lecture per week. Prerequisite: an elementary statistics course or equivalent. Mathematical and statistical techniques for isolating the effects of various factors in handling and processing mineral materials, the statistical analysis of metallurgical and ceramic data, the precision of various data collection schemes.

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 79. 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

200A–200B. Electromagnetic Propagation. (3–3)
Three 1-hour lectures per week. Prerequisite: Engineering 230A–230B; Physics 110C or Electrical Engineering 117A–117B–117D. Physics 210A–210B advisable. The theory of dispersive propagation, at VLF, ELF, and ULF frequencies, in inhomogeneous, anisotropic and layered media, including plasmas; dipole antennae; diffraction around obstacles of simple form. Numerical assignments are made of problems arising in geophysical engineering.

Mr. Morrison (W, Sp)

201. Analysis of Potential Field Data in Geophysics. (3)
Three 1-hour lectures per week. Prerequisite: Engineering 230A–230B; Mathematics 121A–121B or equivalent; Physics 110A–110B. Interpretation of potential field data arising in geophysical surveys; transfer functions of potential field operators such as analytic continuation, derivatives, detrending and data smoothing; linear filters in geophysical interpretation; application of Euler's theorem, conformal mapping, numerical methods of calculating gravitational and magnetic attraction. Mr. Morrison (F)

Three hours of lecture per week. Prerequisite: Statistics 133 or equivalent, concurrent registration in Statistics 135A recommended, knowledge of FORTRAN programming recommended. 202A must be taken before 202B. The construction and analysis of random models for various geophysical phenomena, including ocean wave seismic and geomagnetic measurements; cross-spectral analysis for stationary and nonstationary geophysical models; techniques for treating certain nonlinear models; filter theory applied to geophysical data. ———— (beginning W)

203. Physical Properties of Rocks. (3)
Two 1½-hour lectures per week. Prerequisite: Chemistry 110A, Physics 4E, and Mathematics 12B, or consent of instructor. A survey of the electrical, magnetic, thermal and rheological properties of rocks. The Staff (W)

204. Seismic Exploration. (3)
Three hours lectures per week. Prerequisite: course 121B or equivalent, Engineering 230A or Electrical Engineering 119 or Geophysics 104A–104B or equivalent. Engineering aspects of the analysis and processing of data in modern seismic exploration. Applications of linear theory; digital filtering, temporal and spatial filtering, signals and noise, statistical methods, arrays, beam steering. Types and configurations of the sources and receivers, stacking. Typical results. Mr. Rodgers (Sp)
206. Electrical, Magnetic and Gravity Methods. (5)
Five 1-hour lectures per week. Prerequisite: course 200A–200B, 201, 203. Modern engineering practice in application of electrical, magnetic, and gravity methods to solution of geophysical 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 (F)

207. Mineral Exploration. (3)
Two 1½-hour lectures per week. Prerequisite: course 106, Geology 205A–205B. The design of exploration campaigns based upon the integration of geological and geophysical methods.

The Staff (W)

*208. Risk Analysis and the Theory of Extremes. (3)
Three hours of lecture per week. Prerequisite: Statistics 133. Concurrent registration in Statistics 135A recommended. Risk model for environmental hazards, the statistical theory of extremes are applied to strength of materials and the selection of design criteria, probabilistic analysis of failure risk in engineering structures with particular emphasis on the marine environment.

(And other doctoral degrees). May not be used to meet either unit or residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

Mr. Morrison (F, W, Sp)

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.

Mr. Rodgers (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)

Mr. Morrison (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.

Mr. Morrison (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.

Mr. Morrison (F, W, Sp)

Naval Architecture

Upper Division Courses

151. Statics of Naval Architecture. (3)
Three 1-hour lectures per week. Prerequisite: Mechanical Engineering 105B 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. Webster (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 105C (recommended course 152B). Power requirements and selection of power plants for various types of vessels. The selection of auxiliary machinery for steam and motor ships will be considered.

Mr. Webster (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.

154B. A more detailed study of some single aspect of the design.

Mr. Webster (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)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 79. 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 stresses, strains, and displacements; 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)

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 doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.
The Staff (Mr. Wehausen in charge) (F, W, Sp)

Nuclear Engineering

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. Olander, Mr. Kaplan (F)

165. Introduction to Nuclear Engineering. (4)

Mr. Schrock, Mr. Frussin, Mr. Kaplan (F W, S)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 79. 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. Grossman (F, W, Sp)

Graduate Courses

202. Experimental Neutronics Laboratory. (2)
203. Chemical Methods in Nuclear Technology. (3)
One 1 1/2-hour lecture and one 4 1/2-hour laboratory per week. Prerequisite: course 201 and consent of instructor. Experimental illustrations of the interrelation between chemical and nuclear science and technology; fission process; chemistry of fission fragments; chemical effects of nuclear transformations; application of radioactivity to study of chemical problems; neutron activation analysis.

Mr. Prusin (Sp)

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. Pigford (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. (3)
Three 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)

230. Engineering Aspects of Controlled Fusion. (4)
Four hours of lecture per week. Prerequisite: Physics 142 or Electrical Engineering and Computer Sciences 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 (W)

231. Thermolectric and Thermionic Energy Conversion. (4)
Four hours of lecture per week. Prerequisite: consent of instructor. Derivation of thermolectric properties from irreversible thermodynamics; thermolectric properties of metals and semiconductors; power, efficiency, and geometrical configurations for thermolectric devices. Thermionic emission from metallic surfaces; power density and efficiency for close-spaced vacuum diodes operating as energy converters.

Mr. Pigford (W)

232. Magneto-hydrodynamic Energy Conversion. (4)
Three 1 1/2-hour lectures per week. Prerequisite: course 260A. Principles and applications of the direct conversion into electrical energy of the thermal and kinetic energy of an electrically conducting fluid in interaction with an electromagnetic field. General magneto-hydrodynamic theory: magneto-hydrodynamic power generation. Coupling of fission reactors to magneto-hydrodynamic converters.

Mr. Grossman (Sp)

240. Biological Effects of Radiation and Radiation Safety. (4)
Three 1 1/2-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–137C 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. Yadigaroglu (W, Sp)

255. Numerical Methods of Reactor Analysis. (4)

Mr. Amster (Sp)

256A–256B. Advanced Reactor Analysis and Transport Theory. (3–3)
Two 1 1/2-hour lectures per week. Prerequisite: course 250A–250B; Mathematics 220A–220B recommended. The theory of the distribution of neutrons in space, direction, and energy. Formulations of neutron Boltzmann equation, exact solutions of one-group problems, polynomial expansions, numerical methods. Slowing-down problems, multi-group methods, neutron thermalization. Singular eigenfunction expansions, invariant imbedding, variational techniques, time dependent problems.

Mr. Amster (F, W)

260A–260B. Thermal Aspects of Nuclear Reactors. (4–4)
Three 1 1/2-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, Mr. Schrock (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. Ruby (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 associated with the design of nuclear reactor systems.
286. Two Phase Flow and Heat Transfer. (4)
Four hours of lecture per week. Prerequisite: Mechanical Engineering 105B and 151. Study of the hydromechanics 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. Pigford (Sp)

270. Nuclear Reactions and Interaction of Radiation With Matter. (4)
Three 1½-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 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)

ENGLISH
(Department Office, 322 Wheeler Hall)

Professors:
Jonas A. Barish, Ph.D.
Fredrick C. Crews, Ph.D.
Phillip Damon, Ph.D.
Stanley E. Fish,† Ph.D.
Thomas B. Flanagan,† Ph.D.
Norman S. Grabo, Ph.D.
James D. Hart, Ph.D.
Howard E. Hugo, Ph.D.
Arthur E. Hutson, Ph.D.
Charles W. Jones, Ph.D., Litt.D.
John E. Jordan, Ph.D. (Chairman)
Ulrich Kneepf, Ph.D.
Josephine Miles, Ph.D., Litt.D.
N. Scott Monaday, Ph.D.
Charles Muscatine,† Ph.D.
Brendan P. O'Hehir, Ph.D.
Thomas F. Parkinson, Ph.D.
John Paterson, Ph.D.
Norman Rabkin, Ph.D.
Ralph W. Rader, Ph.D.
John H. Raleigh, Ph.D.
Alain Renoir, Ph.D.
Hugh M. Richmond, D.Phil.

Special Studies
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.
(F, W, Sp)

299. Individual Research. (1–12)
Investigation of advanced nuclear engineering problems.
The Staff (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.
(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)

Mark Schorer, Ph.D., Litt.D.
Wayne Shumaker, Ph.D.
Henry Nash Smith, Ph.D., Litt.D.
John L. Traugott, Ph.D.
Ernest Tuveson, Ph.D.
Larzer Ziff, Ph.D.
Arthur G. Brodeur, Ph.D., LL.D. (Emeritus)
Bertrand H. Bronson, Ph.D., D.és L. (hon.).
Dr. of Humane Letters (hon.), (Emeritus)
Bertrand Evans, Ph.D. (Emeritus)
Willard E. Farnham, Ph.D., LL.D. (Emeritus)
Benjamin H. Lehman, Ph.D., LL.D. (Emeritus)
George R. Stewart, Ph.D., L.H.D. (Emeritus)

Associate Professors:
Paul J. Alpers, Ph.D.
Robert Bloom,† Ph.D.
Stephen Booth, Ph.D.
Julian C. Boyd, Ph.D.
James E. Breslin,† Ph.D.
Richard Bridgman,† Ph.D. (Vice-Chairman)
Jackson V. Burgess, M.F.A.
John S. Coolidge, Ph.D.
Donald M. Friedman, Ph.D.

Note: For key to footnote symbols, see page 78.
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. 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. An introductory course in literary scholarship (208), normally taken in the first or second quarter of graduate study, and a two-quarter seminar (250) are required of all graduate students. There are no other specific course requirements. The first five quarters of study are devoted to preparing for the ten-hour written comprehensive examination on the history and criticism of English and American literature from Chaucer through the present, with special attention to the ages of Chaucer, Shakespeare, and Milton. 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 4 1/2 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)

20. Modern British and American Literature. (5)
Four to 4 1/2 hours per week. Mr. Crews (Sp)

25. Language. (5)
Four to 4 1/2 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.

Mr. Casteen (W)

26. Introduction to the Study of Poetry. (5)
Four to 4 1/2 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. Booth (F)

27. Introduction to the Study of Fiction. (5)
Four to 4 1/2 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.

Mr. Tuveson (W)

28. Introduction to the Study of Drama. (5)
Four to 4 1/2 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. Barish (Sp)

30. American Words and Writers. (5)
Four to 4 1/2 hours per week.

Mr. Crews (F)

33A–33B–33C. American Studies. (5-5-5)
Four to 4 1/2 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. R. Hutson (F, W, Sp)

40. Intermediate Expository Writing. (5)
Four to 4 1/2 hours per week. Prerequisite: course IA–1B or equivalent, and consent of instructor.
Mr. Paterson (Sp)

42. Writing in Connection with the Reading of Important Books of the Nineteenth and Twentieth Centuries. (5)
Four to 4 1/2 hours per week. Prerequisite: course IA–1B or equivalent and consent of instructor.
Mr. Tracy (F)

44A-44B-44C. Masterpieces of Literature. (5–5–5)
Four to 4 1/2 hours per week. Lectures on great works of the world’s literature.
44A. Classical Literature. Mr. Rabkin (F)
44B. Medieval and Renaissance Literature. Mr. Jones (W)
44C. Literature since the seventeenth century.

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 4 1/2 hours per week. 110A is prerequisite to 110B.

110A. Structure of the English language. Mr. Boyd (F)
110B. History of the English language. Mr. Brooks (Sp)

COURSES IN LITERATURE

114A–114B–114C. English Drama. (5–5–5)
Four to 4 1/2 hours per week.

114A. English drama to 1603. Mr. Altman (W)
114B. English drama 1603–1700. Mr. Rabkin (Sp)
114C. British and American drama from 1860 to the present. Mr. Tracy (W)

*IDS 115. Music and Poetry of the English Renaissance. (4)
See Interdepartmental Studies for the complete description of this course. Mr. Orgel (F)

116. The English Bible as Literature. (5)
Four to 4 1/2 hours per week. Mr. Jordan (Sp)

117A–117B. Shakespeare. (5–5)
Four to 4 1/2 hours per week. A chronological survey of Shakespeare’s career. Mr. Orgel (F, W)

117E. Shakespeare for Nonmajors. (5)
Four to 4 1/2 hours per week. Mr. Burgess (W)

117J. Shakespeare. (5)
Four to 4 1/2 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. Altman (F); Miss Fox (W); Mr. Friedman (Sp)

117S. Shakespeare. (5)
Four to 4 1/2 hours per week. Lectures on Shakespeare and reading of his best work.
Mr. Kuryds (F); Mr. Richmond (Sp)

119. The Age of Johnson. (5)
Four to 4 1/2 hours per week. Mr. Bridgman (Sp)

120A–120B. Medieval Literature. (5–5)
Four to 4 1/2 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 (F)
120B. Close study of selected classics in translation, including the Nibelungenlied and Dante’s Divine Comedy. Mr. Scott (W)

121A–121B. Romantic Period. (5–5)
Four to 4 1/2 hours per week.
121A. Blake, Wordsworth, Coleridge and contemporaries. Mr. Paley (W)
121B. Byron, Shelley, Keats and contemporaries. Mr. Hugo (Sp)

122A–122B. Victorian Period. (5–5)
Four to 4 1/2 hours per week.
122A. British literature from about 1840 to 1870. Mr. Tracy (F)
122B. British literature from about 1870 to 1901. Miss Christ (Sp)

123. Nineteenth-Century British Prose. (5)
Four to 4 1/2 hours per week.

125A–125B. The English Novel. (5–5)
Four to 4 1/2 hours per week. 125A is not prerequisite to 125B.
125A. Defoe through Scott. Mr. Rader (F)
125B. Dickens through Conrad. Mr. Knoepflmacher (Sp)

125D. The Novel in Europe and America in the Nineteenth and Twentieth Centuries. (5)
Four to 4 1/2 hours per week. Mr. Hugo (W)
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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 eighteenth century, with consideration of the more important aspects of English literary history. 146A, Chaucer through Spenser; 146B, Marlowe through Milton; 146C, Dryden through Austen; 146D, Blake through Yeats.
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 hour per week. Mr. Kratins (F); Mr. Collier (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 hour per week. Mr. Friedman (F), Mr. D. Griffin (Sp)

151S. Shakespeare. (5)
Four to 4½ hours per week. Mr. Snow (F); Mr. Rabkins (W); Mr. Kurdys (Sp)

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 79. 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 4½ 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.

   Mr. Burgess (F); Mr. Parkinson (Sp)

142A. Advanced Composition. (5)

Four to 4½ hours per week. Primarily for students seeking the secondary school teaching credential whose teaching major is English.

   Mr. Coolidge (F); Mr. Booth (W); Mr. Nummi (Sp)

142B. Advanced Composition. (5)

Four to 4½ hours per week. Primarily for students seeking the secondary school teaching credential whose teaching minor is English.

   Mr. Kratins (F); Mr. Booth (W); Mr. Kratins (Sp)

142C. Advanced Composition. (5)

Four to 4½ hours per week. Primarily for candidates for the general elementary teaching credential whose teaching major or minor is English. Review of elements of composition, writing in connection with discussion of books suitable for elementary and junior high school.

   *142D. Advanced Prose. (5)

Four to 4½ hours per week. Prerequisite: consent of instructor. Special section in advanced prose for teaching assistants, readers, and honors students in departments other than English.

   Mr. Oliver (F); Mr. Feingold (W)

   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 4½ hours per week.

   Mr. Michaels (W); Mr. Burgess (Sp)

143B. Verse. (5)

Four to 4½ hours per week.

   Mr. Parkinson (F); Miss Miles (W); Mr. Scott, Mr. Tillinghast (Sp)

143C. Long Narrative. (5)

Four to 4½ hours per week. The student will work throughout the quarter on a single project, either fiction (novel) or nonfiction (biography, history).

   Mr. Momaday (F)

143D. Expository and Critical Writing. (5)

Four to 4½ hours per week.

143T. Poetry Translation Workshop. (5)

Four to 4½ 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.

   Mr. Oliver (Sp)

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.

   Mr. Booth (Sp)

*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, pre-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.

*344. Problems and Methods in Teaching World Literature. (3)

Three 1-hour meetings per week. Prerequisite: one course in the literature of a language other than English in the original, or consent of the instructor. Studies of various texts, chiefly European, from Greek tragedy to the present, with emphasis on philosophical, historical and biographical backgrounds.

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 4½ hours per week.

203. Graduate Readings. (5)

Four to 4½ 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. Offerings 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)

Three 1½-hour meetings per week. This course may be repeated for credit.
205. Structure of English. (5)
Four to 4½ hours per week. The structure of present-day English—pronunciation, grammar, vocabulary, dialects. — Mr. Fillmore (F), Mr. Boyd (Sp)

208. Problems in the Study of Literature. (5)
Four to 4½ hours per week. Approaches to literary study, including textual analysis, scholarly methodology and bibliography, critical theory and practice. Offerings 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 4½ hours per week. Prerequisite: Latin 2 or equivalent. An introduction to the central language and literature of the Middle Ages.
210A: Prose  Mr. Jones (F)
210B: Verse  Mr. Jones (Sp)

210C. Readings in Renaissance Latin. (5)
Four to 4½ hours per week. Prerequisite: consent of the instructor. An introduction to the range of Renaissance Latin texts. — Mr. Shumaker (F)

211A. Introduction to Old English. (5)
Four to 4½ hours per week. Open to seniors with consent of the instructor. Rapid reading of Old English texts. — Mr. A. Hutson (F)

211B. Beowulf. (5)
Four to 4½ hours per week. Open to qualified undergraduates, with the instructor’s consent. — Mr. A. Hutson (W)

213. Readings in Middle English. (5)
Four to 4½ hours per week. Rapid reading of selections in Middle English, from the twelfth century through the fifteenth. — Mr. A. Hutson (Sp)

SEMINARS

250. 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. Offerings 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)

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. Offerings vary from year to year. Students should consult the department’s Announcement of Courses for offerings in the current academic year.
Mr. Muscatine (F); Mr. Paterson (W); Mr. Kratins (Sp)

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 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)

English for Foreign Students (EFS)
(Department Office, 2241 College Avenue)

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 Grammar for Foreign Students. (4)
Four and one-half hours of lecture 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. — The Staff (F, W, Sp)

25. Advanced English Grammar 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. — 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 or (2) who have passed course 25. 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.

The Staff (F, W, Sp)

40. Advanced 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)

ENTOMOLOGY AND PARASITOLOGY

(Department Office, 137 Giannini Hall)

Professors:
John E. Casida, Ph.D.
Richard L. Doutt, Ph.D., J.D.
Julius H. Freitag, Ph.D.
Deane P. Furman, Ph.D.
Kenneth S. Hagen, Ph.D.
Carl B. Huffaker, Ph.D.
Dilworth D. Jensen, Ph.D.
Carlton S. Koehler, Ph.D.
E. Gorton Linsley, Ph.D.
Werner J. Loher, Ph.D.
Powers S. Messenger, Ph.D. (Vice-Chairman)
Woodrow W. Middlekauff, 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:
John R. Anderson, Ph.D.
Donald L. Dahlsten, Ph.D.

Howell V. Daly, Ph.D.
Rudolph L. Pipa, Ph.D.
Jerry A. Powell, Ph.D.
Clarence J. Weinmann, Ph.D.

Assistant Professor:
Bernd Heinrich, Ph.D.

Assistant Professor:
John E. Simmons, Jr., Ph.D., (Acting)

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. Pinnock, Ph.D.
George O. Poinar, Jr., Ph.D.
Douglas W. Price, Ph.D.
Edward S. Ross, Ph.D.
Charles H. Schaefer, Ph.D.

Undergraduate Major Adviser: Mr. Falcon
Graduate Advisers for Entomology: Mr. Freitag, Mr. Huffaker, Mr. Koehler, Mr. Loher.
Graduate Adviser for Parasitology: Mr. Weinmann.
Graduate Adviser for Medical Entomology: Mr. Anderson.

The Department of Entomology and Parasitology in the College of Agricultural Sciences offers the entomology major in the Agricultural Sciences Curriculum (see page 85). 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.

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

† 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 78.
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 (5); 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.

**Lower Division Course**

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. **(F)**

102A–102B. Anatomy and Physiology of Insects. (4-4)
Lectures, 2 hours per week; laboratory, 6 hours per week. **Prerequisite**: upper division standing in zoology or entomology. **Recommended**: course work in chemistry through introductory organic. 102A is not prerequisite to 102B. Sequence, beginning (F).

102A. Principles of nutrition, metabolism, and distribution of metabolites. **Mr. Pipa (F)**

102B. Principles of growth and development, sensory reception, neuromuscular interactions, and reproduction. **Mr. Pipa (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)
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. Dahlsten, 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 families. 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)

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. 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 8A–8B, or equivalent. Chemical composition of insecticides; their mode of action; resistance mechanisms; and methods of toxicity testing. Mr. Gordon, Mr. Casida (Sp)

130. Biological Control of Insect and Weed Pests. (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; infections 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. Mr. Furman, Mr. Anderson (W)

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. Mr. Furman, Mr. Anderson (W)

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 79. Must be taken on a passed/not passed basis. The Staff (Mr. Smith in charge) (F, W, Sp)

IDS 10A–10B–10C. Man and His Environment—Crisis and Conflicts. (4–4–4)
See Interdepartmental Studies for a complete description of this course.

IDS 136. Biological Deterioration of Wood. (3)
See Interdepartmental Studies for a complete description of this course.

Graduate Courses

204. Principles of Systematic Entomology. (3)
Lectures, 3 hours per week. Prerequisite: course 104. To be offered in odd-numbered years. Theory and philosophy of systematic entomology with emphasis on phylogeny, zoogeography, and nomenclature.

*205. Population Ecology. (3)
Lectures, 3 hours per week. Prerequisite: course 105. To be offered in even-numbered years. Population dynamics, regulation, and mensuration, theory of natural control. Mr. Huffaker, 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.

211. Insect-Crop Relationships. (4)
Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: course 100 or 110. Bionomics 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. Dahlsen, Mr. Wood (F)

217. Advanced Insect Physiology, Biochemistry, and Toxicology. (3)
Lectures, 3 hours per week. Prerequisite: courses 102A–102B, 117. Recommended: Biochemistry 102. May be taken twice for credit. Selected topics.
Mr. Casida, Mr. Gordon (W)

218. Laboratory in Advanced Insect Physiology, Biochemistry, and Toxicology. (1)
Laboratory, 3 hours per week. Prerequisite: course 217 (may be taken concurrently). May be taken twice for credit. Selected laboratory studies demonstrating techniques and principles.
Mr. Casida, Mr. Gordon (W)

219. Physiological Mechanisms in Insect Behavior. (3)
Lectures, 2 hours per week; laboratory, 3 hours per week (to be arranged). Prerequisite: upper division course in animal physiology. Orientation, feeding-behavior, migration, rhythms, hormones and behavior mechanisms in insect communication.
Mr. Loher (W)

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 102A, 102B, 140. To be offered in odd-numbered years. Advanced consideration of infectious and noninfectious diseases of insects, diagnosis, symptomatology, morphopathology, physiopathology, epizooteiology, 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 genetics 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, biochemistry 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 (Sp)

*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. Freitag, 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.
Mr. Jensen (W)

272. Principles and Methods of Entomological Research. (4)
Lectures, 4 hours 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)

*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)

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 Physiology, Biochemistry, and Toxicology. (2)
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 courses include those courses whose content, philosophy, or method provide a common base of knowledge for the several disciplines within the College of Environmental Design. These courses are taught at both the undergraduate and graduate levels, primarily in the Department of Architecture, with offerings by the Department of Landscape Architecture and the Department of Design. At the present time, courses on history of the environment and certain introductory courses in architecture are represented. The scope and number of Environmental Design courses is expected to expand with the growth of interdisciplinary research and the definition of common areas of concern within the College.

The College of Environmental Design is comprised of the departments of Architecture, City and Regional Planning, Design, and Landscape Architecture. Courses offered by the respective departments are to be found immediately following the listing of Environmental Design courses.

For general information concerning the College of Environmental Design, please see page 63. Information on the degree programs can be found in the Architecture, City and Regional Planning, Design, and Landscape Architecture sections of this catalogue, as well as in the ANNOUNCEMENT OF THE COLLEGE OF ENVIRONMENTAL DESIGN.
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. History of the Environment—Ancient and Medieval. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Prerequisite: open to sophomores in the College. Ancient and medieval architecture, their relation to urban and rural land patterns, transportation systems, and to the cultural artifacts of their time. Mr. Kostof (F)

171. History of the Environment—Renaissance and Modern. (4)
Two 1½-hour lectures and one 1-hour discussion per week. Renaissance and Modern architecture, their relation to urban and rural land patterns, transportation systems, and to the cultural artifacts of their time. Miss Evenson (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.
Donald L. Foley, Ph.D.
Sami Y. Hassid, Ph.D.
Henry J. Lagorio, M.A.
Gerald M. 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 L. Prestini, B.S.
Donald P. Reay, M.Sci.
Jesse Reichek
Horst W. Rittel
George P. Simonds, M.A., F.A.I.A.
Karl V. Steinbrugge, B.S.
Claude Stoller, M.Arch., F.A.I.A.
Harold A. Stump, A.B.
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)

172. History of the Environment. (4)
Three 1-hour lectures per week. The theory and practice of design from preindustrial handcrafts to mechanical production and the evolution of a machine aesthetic. Mr. Schaefer (Sp)

175. Great Cities. (4)
Two 1½-hour lecture-discussions per week and independent student research under faculty guidance. Prerequisites: courses 170 and 171 or consent of the instructor. A study of the major monuments of a great city and its changing character from its founding to the present. Course may be repeated for credit. ——— (W)

177. Survey of Urban Design. (4)
Two 1½-hour lectures per week and other meetings as scheduled. Prerequisites: courses 170 and 171 or consent of instructor. The evolution of urban form, civic design, and planning theory from ancient times to the present with emphasis on the role of the city in civilization and on structure and function of contemporary cities. Miss Evenson (Sp)

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 graduate programs leading to the professional degree of
Master of Architecture and to the academic degree of Doctor of Philosophy in archi-
tecture.

Master of Architecture

The Master of Architecture program is offered in three options depending upon the
previous experience of the student, as follows:

OPTION I This option is for holders of a five-year Bachelor of Architecture degree
from an accredited United States school of architecture, and for candidates with an
equivalent education in an acceptable foreign school. A minimum residence of one
year in the Department of Architecture at Berkeley is required.

OPTION II This option is for holders of the degree of Bachelor of Arts in the
College of Environmental Design at Berkeley, with a departmental major in architecture, who
have demonstrated superior academic performance in that curriculum. A minimum
residence of two years in the graduate program in the Department of Architecture at
Berkeley is required.

OPTION III This option is for holders of other bachelor degrees from acceptable
institutions. Candidates must complete designated courses from the A.B. curriculum
or show acceptable evidence of equivalent competence. The minimum residence re-
quirement in the Department of Architecture at Berkeley is two years in addition to
any period required for completion of the courses from the A.B. curriculum. If none
of these courses have been previously fulfilled, the minimum residence required will
normally be ten quarters.

Joint Program in Urban Design

The departments of Architecture and City and Regional Planning jointly offer a
program of studies in urban design for exceptionally qualified holders of the Bachelor
of Architecture degree or its equivalent. This program aims at equipping students with
a bases of operationally useful tools for professional practice in urban design. The
professional degrees Master of Architecture and Master of City Planning, will be
recommended for students who have complied with the rules of candidacy for these
degrees.

Admission to this program allows a student to complete the two degrees in less
time than if they were taken separately. The applicant should seek admission to the
Department of Architecture. The standard admissions procedure for the Department
applies with the additional requirement of the submission of scores from the Graduate
Record Examination.

Doctor of Philosophy Degree in Architecture

The Doctor of Philosophy program is open to holders of the bachelor’s degree from
an accredited college or university who present outstanding academic records. It is
anticipated that most applicants will have completed first a professional degree in
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 Form 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. Mr. Solomon (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. Mr. Brown (F, W, Sp)

102C. Synthesis of Determinants of Architectural Design. (5)
   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. (F, W, Sp)

104A–104B–104C. Community Design. (4–4–4)
   Two 4-hour laboratory-seminars per week. Prerequisite: 145A–B–C and/or 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)

"191A. Physical Criteria in Housing. (5)
   Two 2-hour lectures per week and field trips. Recommended: City and Regional Planning course 100 or 111. Dimension and schemata of housing facilities. Comparative study of needs and standards. Survey of European and American examples. Mr. Cardwell (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.
   Mr. Forrest, Mr. Weisbach (F, W, Sp)

Course Series: Design Options Group I—Architectural Design.

Two 4-hour laboratory-seminars per week. Prerequisite: course 102A–102B–102C. Architectural design problems entailing the range of relevant factors and difficulties concerning typical cases. Courses shall present topical problems as case studies and may be taken in any sequence.

201. Housing Facilities. (4)
   Mr. DeMars, Mr. Cardwell and Staff (F, W, Sp)

202. Educational Facilities. (4)
   Mr. Osmon and Staff (F, W, Sp)

203. Commercial Facilities. (4)
   Mr. Czaja and Staff (F, W, Sp)

204. Civic Facilities. (4)
   Mr. Peters and Staff (F, W, Sp)

205. Multi-Level Real Estate. (4)
   Mr. Olsen and Staff (F, W, Sp)

206. Introduction to Urban Design. (4)
   and Staff (F, W, Sp)

207. Special Problems. (4)
   and Staff (F, W, Sp)

208. Combined Course. (4)
   Mr. Lagorio, Mr. Simonds, and Staff (F, W, Sp)
   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.

   Three 1-hour discussions per week. Prerequisite: graduate and advanced undergraduates of any major. Psychological, ecological, and morphological wholeness in the environment and the use of pattern languages to create designs that are whole.
   Mr. Alexander and Staff (F, W, Sp)

Course Series: Design Options Group II—Architectural Design and Research.

Two 4-hour laboratory-seminars per week. Design and research in special study areas. Prerequisite: enrollment in Option I or completion of three courses in Design Options Group I and completion
of all required courses and 6 units of professional electives in the particular study area of the course offering. 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. (6)
Mr. Montgomery, Mr. Logan and Staff (F, W, Sp)

281. Study in Area B Environmental Control Systems. (6)
Mr. Bender (F, W, Sp)

282. Study in Area C Structure and Production as Related to Design Problems. (6)
Mr. Ehrenkrantz (F, W, Sp)

283. Study in Area D Design Theories and Methods as Related to Design Problems. (6)
Mr. Protzen (F, W, Sp)

284. Study in Area E Social and Economic Factors as Related to Design Problems. (6)
Mr. Van der Ryn (F, W, Sp)

286. 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 contents. Assignments preparatory to comprehensive examination. At the option of the instructor, students may repeat the seminar up to a maximum of three quarters.
Mr. Reichek (F, W, Sp); Mr. Forrest (W, Sp); Mr. Hassid (Sp)

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 sequence or consent of the instructor. Environmental phenomena, needs, controls and counter measures, introduction and general survey.
Mr. Brown (F, Sp)

211. Environmental Control Systems. (3)
One 2-hour lecture and one 2-hour laboratory per week. Prerequisite: course 110. Psychophysical synthesis of sensory factors in the design of control systems.

212. Environmental Control Systems. (3)
One 2-hour lecture and one 2-hour laboratory per week. Prerequisite: course 211. Synthesis of control systems including the distribution of light, sound, air, transport, power, communications, water, waste and protective devices.

213. Design Problems in Environmental Control Systems. (3)
Two 2-hour laboratory-seminars per week. Prerequisite: course 211 or consent of instructor. Combined course, must be taken concurrently with 208 and 222. Interaction of environmental control systems, relation and integration of natural and artificial systems with other design components.
Mr. Anderson, Mr. Yanow (F, W, Sp)

Two 1½-hour seminars per week. Prerequisite: course 212 or consent of the instructor. Advanced study in environmental control systems.

219A. Light in Architectural Design.
Mr. Peters (F)

219B. Acoustics in Architectural Design.
Mr. Wetherill (Sp)

219C. Environmental Control Systems Related to Climatic Conditions.

Study Area C—Structure and Production

120. Introduction to Structural Systems of Buildings. (5)
(Formerly 191C)
Two 1½-hour lectures and one weekly field trip; presentation or demonstration. Prerequisite: Upper division standing or consent of instructor. Study of the natural and imposed forces on man-made materials and structures. Survey of systems used in building construction.
Mr. Bender (F), Mr. Lagorio (W)

121. Construction Systems and Production. (3)
Two 1½ hour lectures per week. Prerequisite: completion of engineering sequence or consent of the instructor. Study of building construction techniques, systems and components.
Mr. Weisbach (F, Sp)

222. Design Problems in Structure and Production. (3)
Two 2-hour laboratory-seminars per week. Prerequisite: course 212 or consent of instructor. Combined course, must be taken concurrently with 208 and 213. Synthesis of structural systems and relation to architectural design.
Mr. Steinbrugge and Staff (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 212 or consent of the instructor. Implications of industrialized building components and systems; design, fabrication and erection.

Two 1-hour seminars and one 2-hour laboratory per week. Prerequisite: course 212 or consent of instructor. Advanced study in structure and production in architecture.
229A. (F); 229B, Mr. Bender (W)
229C, Mr. Distefano (W)
Study Area D—Design Theories and Methods

130. Architectural Design Methods. (4)
Two 1 1/2-hour lectures and one 2-hour laboratory-seminar per week. Prerequisite: course 130. Intensive study of problem solving techniques developed in other fields as they apply to environmental design problems. Mr. Rittel (F); Mr. Protzen (Sp)

230. Advanced Design Methods. (3)
Two 1 1/2-hour seminars per week. Prerequisite: course 130. Intensive study of problem solving techniques developed in other fields as they apply to environmental design problems. Mr. Rittel (W)

231A—231B. Architectural Programming. (3–3)
Two 3-hour laboratory-seminars per week. Prerequisite: course 130 or consent of the instructor. 231A. Problem definition and program development. Mrs. Lindhein (W) 231B. Methods of evaluating and validating architectural programs, such as interviews, observation, simulation, and questionnaire techniques. Mrs. Lindhein (F)

232. Seminar in Architectural Research. (3)
One 2-hour seminar per week. Prerequisite: enrollment in Option I. Research methods and problems. Appraisal of research endeavors. Presentations by instructors and guests, discussion of student reports. Mr. Rittel (F); Mr. Protzen (W)

233A. Urban Design Workshop I: Methods of Design Analysis. (4)
One 1 1/2-hour seminar and one 2 1/2-hour laboratory per week. Prerequisite: Computer Science I or 2 or consent of instructor. Workshop on analysis of architectural and urban design projects. Topics covered include simulation modeling, operational gaming, optimization. Mr. Rittel (F); Mr. Protzen (W)

233B. Urban Design Workshop II: Methods of Design Analysis. (4)
One 1 1/2-hour seminar and one 1 1/2-hour laboratory per week. Prerequisite: course 233A or consent of instructor. Workshop on analysis of architectural and urban design projects. Topics covered include network analysis, project scheduling and control, engineering economy, cost feasibility analysis. Mr. Montgomery (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. Hiatuses that remain in the record. Mr. Meier (F)

239A—239B—239C. Seminar in Design Theories and Methods. (3–3–3)
Two 1 1/2-hour seminars per week. Prerequisite: consent of the instructor. 239A. Symbolic Processes in Architectural Design. Mr. Rittel (Sp) 239B. Rational Thought and the Design Process. Mr. Rittel (W) 239C. Exploration Toward a Theory of Form. (Sp)

Study Area E—Social and Economic Factors in Architectural and Urban Design

140. Social and Cultural Factors in Architectural and Urban Design. (4)
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. --- (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. Mr. Stump (W)

145A–145B–145C. Design Consequences of Public Technological and Social Change. (4–4–4)
(145C formerly numbered 191E) 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. Reichek and Staff (F, W, Sp)

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. (F)

242A–242B. Seminar in Architecture. (2–2)
One 2-hour seminar per week. Prerequisite: enrollment in Option I. Relation of architectural research to the discipline of architecture. Topics related to theory and practice. Presentation by instructors and guests, discussion of student reports. Sequence beginning (W). (W, Sp)

243. The Axiology of Space. (4)
Two 1 1/2-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. Sommer (Sp)
Two 1½-hour seminars per week. Prerequisite: consent of the instructor.
249A. Social and Cultural Factors. Mr. Simmons (F); Mr. Foley (Sp)
249B. Behavioral Factor. (F)
249C. Economic Factors. (Sp)
249D. Technological Factors. Mr. Meier (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.

*191F. 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 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 consent of the instructor.
Mr. Czaja (F, Sp)

269A–269B–269C. Seminar in Architectural Administration. (3–3–3)
Two 1½-hour seminars per week. Prerequisite: course 160 or consent of instructor.
269A. Construction Law. Mr. Sweet (F)
269B. Building Economics. Mr. Olsen (W)
269C. Architectural Administration. Mr. Friedman (W)

Study Area G—History of the Environment

See Environmental Design 169 through Environmental Design 177.

*173. American Architecture. (4)
(Formerly Environmental Design 173)
Two 1½-hour lectures per week and other meetings as scheduled. Prerequisite: Environmental Design 170 and 171 or consent of the instructor. The background and evolution of modern architecture in the nineteenth and twentieth centuries.
Miss Evenson (F)

*176. The Architecture of Islam. (4)
(Formerly Environmental Design 176)
Two 1½-hour lecture/discussions per week and independent student research under faculty guidance. 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.

*178. The Architecture of the Far East. (4)
(Formerly Environmental Design 178)
Two 1½-hour lecture/discussions per week. Prerequisite: Environmental Design 170 and 171 or consent of instructor. Detailed investigation of selected architecture of the Near and Far East.

*271. History of Architecture Theory. (4)
(Formerly Environmental Design 179)
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)
(Formerly 272A, 272B)
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 concentrated study from the building types of the ancient world. May be repeated once for credit.
Mr. Kostof (F, 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 environment of the West Coast.

*274. Seminar in Modern Architecture. (4)
Two 1½-hour seminars per week. Prerequisite: Environmental Design 170 and 171 plus Environmental 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 research.
Miss Evenson (W)

278A–278B. Methods of Historical Research and Criticism in Architecture. (4–4)
One 3-hour seminar per week and other meetings to be arranged. Prerequisite: graduate standing and consent of instructor. Consideration of basic tools and methods of research in the history of the environment, the historiography of the field since 1900, and the relevance of allied disciplines like archaeology, preservation and restoration, anthropology, etc.
Miss Evenson (W, Sp)
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 meetings with faculty sponsor and written reports required.
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 79. Must be taken on a passed or not passed basis. Studies developed to meet individual needs.
The Staff (Mr. Peters in charge) (F, W, Sp)

CITY AND REGIONAL PLANNING

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.
T. J. Kent, Jr., M.C.P.
Richard L. Meier, Ph.D.
Corwin R. Mocrine, 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 Professors:
Stephen S. Cohen, Ph.D.
Andrei Rogers, Ph.D.

Assistant Professors:
Douglass B. Lee, Ph.D.

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 individual research under the supervision of a faculty adviser and designed to reinforce the student's background 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)

Professors:
A. K. Roland A. Artle, † Econ.Dr.
Henrik L. Blum, M.D., M.P.H.
Horst Rittel

Assistant Professors:
Frederick C. Collignon, M.A. (Acting)
Kenneth H. Craik, Ph.D.
Thomas G. Dickert, M.L.A., M.C.P. (Acting)
Carl Werthman, Ph.D.
Brandon Howell, B.Sc.

Lecturers:
Allan B. Jacobs, M.C.P.
Peter Labrie, M.C.P.
Peter Marris, B.A.
Chester McGuire, M.B.A.
David H. Stimson, Ph.D.
Virgus Streets, B.A.
Michael B. Worman, M.C.P.

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 Joint 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 Joint Program with the School of Law.

These programs reflect the expanding 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.

**100L. City Planning Laboratory for Architects and Landscape Architects. (5)**
Three 3-hour studies per week. Prerequisite: course 110. Laboratory: individual and group practice in solving typical city planning problems.

**110. Introduction to City Planning. (4)**
(Formerly number 100)
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.

**111. Introduction to Housing. (5)**
Two 1½-hour lectures per week and two 3-hour field trips. Open to major in all fields. Historical development of housing problems in Western Europe and the United States; local, state, and federal housing programs in the United States; critical issues and the future of housing.

*121. Urban Aesthetics. (4)*
Three 1½-hour lectures per week. Open to majors in all fields. Perception of the city in concept and actuality through both vicarious and direct experience; development of the form of the urban environment; influence of utopian and ideal concepts; current criticisms of, and proposals for, the design of urban areas.

**122. The Black Ghetto in Urban Structure. (3)**
(Formerly numbered 191A)
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.

*Mr. Labrie (F); Mr. Streets (Sp)*

**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)**
(Formerly numbered 200)
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.

*Mr. Dyckman (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. Mocine, 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 (Sp)

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, and Staff (W)

204. Introduction to Planning Analysis. (Formerly numbered 204A)
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. Prerequisite: consent of the instructor. Beginning computer programming in the Fortran IV computer language, with applications in matrix techniques and urban data processing. Prepares students for course 205 and other courses using programming. Problems.
Mr. Lee (F)

205A–205B. Methods of Urban and Regional Analysis. (4)
(Formerly numbered 204B and 205)
Two 1½-hour sessions per week. Prerequisite: Statistics 131 or equivalent, or consent of instructor. Course 205A is prerequisite to 205B. A rigorous course in the use of computers and linear models in urban and regional analysis. Regression and covariance analysis, linear programming, game theory, network analysis, stable growth theory, principal components and factor analysis. Applications in demographic, economic, land use, and transportation analysis.
Mr. Rogers (W, Sp)

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. Wornum (W)

207A–207B. Economic Analysis for Social Planning. (4–4)
(Formerly numbered 291F)
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. Wornum (F)

209. Introduction to Housing, Renewal, and Development. (4)
Two 1½-hour lectures and one 2½-hour laboratory per week. Introduction to the design of the large-scale physical environment. Overview of environmental perceptions, needs and values; the attributes, components, structure and meaning of the large-scale physical environment; survey, interview, evaluational and simulation techniques, environmental factors in the design and planning process.
Mr. Appleyard (W)

210. Environmental Factors in Urban Design. (4)
Two 1½-hour lectures and one 2½-hour laboratory per week. Introduction to the design of the large-scale physical environment. Overview of environmental perceptions, needs and values; the attributes, components, structure and meaning of the large-scale physical environment; survey, interview, evaluational and simulation techniques, environmental factors in the design and planning process.
Mr. Appleyard (W)

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. Density and interactional approaches to analysis of spatial distribution. 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. Lee (Sp)

212. Introduction to Economics of Public Enterprise. (4)
Two 1½-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 incidences. 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. Methods of effectuating general-plan policy. Legal, administration, and financial aspects. Review of current practice and possible improvements in effectuation procedures. Mr. Mocine (Sp)

215. Introduction to Urban Land Use and Transportation Systems. (4)

Two 1½-hour seminars per week. The dimensions and determinants of land use; survey methods; introductions to analytic and predictive models. Determinants of travel; accessibility and channel capacity; traffic generation, assignment and distribution. Problems of planning for land use and for transportation facilities. 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.

217. Urban Renewal. (4)

Two 1½-hour lectures per week. Prerequisite: course 209 or consent of instructor. (Open to city planning graduate majors only.) Central-city housing and renewal policies; new construction, conservation, rehabilitation and redevelopment. Economic, social and political issues, and fiscal implications. Organization of federal, state and local programs, planning and programming.

Mr. Montgomery (W)

219. Population and Employment Analysis and Forecasting. (4)

Two 1½-hour sessions per week. Theory, estimation, and projection of urban-metropolitan population and employment; spatial allocation methods. Regional and interregional social accounts for local economic analysis and forecasting.

Mr. Montgomery (W)

220. Multisectoral Analysis of Regional Growth and Development. (4)

Two 1½-hour sessions per week. Prerequisite: course 205A or 219 or consent of instructor. Theory, estimation, projection and planning of dynamic multisectoral, interregional demographic and economic systems. Balanced growth, interregional labor markets and interregional migration, consistent projections of growth, and multisectoral programming models.

Mr. Rogers (Sp)

223. Psychological Functions of the Urban Environment. (4)

Two 1½-hour seminars per week. Prerequisite: course 210 or consent of instructors. Review of current efforts in environmental psychology, the theory of man-environment relations, survey and research methods appropriate to environmental psychology.

Mr. Appleyard, Mr. Craik (Sp)

226. The Metropolitan Region. (4)

Two 1½-hour seminars per week. The social organization and spatial patterning of the large metropolitan area. Physical development problems and policies.

Mr. Foley (W)

227. The Future of Urbanism and Cities. (4)

Two 1½-hour lectures per week. Consequences of increasing societal scale. Multiple perceptions of “community”; implications of declining localism. Problems of prediction. Review of speculations on future social and technological changes and their urban and city influences. Implications for public policy and for strategies of planning. Mr. Meier (Sp)

228. 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 (W)

231. Seminar in City and Metropolitan Planning. (4)

One 2½-hour session per week. Prerequisite: graduate standing in a social science department or professional school or consent of the instructor. History of American city planning; role of physical planning in local government; the urban general plan and its effectuation; relations between city planners and other professionals. Mr. Jacobs (Sp)

233. Introduction to Regional Analysis and Planning. (4)

One 2-hour seminar and one 1-hour seminar per week. Prerequisite: consent of instructor. 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. Alonso (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 externalities, with respect to their implications for urbanization and spatial allocation of urban growth among cities as well as within cities. Policy issues.

Mr. Artie (W)

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 outcomes 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 intercession; and processes and procedures of distinctive "legal" character.

(W)

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; value 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. Mr. Rogers (W)

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 government actions. Designing community-development programs within a setting of mixed public-private enterprise. Benefit-costs analysis; cost-effectiveness bases 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.

Mr. Dyckman (W)

253. Research Seminar in Regional Development. (4)
One 3-hour seminar per week. Prerequisite: course 233 or consent of instructor. A close examination of selected issues in policy, methods and patterns of regional development, through student and faculty research papers and class discussion.

Mr. Alonso (Sp)

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)

(Formerly numbered 291A)
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, city and local programs will examine their own plans and strategies in several social policy areas.

Mr. Duhl (Sp)

261. Urban Social Policies Planning Seminar. (3)
(Formerly numbered 291B)
One 2-hour seminar per week. Prerequisite: course 250. Limited to doctoral students in fields of urban social policy or consent of instructor. Intensive examination of the theoretical issues posed in lecture course 260. Topics will concern the political character of governmental planning, the rational and nonrational 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)
(Formerly numbered 291C)
Two 2-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.

Mr. Stimson (W)

263. Deliberate Social Change in the City. (3)
(Formerly numbered 291D)
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)
(Formerly numbered 291E)
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)
(Formerly numbered 291G)
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.

Mr. Marris (Sp)

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)

2911. Rural Poverty and the Urban Ghetto: Strategies for Change. (4)
Two 1½-hour seminars per week. Prerequisite: consent of the instructor. Analysis of the linkages between rural and urban poverty. Appraisal of alternative development strategies and public policies for coping with geographically-clustered poverty.

Mr. Collignon (F)
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)

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

DESIGN

(Department Office, 234 Wurster Hall)

Professors:
Mary A. Dumas, M.A.
William A. Garnett
Lucretia Nelson, M.A.
Willard V. Rosenquist, M.A.
Charles E. Rossbach, M.F.A.
Herwin Schaefer, Ph.D.
Peter H. Voulkos, M.F.A.
Anna Hadwick Gayton (Anna Gayton Spier), Ph.D. (Emerita)
Hope M. Gladding (Emerita)
Lea Van Puymbroek Miller, M.F.A. (Emerita)

Winfield Scott Wellington, M.A., Gr.Arch. (Emeritus)
Associate Professor:
Margaret P. Dhaemers (D'Hamer), M.A., M.F.A.
Assistant Professors:
Michael Lackman, M.F.A.
Marvin B. Lipofsky, M.F.A.
Craig McArt, M.F.A.
Donald E. Potts, M.A.

The program in Design will be directed toward a curriculum in product and communication design, design theory, history, and practice. A revised curriculum containing new courses and requirements is in the process of adoption. Undergraduates considering this field should consult the Department or the September 1971 Announcement of the College of Environmental Design.

The Major

Students admitted before spring quarter, 1969, could elect a major in design emphasizing ceramics, interior design or textile design. See page 63 for future admittees.

Lower Division. Required: Design 1, 2A, 2B, 11, 12; one of the following: Design 20, 21, 22, 24, 25; History of Art 1A or 1B or 1C or 1D. Recommended: History 4A, 4B, 4C, 4D, 19A, 19B; Philosophy 126A; Anthropology 2, 3.

Upper Division. Required of all majors in design: 127A, 144A, 190.

EMPHASIS ON CERAMICS

Design 120A, 120B, 140A, 140B, 140C; 4 units from upper division studio design courses other than 120A, 120B, 127A; 4 units from upper division history–theory design courses other than 140A, 140B, 140C, 144A.

EMPHASIS ON INTERIOR DESIGN

Design 123A, 123B, 142A, 142B, 148; 4 units from upper division studio design courses other than 123A, 123B, 127A; 4 units from upper division history–theory design courses other than 142A, 142B, 144A, 148.
EMPHASIS ON TEXTILE DESIGN


Preparation for Graduate Study  The graduate major in design requires broad background training in studio and history–theory courses in the visual arts, with an emphasis in one of the design areas. Before admission to graduate standing, the candidate must present credentials and a portfolio, or other evidence, to the graduate committee of the department.

Lower Division Courses

2A–2B. Design Survey. (5–5)
Three hours lecture and one 1-hour section per week. An 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.

2A. The Ancient World and the Middle Ages.
Mr. Schaefer (F)
2B. The Renaissance to the present.
Mr. Schaefer (W)

11. Freehand Drawing for Design. (4)
Six hours studio per week. Prerequisite: course 1. Observation of form and structure in natural objects. Development of abstraction and form.

Upper Division Courses

Group A: Studio Courses

120A–120B. Advanced Ceramic Design. (4–4)
Six hours studio per week. Prerequisite: courses 120A, 140A, 140B. Advanced ceramic processes in construction and glazing. 120B may be repeated for credit.
Mr. Voulkos (F, W, Sp)

121A–121B. Advanced Printed Textile Design. (4–4)
(Formerly numbered 121A–121B–121C)
Six hours studio per week. Prerequisite: courses 21, 141A, 141B. Advanced problems of printed textile design through various dyeing and printing processes. 121B may be repeated for credit.
Miss Dumas, (F, W, Sp)

122A–122B. Advanced Woven Textile Design. (4–4)
Six hours studio per week. Prerequisite: courses 22, 141A, 141B. Extended problems in design on the loom, exploring techniques of gauze, tapestry, brocade, etc., for understanding of their unique design qualities. Interrelation of techniques and materials is stressed, toward the use of weaving as an expressive design medium. 122B may be repeated for credit.
Mr. Rossbach (F, W, Sp)

123A–123B. Interior Design. (4–4)
Six hours studio per week. Prerequisite: courses 21 or 22, 142A, 142B, 148. Planning for interiors, including scale drawings and study of color and materials. 123B may be repeated for credit.
Mr. McArt (F, W, Sp)

124A–124B. Advanced Design: Lettering. (4–4)
Six hours of studio per week. Prerequisite: course 24.
124A. Advanced problems in calligraphy. Integration of calligraphic and design elements for visual communication.
124B. Lettering and its application in the public environment. Emphasis on functional aspects in the ordering of human activities, e.g., traffic direction, signing of buildings, etc. 124B may be repeated for credit.
(F, W, Sp)

125A–125B. Advanced Metal Design. (4–4)
Six hours studio per week. Prerequisite: course 25. Studies of volume and spatial relationships in metal. 125B may be repeated for credit.
Mr. Lackman (F, W, Sp)

126A–126B. Form in Glass. (4–4)
Six hours studio per week. Prerequisite: courses 20, 140C. An introduction to the basic techniques of free-blown glass and its design. 126B may be repeated for credit.
Mr. Lipofsky (F, W, Sp)

127A. Advanced Design: Light and Motion. (4)
Six hours studio per week. Prerequisite: course 12. Study of relationships of light and motion.
Mr. Rosenquist, Mrs. Dhaemers, Mr. Potts (F, W, Sp)

127B. Advanced Design: Photography. (4)
Six hours studio per week. Prerequisite: course 12. Basic techniques of photography. Design with light. 127B may be repeated for credit.
Mrs. Dhaemers, Mr. Garnett (F, W, Sp)

Group B: Lecture Courses

141A–141B–141C. History of the Textile Arts. (4–4–4)
Three hours lecture per week.
141A. The New World: Andean South America, Middle America and the Southwestern United States. Developments of native materials, techniques and designs.
141B. The Old World: The Orient, India and the Near East. Early developments and establishment of historic styles to the 17th century. (W)
141C. The Old World: Mediterranean countries and Europe. Coptic and European tapestry art, influences from Persia, India and the Orient on European textile design in the seventeenth and eighteenth centuries.
143A–143B. Primitive Art. (5–5)
Three hours lecture per week. Lectures, readings, films, and observation exercises using material from Robert H. Lowie Museum of Anthropology. 143A stresses early developments and problems of formal organization; 143B stresses problems of representational and associative content and culture contexts. 143A not prerequisite to 143B.
Miss Nelson, 143A (W); 143B (Sp)

148. History of Interior Design. (5)
Three hours lecture and one 1-hour section per week. The interior as an aesthetic composition and as an expression of domestic culture from the Middle Ages to the present, with a preliminary survey of the Ancient World.
Mr. Schaef er (W)

Group C: Special Courses

193. Non-Woven Textiles. (4)
Three hours per week. Prerequisite: courses 122A, 141A, 141B, 141C. Theory and problems concerning the construction and design of ethnic and historic textiles.
Mr. Rossbach (F)

198. Special Studies in the Practice of Design. (2–5)
Prerequisite: restricted to senior honor students and graduates. Advanced studio work in specific design areas.
The Staff (F, W, Sp)

LANDSCAPE ARCHITECTURE

(Department Office, 202 Wurster Hall)

Professors:
Donald Appleyard, M.C.P., A.A. Dip.
Garrett Eckbo, M.L.A.
R. Burton Litton, Jr., M.L.A.
Richard L. Meier, Ph.D.
Edward C. Stone, Ph.D.
H. Leland Vaughan, B.L.A. (Emeritus)
Francis Violich, B.S.

Associate Professors:
Michael M. Laurie, M.L.A.
Robert J. Tetlow, B.L.A., M.L.A.
Robert H. Twiss, Ph.D.

Assistant Professors:
Russell A. Beatty, M.L.A.

Joe R. McBride, Ph.D.
Robin C. Moore, M.C.P.

Professors:
Richard W. Harris, Ph.D.
I. Michael Heyman, B.A., LL.B.

Assistant Professor:
Thomas G. Dickert, M.L.A., M.C.P. (Acting)

Lecturers:
David Arbegast, M.S.
Clare Cooper, M.A., M.C.P.
J. B. Jackson, B.A.
Lannon Leiman, B.A.
Frederick F. Warnke, M.S.

Departmental Major Advisers: Undergraduate, Mr. Laurie
Graduate, Mr. Twiss

The Profession

The profession of landscape architecture plays an important role in identifying and solving environmental problems in rural and urban areas. Landscape architects are involved in federal, state, and local agencies and programs that deal with conservation of open space and natural amenities, parks and recreation, land management and development, the impact of freeways on city and landscape, urban redevelopment and planning, housing, and schools. Because of the complexity of the problems, there is frequently collaboration with architects, city planners, engineers, ecologists, and sociologists.
Undergraduate Program

The undergraduate program leading to a Bachelor of Arts degree with a major in landscape architecture requires broad general knowledge, substantial design talent, and great technical competence. At the core of the curriculum are a series of courses in the art, science, techniques, and materials of landscape architecture. Course content includes open space, park, and recreation developments and systems; residential housing, commercial, and institutional site plans; and landscape analysis techniques. Opportunities exist for elective courses which may expand the core subject material, or which offer diverse opportunities for individual study, community projects, or added technical inputs.

The undergraduate and professional graduate curriculum 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.

Graduate Program

The program is designed to accommodate students with the Bachelor of Arts degree with a major in landscape architecture, the Bachelor of Landscape Architecture degree, and the bachelor's degree from a number of disciplines such as architecture, design, planning, engineering, plant science, forestry, and geography. The program offers two broadly conceived emphases: Landscape Design and Environmental Planning.

Landscape Design concentrates on site planning and the detailed design of public and private exterior spaces in urban and natural contexts. It covers plant materials, site construction, behavioral factors in open space design, community recreation projects, project planning and programming.

Environmental Planning focuses on planning and design within the context of natural and urban environments. The program includes study of ecological systems, conservation planning, resource development, recreation planning, urban open space, and highway systems.

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.

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

11. Graphic Presentation Techniques. (3)
   One 1-hour lecture and one 3-hour laboratory per week. Prerequisite: Environmental Design 6. Perspective, rendering, and professional graphics.
   Mr. Tetlow (W, Sp)

23. Introduction to Plant Materials. (4)
   Two 3-hour laboratories per week. Plant identification and classification. Common plants suitable for central California.
   Mr. Beatty (F)

Upper Division Courses

Students should see their advisers for prerequisites to all upper division courses in landscape architecture for majors in landscape architecture.

100. Survey of Landscape Architecture. (3)
   Two 1½-hour lectures per week. An introduction to the history, theory, and materials of landscape architecture; contemporary application and practice.
   Mr. Laurie (W, Su)
121. Landscape Analysis and Problem Organization. (3)

Two 1½-hour meetings per week. Theories and methods in landscape analysis, emphasizing natural factors and design problem organization. ---, Mr. Violich (F)

122. Landscape Planning for the Community. (4)

Two 4-hour laboratories per week. Prerequisite: Environmental Design 3, 4, 6; Architecture 101. Physiographic and cultural influences on landscape planning for the community environment. Mr. Laurie (F)

123. Regional Plant Materials. (4)

Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 23 or consent of instructor. Identification and utilization of native and introduced plants, and their impact in the landscape. Mr. Beatty (Sp)

124. Landscape Construction. (4)

Two 4-hour laboratories per week. Prerequisite: Civil Engineering 21 or consent of instructor. Topographic and grading problems in landscape construction. Design and structural relationships; graphic and computational exercises; working drawings. Mr. Tettlow (W)

125. History and Literature of Landscape Architecture. (3)

Two 1½-hour lectures per week. Developmental history of landscape design practice; relationships to society, climate and topography. --- (Sp)

131. Professional Practice Seminar. (2)

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. --- (Sp)

132. Landscape Design for the Community. (4)

Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 122. The effect of landscape criteria on open space design, and the development of community form. Mr. Laurie (W)

133. Planting Design. (4)

Two 3-hour laboratories per week. Prerequisite: Landscape Architecture 23 or equivalent. Application of fundamental, technical, and aesthetic principles of planting design to landscape problems. Mr. Beatty (W)

142. Urban Landscape Design. (4)

Two 4-hour laboratories per week. Prerequisite: consent of instructor. Design problems within the urban context, including renewal and development. ---, Mr. Eckbo (W)

143. Landscape Horticulture. (3)

Two 2-hour meetings per week. Prerequisite: Landscape Architecture 23. Horticultural factors in landscape design, installation and maintenance. Consideration of the scientific, advances made in knowledge of plant growth, soil management, irrigation, turfgrass production, and other planting and maintenance operations. Mr. Harris (W)

151. Social and Psychological Factors in Open-Space Design. (3)

Two 1½-hour lectures per week. Social and psychological factors in open-space design. Theories of home, neighborhood, territory, communication, public behavior and play. Feedback research on user-behavior in existing housing developments, parks, urban squares, playgrounds, campgrounds. Observation and evaluation of local open spaces; programs for redesign. Miss Cooper (F)

152. Landscape Design. (4)

Two 4-hour laboratories per week. Prerequisite: course 142. Project planning and design at limited scale. Mr. Moore, Mr. Eckbo (Sp)

154. Landscape Construction. (4)

Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 124. Materials and structures in landscape construction. Design and structural relationships; graphic exercises and working drawings; specifications. Mr. Tettlow (F)

160. Recreation and Open Space Systems. (4)

Two 2-hour lectures and one discussion meeting per week. Planning and design of open space systems for neighborhood, community and region; including, but not limited to, park and recreation areas. Principles, standards, and procedures. --- (W)

164. Landscape Construction and Site Engineering. (4)

Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 124 or equivalent. Design and construction of site utilities. Engineering of irrigation, drainage, and soil structures used in site development. Graphic exercises, working drawings, and specifications. Mr. Tettlow (Sp)

172. Site Planning. (4)

Two 4-hour laboratories per week. Prerequisite: advanced standing in architecture or landscape architecture. Planning and design of large-scale site developments with special reference to the landscape architect's role. Mr. Tettlow (Sp)

182. Intensive Design. (4)

Two 4-hour laboratories per week Prerequisite: Landscape Architecture 122 and 132, or consent of instructor. The design of gardens, parks, plazas, general open spaces. Mr. Tettlow (F)

191A. Community Participation in Design and Neighborhood Recreation Projects. (4)

Two 4-hour laboratories per week. Development of plans and construction techniques for specific projects in collaboration with neighborhood organizations, city agencies, and industry. Mr. Laurie, Mr. Moore (F, W, Sp)

197. Field Study in Landscape Architecture. (1-5)

To be arranged. Prerequisite: upper division standing and consent of instructor and sponsor. See departmental information sheet for limitations. Supervised experience related to specific aspects of landscape architecture. Regular individual meetings with faculty and outside sponsor. Reports required. The Staff (F, W, Sp) Also SSI, SSII

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 79. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)
See Environmental Design course listings or description of required environmental design courses for landscape architecture major.

Graduate Courses

00A–200B–200C. Introduction to Landscape Design. (4–4–4)
Two 4-hour laboratories per week. Prerequisite: consent of instructor; for graduate students entering landscape architecture from non-design fields. Development of design perception and graphic expression, introductory project organization and design problems. Mr. Litton (F, W, Sp)

201. Ecological Planning Laboratory. (4)
(Formerly numbered 202A)
Two 4-hour laboratories per week. Prerequisite: course 152, or consent of instructor. Course 200 to be taken concurrently. Problems in policy making and analysis in the regional landscape. Mr. Appleyard (W)

202. Environmental Factors in Urban Design. (3)
Two 1½-hour lectures and discussion per week. The components, structure, and meaning of the urban landscape. Environmental problems, attitudes, and criteria. Survey analysis and design methods, implementation and controls. Case studies of urban Design projects. Mr. Appleyard (W)

203. Urban Design Laboratory. (4)
Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 152 or consent of the instructor. Landscape Architecture 202 to be taken concurrently. Problems in policy making and design of the urban physical landscape. Mr. Appleyard, Mr. Moore (W)

204. Intensive Design. (Variable 2–3)
Two hours of lecture per week. Analysis of program requirements and of site potentials, resultant form determinants. Development of concepts based on perceptual evaluation of site. Context of culture, project, site, and program for design vocabulary, large organizational determinants and landscape details. Impact of regional and urban context. Mr. Eckbo (Sp)

205. Intensive Design Studio. (4)
Prerequisite: Landscape Architecture 152, or consent of the instructor. Landscape Architecture 204 to be taken concurrently. Project design in the context of the urban or regional landscape. Mr. Tettlow (Sp)

206. Advanced Construction. (4)
Two 4-hour laboratories per week. Prerequisite: L.A. 164, or equivalent. Advanced landscape construction and administration. Mr. Tettlow (W)

207. Advanced Planting Design. (4)
Two 3-hour laboratories per week. Prerequisite: Landscape Architecture 133 or equivalent. Advanced studies in the use of plant materials to organize outdoor space. Mr. Eckbo, Mr. Beatty (F)

208. Introduction to Computer Graphics and Mapping. (3)
Two 1½-hour lectures 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 (F)

209. Environmental Planning. (4)
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. Report required. Mr. Twiss (Sp)

211A–211B. Advanced Seminar in Urban Design. (Variable 2–3)
Two hours per week. Prerequisite: Landscape Architecture 202 or consent of instructor. Intensive study of particular environmental problems, current design solutions, and innovations in the field of urban design. Mr. Appleyard (F, W)

212A–212B. Advanced Urban Design Laboratory. (4–4)
Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 203, or consent of instructor. Landscape Architecture 211A–211B to be taken concurrently. Design problems related to the landscape character of the existing urban environment, and the analysis and design of new communities and cities. Mr. Appleyard, Mr. Moore (F, W)

220. Legislation and Administrative Regulation in Environmental Management. (3)
Two 1½-hour meetings per week. Prerequisite: consent of the 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)

221A–221B. Natural Resources Planning. (3–3)
Two hours of lecture per week. Prerequisite: course 200 or consent of instructor. A multidisciplinary approach to planning and design. Problems in regional or natural resource conservation. Mr. Meier, Mr. Twiss (F, W)

222A–222B. Advanced Regional Design Laboratory. (4–4)
Two 4-hour laboratories per week. Prerequisite: Landscape Architecture 201 or consent of instructor. Landscape Architecture 221A–221B to be taken concurrently. Problems concerned with inventory, analysis and evaluation and regional landscape resources and values. Landscape policymaking and design for major physiographic regions. Mr. Violich, Mr. Twiss (F, W)

231A–231B. Advanced Seminar in Intensive Design. (Variable 2–3)
Two hours per week. Prerequisite: Landscape Architecture 204 or consent of instructor. Design theory related to detailed investigation of specific sites and programs for semipublic and public spaces (parks, plazas, campus spaces, gardens). Mr. Eckbo (F, W)
(5–5)  
Two 4-hour laboratories per week. Prerequisite: course 205 or consent of instructor, course 231A–231B to be taken concurrently. Design problems related to detailed, intimate, specific, subtle, qualitative considerations on specific sites—gardens, parks, plazas, campus spaces. Mr. Eckbo (F, W)

241. Seminar on Theory of Environmental Design.  
(Variable 2–3)  
Two hours per week. Theory of environmental design as formulated in selected literature. Relationships among allied environmental arts and sciences. Mr. Eckbo (F, W)

ENVI RONMENTAL STUDIES

Head adviser: Mr. James N. Anderson.

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 proposed senior seminar is an important feature of the group major in environmental studies. Typically a group of fifteen seniors, including students 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.

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; Physics and Chemistry of the Environment (proposed course); Senior Seminar (proposed course). 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; Evolution of the Earth for Physics and Chemistry Students (proposed course); Flora and Fauna of the San Francisco Bay Area (proposed course).

Area II, Biological Science

Lower Division Courses  Mathematics 16A–16B–16C; Computer Science 2; Physics 6A–6B–6C; Biology 1A–1B–1C; Chemistry 1A–1B. Strongly recommended: Chemistry 8A, 8B.

NOTE: For key to footnote symbols, see page 78.
**Upper Division Courses** Anthropology 148 or Geography 103 or Sociology 160; Biology 150, Demography 100; Senior Seminar (proposed course).

*Seven biology courses, to be selected from the following list:* Botany 125, 154; Entomology 103; 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; Flora and Fauna of the San Francisco Bay Area (proposed course).

**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; Senior Seminar (proposed course).

*Recommended electives:* Geology 10, 110; Interdepartmental Studies 180; Public Health 150 or Civil Engineering 144; Sociology 178; Flora and Fauna of the San Francisco Bay Area (proposed course).

**FAMILY SOCIOLOGY**

For courses in Family Sociology, see Department of Nutritional Sciences.

**FOLKLORE**

Professors: William R. Bascom, Ph.D. (Chairman)  
Alan Dundes, Ph.D.  
Wolfram 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 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 Kroeber.

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.
   The Staff (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

[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.
138. The Greek and Roman Historians.

Comparative Literature
41A–41B–41C. Introduction to Literary Forms.
110. The Classical Tradition in Western Literature.
120. The Biblical Tradition in Western Literature.

NOTE: For key to footnote symbols, see page 78.

French
142A–142B. French Literature of the Middle Ages in English Translation.
146A–146B. Contemporary French Literature in English Translation.
German

*Dutch 39. Dutch Literature in English Translation.
*Yiddish 39. Yiddish Literature in English Translation.

Italian

130. Dante’s Divine Comedy.
135. Petrarch and Boccaccio.
140A–140B. Basic Reading: Petrarch.
150. Machiavelli.
155A–155B. The Renaissance.
170. Modern Italian Literature.
180. Film and Literature.

Near Eastern Languages

152A–152B–152C. The Literature of Ancient Israel.
163A–163B. History of Persian Literature.
168A–168B. Turkish Literature in Translation.
172A–172B. Ancient Mesopotamian Documents and Literature.
182A–182B. Arabic Literature in Translation.

Oriental Languages

40. Civilizations of Eastern Asia: China.
41. Civilizations of Eastern Asia: Japan.
42. Civilizations of Eastern Asia: Korea.
43. Civilizations of Eastern Asia: Mongolia.
55. Traditional Japanese Historical Writing.
70. Introduction to Buddhism.
71. The Development of Buddhism in the Far East.

Scandinavian

06. History of Scandinavian Drama up to 1900.
07. The Plays of Ibsen.
08. Strindberg and his Writings.
109. Scandinavian Drama of the Twentieth Century.
120A–120B. The Novel in Scandinavia.
125. Old Icelandic Literature.
160. Scandinavian Mythology.
171. Contemporary Swedish Literature.
175. 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.
170A–170B. Survey of Serbian and Croatian Literature.

Hungarian


Portuguese

39C–39D. Brazilian Literature in English Translation.

South and Southeast Asian Languages and Literatures

121A–121B–121C. Literary and Cultural Traditions of India.
123. The Indian Story.

Spanish

**FORESTRY AND CONSERVATION**

(Department Office, 145 Mulford Hall)

Professors:
Harold H. Biswell, Ph.D.
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.
Arno A. Starker Leopold, Ph.D.
Emmanuel Fritz, M.F.
Edward Dennis E. Teegarden, Ph.D.
Henry J. Vaux, Ph.D.
John A. Zivnuska, Ph.D. (Chairman)
Emanuel Fritz, M.F. (Emeritus)
Joseph Kittredge, Ph.D. (Emeritus)
Myron Krueger, M.S., D.Sc. (hon.) (Emeritus)

Associate Professors:
William J. Libby, Ph.D.
William L. M. McKillop, Ph.D.
Dennis E. Teegarden, Ph.D.

Paul J. Zinke, Ph.D.
Woodbridge Metcalf, M.S.F. (Emeritus)

Assistant Professors:
Don C. Erman, Ph.D.
John A. Helms, Ph.D.
Joe R. McBride, Ph.D.
Lee C. Wensel, Ph.D.

Assistant Professors:
Donald G. Arganbright, M.S. (Acting)
William A. Atkinson, M.S. (Acting)

Lecturers:
Arthur B. Anderson, Ph.D.
Paul Casamajor, M.F.
William O'Regan, Ph.D.
Herbert C. 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 63.

*Letters and Science List: courses 10, 111, 112, 115, 116, 122, 123A-123B-123C, 142, 143, 144, 173, 175, 177, 178, IDS 10A-10B-10C, IDS 170, IDS 186, are included in the Letters and Science List of Courses. For regulations concerning this list see the ANNOUCEMENT 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—Crisis and Conflicts. (4-4-4)

See Interdepartmental Studies for the complete description of this course.

IDS 49. Introduction to Conservation of Natural Resources. (2)

See Interdepartmental Studies for the complete description of the course.

**General Forestry**

Upper Division Courses

100A–100B–100C. Field Study of Forestry and Wildland Resources. (5–6–4)

450 hours of field instruction. Prerequisite: 12 units of biological sciences and 3 units of plane

NOTE: For key to footnote symbols, see page 78.
110. Introduction to Planning Natural Resource Use. (5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: 8 units of principles of economics. Principles of planning renewable natural resource use to maximize net benefits to society, with primary reference to wildlands; elements of decision-making processes; identification of resource values; methods and techniques of economic and social analysis for planning resource use.
Mr. Casamajor (W)

111. Wildland Resource Supply. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: 8 units of principles of economics. Nature and extent of forest and other wildland resources; costs in relation to efficient resource use and conservation; analysis of short-run and long-run supply problems; structural and institutional factors affecting supply; supply concepts in relation to environmental quality.
Mr. Vaux (Sp)

112. Analysis of Demand for Wildland Resources. (4)
Three 1-hour lectures and one 3-hour discussion session per week. Prerequisite: 8 units of principles of economics. Wildland resources and consumers; consumer theory; priced and non-priced resource products; derived demand; social preference in relation to resource management; assessment of project benefits.
Mr. McKillop (F)

113. Forest Regulation and Management. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: course 110. 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. Craig (W)

114. Decision-Making in Resource Management. (5)
Three 1-hour lectures and one 4-hour laboratory per week. Prerequisite: courses 113 and 125; Mathematics 16A–16B or equivalent. Concepts, techniques, and organization of decision-making in forest resource management and conservation; analysis of selected case studies.

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 1½-hour lectures per week. Prerequisite: consent of instructor; background in principles of resource ecology and economics is required. Analysis and evaluation of trends in demand and use of forests and wildlands for recreational purposes; policy and management problems arising from recreation use; basic concepts of resource management as tools for analysis of problems in resource oriented recreation.
Mr. Vaux (W)

118A–118B. Undergraduate Seminar in Current Issues. (1–1)
One 1-hour seminar per week. Discussion of current policy issues related to renewable natural resources with emphasis on the development of the oral and written communication skills of the students.
118A—Mr. Zivnowsk, Mr. Schultz, Mr. Vaux (F, W, S)
118B—Mr. Zinke, Mr. Sampert, Mr. Libby (F, W, Sp)

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, autecology, and silvicultural characteristics and a review of the literature of the field.
Mr. Zinke (F)

122. Forest Influences and Watershed Management. (4)
Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: 3 units of biology or soil science. The influence of forests and associated vegetation on watershed characteristics, including the energy balance, micrometeorology, hydrologic cycle, chemical quality of water, and erosion processes; the application of this information to watershed management.
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 processes and is oriented to man's role as a manipulator of ecosystems, 123A. Ecosystem Concepts and the Major Subsystems, 123B. Biota, 123C. Ecosystem Evolution and Major Biomes. The Staff (Mr. Schultz in charge, 123A) (F) (Mr. Erman in charge, 123B) (W) (Mr. Stone in charge, 123C) (Sp)

125. Principles of Silviculture. (5)
Four 1-hour lectures per week; four Saturday excursions will be required. Prerequisite: course 123C or equivalent preparation in community ecology. Principles and concepts of the biological aspects of establishment, growth, composition, and quality of forest trees and stands. The manipulation of forests and the development of stand structure to maximize the usefulness of forests to man.
Mr. Helms (F)

IDS 149, Senior Seminar in Natural Resources. (4)
See Interdepartmental Studies for the complete description of this course.

IDS 186. Remote Sensing of Earth Resources. (5)
See Interdepartmental Studies for the complete description of this course.

Graduate Courses

201. Advanced Forest Mensuration. (3)
One 2-hour lecture and one 2-hour laboratory per week. Prerequisite: course 101 or equivalent. Advanced topics in forest mensuration and forest inventory.
Mr. Wensel (F)
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 forest 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.

Mr. Biswell (W)

209. Seminar in Research Methods. (3)

One 3-hour seminar 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)

Two 1½-hour meetings per week. Prerequisite: 12 units of economics, agricultural 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)


(Formerly numbered 214A–214B)

Two 1½-hour meetings per week. Prerequisite: courses 110, 114 or equivalent. Case studies involving inventory, evaluation, decision making, and planning for wildland 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 (Sp)

IDS 222. Natural Environment Evaluation. (4)

See Interdepartmental Studies for the complete description of this course.

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 (W)

225. Advanced Silviculture. (3)

Two 1½-hour lectures per week. Prerequisite: course 125.

Mr. Helms (F)

250. Tropical Forestry. (12)

Ten lecture hours and thirty laboratory hours of field instruction. Prerequisite: graduate status in forestry. Evaluation of biological, sociological, and managerial aspects of tropical forest resources. An eight-week (April–June) intensive field course in Central America offered in cooperation with the Organization for Tropical Studies. Travel and subsistence fellowships available from OTS. Sponsored by Graduate Council. See Mr. Helms or Mr. Gra for details.

Wood Science

Upper Division Courses

131. Anatomy and Physical Characteristics of Wood. (4)

Two 1-hour lectures and two 3-hour laboratories 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 (W)

132. Mechanical Processing of Wood. (4)

Four 1-hour lectures 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)

IDS 136. Biological Deterioration of Wood. (3)

See Interdepartmental Studies for the complete description of this course.

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. Seminar in Physical Properties of Wood. (3)
One 3-hour seminar per week. Open to qualified graduate students from other departments.

Mr. Arganbright (W)

233. Seminar in Mechanical Properties of Wood. (3)
One 2-hour seminar and one 1-hour of individual conference per week. Open to qualified graduate students from other departments.

Mr. Schniewind (Sp)

234. Seminar in Wood Chemistry. (3)
One 3-hour seminar per week. Mr. Anderson (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) (W, Sp)
(Mr. Dickinson in charge, 238F) (F, W, Sp)
(Mr. Wilcox in charge, 238G) (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 (Sp)

Wildlife Science

Upper Division Courses

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

275. Wildlife Agriculture. (4)
(Formerly numbered Zoology 175)
Two 2-hour lecture and discussion periods per week. Prerequisite: Interdepartmental Studies 170 or equivalent; recommended Zoology 140, or Biology 150. Dynamics of wildlife populations, mechanisms regulating natality, mortality, population density, and productivity.

Mr. White (W)

177. Case Histories in Wildlife Management. (4)
Two 2-hour lecture and discussion periods per week. Prerequisite: Forestry and Conservation 175 or equivalent. Analysis of biological, political and economic factors that influence decision-making process in governmental programs of wildlife conservation and management.

Mr. Leopold (Sp)

178. Aquatic Biology. (4)
Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: 8 units of biology. Analysis of basic 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: Interdepartmental Studies 170 and Forestry and Conservation 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 (Sp)

278. Seminar in Aquatic Biology. (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 79. Must be taken on a passed or not passed basis.

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

FRENCH

(Except Office, 4125 Dwinelle Hall)

Professors:

Jonas A. Barish, Ph.D. (Interim Chairman)
Alexandre E. Calame, Docteur ès Lettres
Francis J. Carmody, Ph.D.
Alvin A. Eustis, Jr., Ph.D.
Basil Guy, Ph.D.
Irving Putter, Ph.D.
Warren Ramsey, Ph.D.
Manfred M. G. Sandmann, Litt.D.
Ronald N. Walpole, Ph.D.
Clarence D. Brenner, Ph.D. (Emeritus)
Jacqueline de la Harpe, Docteur ès Lettres (Émerita)
Marie-Louise Dufrenoy, Ph.D. (Emerita)
Percival B. Fay, Ph.D. (Emeritus)

Associate Professors:

Paul M. Bertrand Augst, Ph.D.
Leonard W. Johnson, Ph.D.

The Major Courses 1, 2, 3, 4, 5, 6, 33A–B–C, 35, or their equivalents; 44 upper division units in French (of which 18 units have to be taken in residence) including:

(a) courses 101, 102, 103, 130A;

(b) seven literature courses distributed as follows: at least five courses (in at least three centuries) chosen from courses 115A through 120B. Additional literature courses, if necessary to make up the seven courses, chosen from courses 121A, 121B, 122A, 122B, 140, H198;

NOTE: For key to footnote symbols, see page 78.

Graduate Courses

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)

Walter E. Rex, Ph.D.
Clifford H. Bissell, Ph.D. (Emeritus)
Edward F. Meylan, Ph.D. (Emeritus)

Assistant Professors:

Joseph J. Duggan, Ph.D.
Marie-Hélène Huet, Ph.D.

Lecturers:

Esther Alder, Ph.D.
John D. Bednar, Ph.D.
William Daoust, B.A.
Françoise M. Hourcade, Diplôme d’études Supérieures
Anne-Marie Lasocki, Ph.D.
Françoise Sorgen, Diplôme d’études Supérieures
Jean Abou, Maîtrise de Lettres Modernes
Jacques Henry, Agrégation d’Anglais
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  Twenty-four units of lower division courses in French (or the equivalent) and French 35, 101, 102, 103, and 130A or 134A.

Certificate of Completion in French  Requires the equivalent of the major and courses 130B, 134A–134B, and 300.

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. Courses specifically required: course 221A–B; one quarter of either course 201 or course 206. Recommended: course 220A–B. In the final quarter of residence, candidates must pass comprehensive written and oral examinations. (Bibliography available from the department office.) For further information consult the graduate advisers.

The Ph.D. Program  Language requirements: candidates must pass examinations in Latin and either (a) one other foreign language examined under the Option II program or (b) two other foreign languages examined by the Romance Language Ph.D. Examination Committee. Candidates will be required to demonstrate (a) a comprehensive knowledge of the whole body of French literature; (b) special competence in a field of concentration in French literature; (c) knowledge of the history of the French language from its origins to the present; (d) ability to do original work in literary history or criticism. The candidate will take such courses as he and his adviser consider necessary. The candidate will also be held responsible for a minor subject normally consisting of a period or coherent field of study in any appropriate classical or modern literature. Work in a related field outside these literatures (philosophy, history, art, linguistics, etc.) may be accepted if approved by the graduate adviser. For further information, consult the graduate adviser and the departmental guide sheet.

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. (4)
   Five 1-hour classes and at least one laboratory session per week.
   Mr. Jian (F, W, Sp)

2. Elementary French (Continuation of 1). (4)
   Five 1-hour classes and at least one laboratory session per week. Prerequisite: course 1 or equivalent.
   (F, W, Sp)

3. Intermediate French. (5)
   Five 1-hour classes per week and at least 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. Advanced French. (4)
   Five 1-hour classes per week. Prerequisite: course 4 or equivalent. Composition, reading, and grammar review.
   (F, W, Sp)

6. Advanced French (Continuation of 5). (4)
   Five 1-hour classes per week. Prerequisite: course 5 or equivalent. Composition, reading, and grammar review.
   (F, W, Sp)

*8. Advanced French Reading. (4)
   (Formerly numbered 5R)
   Five 1-hour classes per week. Prerequisite: course 4 or equivalent. Reading; study and translation of French texts; classroom work in English.
12A. Accelerated Beginning French. (8)
An intensive course in beginning French, equivalent to French 1 and French 2. Five 2-hour classes and four laboratory sessions per week. (F, W, Sp)

12B. Accelerated Intermediate French. (10)
An intensive course in intermediate French, equivalent to French 3 and French 4. Five 2-hour classes and four laboratory sessions per week. (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. (F, W, 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)

33A–33B–33C. A Survey of French Literature. (4–4–4)
One lecture and 2 sections per week. Prerequisite: course 5B or equivalent. Prerequisite for the major. 33A. From the origins to the end of the sixteenth century. 33B. The seventeenth and eighteenth centuries. 33C. The nineteenth and twentieth centuries. (F, W, Sp)

35. French Phonetics. (2)
Two 1-hour classes per week and one laboratory session per week. Prerequisite: course 4 or equivalent. Pronunciation; required for the major. (F, W, Sp)

Upper Division Courses

The prerequisite to all upper division courses except 142 and 146 is 28 units of courses, including courses 6 and 35, or the equivalent. Course 101 must usually be taken before any other upper division course. Courses 33A, 33B, 33C are prerequisite to upper division literature courses. Courses 101, 130A, and 134A are prerequisite respectively to 102, 130B, and 134B.

Three 1-hour classes per week. Prerequisite: for 101—courses 6 and 35; for 102—course 101; for course 103—course 102. Students with an A or B in French 6 may be permitted to proceed directly to French 102. Transfer students will normally be expected to take French 101. (In special cases students may be permitted to proceed to French 102 if they first take an examination at the level of difficulty of French 101.) Required for the major. (F, W, Sp)

*104. Methods of Literary Study. (4)
Three 1-hour classes per week. Prerequisite: course 5B or equivalent. Highly recommended for the major. (F, W, Sp)

Three 1-hour classes per week. 106A. Sounds and spelling (introduction to historical grammar); 106B. Words (elementary semantics and linguistic geography); 106C. Constructions, personal and impersonal, verbal and nominal, coordinating and subordinating, etc. Mr. Sandmann (F, W, Sp)

*108A–108B. Readings in French Literature. (4–4)
Three 1-hour classes per week. Masterpieces of French literature read in French; classroom work in English. (F, W, Sp)

115A–115B. The Middle Ages. (4–4)
Three 1-hour classes per week. (F, W, Sp)

116A–116B. The Sixteenth Century. (4–4)
Three 1-hour classes per week. Mr. Johnson (W, Sp)

Three 1-hour classes per week. (F, W, Sp)

118A–118B. The Eighteenth Century. (4–4)
Three 1-hour classes per week. (F, W, Sp)

119A–119B–119C. The Nineteenth Century. (4–4–4)
Three 1-hour classes per week. (F, W, Sp)

120A–120B. Contemporary Literature. (4–4)
Three 1-hour classes per week. (W, Sp)

121A–121B. Literature from 1885 to 1914. (4–4)
Three 1-hour classes per week. Credit and grade will be awarded upon completion of the sequence. (W, Sp)

122A–122B. Modern Drama. (5–5)
Three 1-hour classes per week. Mr. Augst (W, Sp)

130A–130B–130C. Advanced Composition. (4–4–4)
Three 1-hour classes per week. Prerequisite: for course 130A—course 103; for course 130C—course 130B. 130A and 130B are required for the Certificate of Completion in French. Sequence beginning each quarter. (F, W, Sp) 130C (W, Sp)

134A–134B. Culture and Institutions. (4–4)
Three 1-hour classes per week. Prerequisite: course 102. Required for the Certificate of Completion in French. Mr. Guy (F, W)

140. Senior Seminar. (4)
Two 1-hour classes per week. Prerequisite: senior standing and course 33A–33B–33C or its equivalent. To be devoted to the intensive study of major authors, movements and genres. The Staff (F, W, Sp)

H198. Honors Course. (4)
Two quarters with grade of A or B required to qualify for honors in French at graduation. To be taken not later than the beginning of the senior year. The Staff (F, W, Sp)

199. Special Study for Advanced Undergraduates. (2–5)
Individual appointments. Restricted to senior honor students with 3.0 or better in French. (F, W, Sp)
Courses in Which No Knowledge of French Is Required

Three 1-hour classes per week.
39A. To the end of the eighteenth century. (F)
39B. The nineteenth century. (W)
39C. The contemporary period. (Sp)

**142A–142B. French Literature of the Middle Ages in English Translation. (4–4)**
Three 1-hour classes per week.
142A. Epic, romance, history.
142B. Drama, lyric and allegorical poetry.

**146A–146B. Contemporary French Literature in English Translation. (4–4)**
Three 1-hour classes per week.

Graduate Courses

**201A–201B–201C. Historical Grammar. (4–4–4)**
One 2-hour class and one 1-hour class per week. (F, W, Sp)

**202A–202B. Studies in Medieval Literature. (4–4)**
One 2-hour class per week. (F, W)

One 2-hour class per week. Mr. Sandmann (F, Sp)

**204A–204B. Studies in the Eighteenth Century. (4–4)**
One 2-hour class per week. (F, Sp)

One 2-hour class per week. Letters and memoirs.

**206A–206B. Reading and Interpretation of Typical Old French Texts. (4–4)**
One 2-hour class per week. Mr. Sandman (F, W)

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

**209A–209B–209C. Modern Authors. (4–4–4)**
One 2-hour class per week.

One 2-hour class per week. (W, Sp)

**214A–214B. Seminar on Modern Drama. (4–4)**
One 2-hour class per week. Prerequisite: consent of instructor. Mr. Augst

One 2-hour class per week. Mr. Ramsey (W, Sp)

**216A–216B. Poetry of the Renaissance. (4–4)**
One 2-hour class per week. Mr. Johnson (W, 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 (F, W)

One 2-hour class meeting per week. Credit and grade will be awarded upon completion of the full sequence. (F, W)

**220A–220B. Explication de Textes. (4–4)**
Mr. Calame (F, Sp)

**221A–221B. La Dissertation Litteraire. (4–4)**
One 2-hour class per week. Required of all candidates for the M.A. degree. (W, Sp)

One 2-hour class per week. Prerequisite: consent of instructor.

**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. Mr. Eustis (Sp)

**235. Methods of Literary Research. (2)**
One 3-hour class per week. Mr. Eustis

One 2-hour class per week.

**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)

**602. Individual Study. (1–8)**
Prerequisite: on M.A. or completion of at least 24 units beyond the B.A. Individual study with the major adviser, intended to provide an opportunity for qualified students to prepare for the various examinations required of candidates for the Ph.D. May not be used for unit of residence requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (Graduate Advisers in charge) (F, W, Sp)
1G. French for Graduate Students, Beginning. (0)
Two 1-hour classes per week. Course must be taken on a pass/not pass basis. a. Preparation for graduate reading examinations in field of English (three 1-hour classes); b. Preparation for graduate reading examinations in the sciences; c. Preparation for graduate reading examinations in all other disciplines. Mrs. Alder (in charge) (F, W, Sp)

2G. French for Graduate Students, Advanced. (0)
Two 1-hour classes per week. Course must be taken on a pass/not pass basis. a. Preparation for graduate reading examination in field of English (three 1-hour classes); b. Preparation for graduate reading examinations in the sciences; c. Preparation for graduate reading examinations in all other disciplines. Mrs. Alder (in charge) (Sp)

3G. Advanced Translation of French Critical Literature for Graduate Students. (0)
Three one-hour classes per week. Prerequisite:
French 2G or equivalent. Readings in literary criticism. Preparation for graduate reading examinations. Course must be taken on a pass or fail basis. Mrs. Alder (in charge) (Sp)

Teachers’ Courses

300. The Teaching of French at the Secondary Level. (4)
Two 1½-hour classes per week. Required for the Certificate of Completion in French.
Mr. Daoust (F, W)

301A–301B. Teaching French in College. (2–2)
Three hours of lecture and one hour of laboratory per week. Prerequisite: for graduate students teaching at the college level. Required for new T.A.’s. Bi-weekly lectures on methodology, grading and testing, demonstration class with required attendance three times a week; language laboratory observations; supervised classroom practice. Additional seminars and discussion sessions on methodology. (F, W)

GENETICS

(Department Office, 345 Mulford Hall)

Professors:
Spencer W. Brown, Ph.D.
Donald R. Cameron, Ph.D.
Seymour Fogel, Ph.D. (Chairman)
I. Michael Lerner, Ph.D., D.Sc. (hon.c.)
Everett R. Dempster, Ph.D. (Emeritus)
Curt Stern, Ph.D., D.Sc. (Emeritus)

Associate Professors:
James W. Fristrom, Ph.D.
William J. Libby, Jr., Ph.D.
Patricia St. Lawrence, Ph.D.

Assistant Professors:
Alec D. Keith, Ph.D.
Phillip T. Spieth, Ph.D.

Undergraduate Major Adviser: Miss St. Lawrence.
Graduate Advisers: Mr. Brown, Mr. Fristrom, Mr. Keith.

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 Sciences Curriculum (see page 61), 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).

Biological and Agricultural Sciences, 40 units as follows: biology (15); biochemistry (4); microbiology (4); additional biological sciences (17).

Major Field, 23 units as follows: cytology (5); genetics (18).

Additional courses, 39 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

†† 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 78.
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, 1C; 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 130 (or Zoology 110A–110B); Genetics 100 (or 150A–150B); Genetics 101, 100L; at least 13 units from the following, including one course from the Department of Genetics: Genetics 130, 131, 140, 191, 196; Statistics 130A–130B–130C, 131, 131L; Public Health 160A–160B–160C; Molecular Biology 110; Zoology 104.

**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.
in organic chemistry, DNA and chromosome replication; chemistry of alkylation; nonalkylating mutagens; carcinogenesis. Biological and genetic consequences of chemical mutagens. To be taken on a passed/not passed basis. Mr. Keith (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 (Miss St. Lawrence in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed/not passed basis. The Staff (Miss St. Lawrence in charge) (F, W, Sp)

IDS 10A—10B—10C. Man and His Environment—Crises and Conflicts. (4–4–4)
See interdepartmental studies for complete description of this course.

**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. Mr. Fristrom (Sp)

290A—290B—290C—290D—290E. Graduate Seminar in Genetics. (1–4)
Formerly numbered 280
One and one-half hours of lecture per week.

Mr. Keith (Sp)

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 especial 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. Keith in charge) (F, W, Sp)

299. Research in Genetics. (1–12)
The Staff (Mr. Keith 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. Keith 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. Keith in charge) (F, W, Sp)

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.
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.

Allan Pred, † Ph.D.

Professor:
Jan O. M. Broek, Ph.D. *(Visiting)*

Assistant Professors:
John Campbell, Ph.D. *(Acting)*
Robert R. Reed *(Acting)*

Lecturers:
Daniel B. Luten, Ph.D.
J. Ralph Audy, M.D. *(Visiting)*

Departmental Undergraduate Advisers: Mr. Oberlander, Mr. Reed.

Departmental Graduate Adviser: Mr. Vance.

**NOTE:** For key to footnote symbols, see page 78.
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, either in itself (climate, land forms, vegetation) or 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.

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 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 45 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 100A, 100B, 130A, 135, and 183 or 187A
- **Option II**  (Urban-Economic) — Geog 110A, 112, 114, 120 and 187A
- **Option III**  (Physical) — Geog 140, 144, 146, 185, and 187A
- **Option IV**  (General) — Geog 110A, 120, 130A, 140 or 144, and one of the following: 183, or 185, or 187A

All geography majors must take Geog 180 or 181, 189, and two regional courses numbered 150–171.

Some courses carry less than 5 credit units, and the student must be prepared to take an extra course to complete the total of 45 units required. 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 for the 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. Major earth lineaments. Characteristics of climates. The origin and distribution of landforms. Interrelationships of physical phenomena, including vegetation and soils in the major natural regions of the earth.
   Mr. Sternberg (F); Mr. Oberlander (W)

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. Reed (F, Sp)

7. Economic Geography: Agricultural and Mineral Resources. (5)
   Three hours and two 1-hour discussion sections per week. World patterns of production and trade in food and industrial raw materials; the question of resource adequacy, now and in the future.
   Mr. Campbell (Sp)

Upper Division Courses

100A–100B. Principles of Cultural Geography. (5–5)
   Three hours lecture and one hour consultation per week.
   100A: short history of cultural geography; major themes concerning the relation of culture to environment; cultural attitudes to nature; land tenure; processes in the formation of landscapes; gardens.  
   100B: continues with population and environment, religious geography, cities as expressions of varying cultural traditions.

Each course can be taken independently, but if both courses are taken, the 100A–B sequence is preferable; if only one is taken, 100A is recommended. Mr. Broek (100A, F); Mr. Reed (100B, W)

103. The Relations between Nature and Culture. (5)
   Three hours lecture and one hour consultation 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)

110A. Principles of Economic Geography. (5)
   Three hours lecture and one hour consultation per week. A review of classical agricultural location theory, industrial location theory, central place theory, and some of their contemporary revisions. Information circulation and the locational decision-making behavior of individuals and firms.
   Mr. Campbell (W)

*110B. Principles of Economic Geography. (5)
   (Formerly numbered 150B)
   Three hours lecture and one hour consultation per week. Technological change, economic growth, and dynamic interpretations of economic-geographic phenomena.
   Mr. Fred (Sp)

112. Historical Geography of Transportation. (5)
   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 (W)

114. Industrial Localization. (5)
   (Formerly numbered 142)
   Three hours lecture and one hour consultation per week. Factors and trends in the geographic distribution of manufacturing industries.
   Mr. Campbell (Sp)
120. Urban Geography: Morphogenesis of the Western City. (5)

Four hours lecture per week. Historical development of the physical structure of western cities and urban morphology theory from the Middle Ages to the present. Particular attention is given to the morphological expression of specific economic and cultural practices through a study of the mercantile and the industrial city.

Mr. Vance (F)

*125. Social Geography. (5)

Three hours lecture and one hour consultation 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.

Mr. Luten (F)

130A. Natural Resources and Population. (5)

Three hours lecture and one hour consultation 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 food and nutrition, forests, energy, water, and environmental contamination.

Mr. Luten (Sp)

130B. Open Land as a Natural Resource. (5)

Three hours lecture and one hour discussion group per week. Prerequisite: 130A. Emphasis on 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. (5)

Three hours lecture and one hour consultation 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. (5)

Three hours lecture and one hour discussion group per week. Prerequisite: 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. Enrollment limited.

Mr. Luten (Sp)

140. Analysis of Landforms. (5)

Four and one-half hours lecture and one hour consultation per week. Prerequisite: Geography 1, or one or more courses in geology or consent of instructor. 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)

144. Principles of Meteorology and Climatology. (4)

Two 1/2-hour lectures and one 2-hour laboratory per week. Structure and energy balance of the atmosphere, Interactions between the atmosphere and land and water surfaces. Weather development in relation to different orders of tropospheric circulation. Weather persistence and controls of climate.

Mr. Giovinetto (F, W)

146. Physical Climatology of Natural Regions. (4)

Two 1/2-hour lectures per week and two all-day field work periods normally scheduled on the 3rd and 7th Saturdays. Principles of dynamic and synoptic climatology. Interface mass and energy transfer. Heat and water balance of air masses and river basins. Climate as a determinant factor of physical environments.

Mr. Giovinetto (Sp)

150. California. (5)

Four hours lecture per week. Geographical regions of the state; agricultural, urban, and industrial expansion as related to population growth and changing technology. Bases of current environmental crises.

Mr. Powell (Sp)

*151. Western United States. (5)

Three hours lecture and one hour consultation per week.

Mr. Parsons

*152. Historical Economic Geography of the Eastern United States. (5)

Three hours lecture and one hour consultation per week. Nineteenth-century processes of agricultural and industrial location. Migration and settlement spread processes. Development of the urban system.

Mr. Pred

153. Geography of Canada. (5)

Three hours lecture and one hour consultation per week.

Mr. Vance (F)

154. Middle America. (5)

Three hours lecture and one hour consultation per week. Mexico, Central America, and the West Indies.

Mr. Parsons (F)

*155. Spanish South America. (5)

Three hours lecture and one hour consultation per week. The Andean and La Plata countries.

Mr. Parsons

156. Brazil. (5)

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 (W)

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 (Sp)
162A–162B. Soviet Union. (5–5)
Three hours lecture and one hour consultation per week.
162A. A systematic survey. Mr. Hooson (F)
*162B. Prerequisite: course 162A or consent of the instructor. Special problems in Soviet regional geography. Mr. Hooson

163. Southeast Asia. (5)
Three hours lecture and one hour consultation per week. Mr. Reed (W)

*166. The Middle East. (5)
Three hours lecture and one hour consultation per week.

169. Southwest Pacific. (5)
Three hours lecture and one hour consultation per week. Australia, New Zealand, and the South Pacific islands. Mr. Hooson (W)

*170. The Arid Lands. (5)
Four hours lecture per week. A comparative survey of the arid and semiarid regions of the world. Climate, land forms, water, soils, and vegetation; population and resources.

171. The Humid Tropics. (5)
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 (W)

180. Field Geography. (5)
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. (5)
All day Saturday. Prerequisite: course 120 or consent of instructor. Analysis of the structural components of the urban environment of the San Francisco–Oakland Metropolitan Area.

*182. Summer Field Course. (10)
Prerequisite: courses 156 and 157A or consent of instructor. Limited enrollment. Training in field methods based on five weeks study in the Brazilian Amazon. Mr. Sternberg

183. Cartography. (5)
One hour lecture and two 3-hour laboratories per week. Cartographic representation. Mr. Oberlander (W)

185. Topographic Map Interpretation. (5)
Three hours lecture and three hours laboratory per week. Prerequisite: Geography 140, which may be taken concurrently, or equivalent, or consent of instructor. The recognition and analysis of landforms portrayed on standard topographic maps. Mr. Oberlander (F)

187A. Introduction to Quantitative Methods in Geography. (5)
Two 1-hour lectures and two hours of consultation per week. Prerequisite: Statistics 2 or 130A, or consent of instructor. Models and the "problem approach" in geographic research. Introduction to the analysis of spatial distributions (economic and physical) and areal associations. Point pattern analysis, geostatistical methods, quadrate techniques, and nearest neighbor statistics. Spatial sampling designs, "area" and "location" procedures. Mr. Campbell (F)

*187B. Intermediate Quantitative Methods in Geography. (5)
Two 1-hour lectures and two hours of consultation per week. Prerequisite: Geography 187A. Further work in the analysis of areal association. Spatial data systems. Problems in spatial series analysis. Special emphasis on the problem of regionalization, and the analysis of networks.

189. Geographic Thought. (5)
Three hours lecture and one hour consultation per week. Prerequisite: three upper division courses in geography. Reports and conferences on the objectives, subdivisions and methods of geography by American and foreign geographers of the late nineteenth and the twentieth centuries. Mr. Broek (F)

191A. Geography of Human Health and Disease. (3 or 5)
Three hours lecture-discussion and one hour consultation 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. Dr. Audy 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 79. 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.

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. (5)
Three hours per week. Mr. Glacken (W)

210. Problems in Economic Geography. (5)
Three hours per week. Mr. Campbell (F)

*220. Advanced Urban Geography. (5)
Three hours per week. Mr. Vance

230. Geographical Problems in Regional Development and Resource Utilization. (5)
Three hours per week. Physical, biotic, and cultural factors in the development of the tropics. Mr. Sternberg (Sp)

240. Problems in Physical Geography. (5)
(Formerly numbered 261)
Three hours per week. Mr. Oberlander (Sp)
248. Paleoclimatology. (5)
Two 1-hour lectures and two hour consultation 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 (F)

Graduate Research Seminars
251. Cultural Geography. (5)
Three hours per week. Mr. Reed (Sp)

*252A-252B. Economic Geography. (5-5)
Three hours per week. Mr. Fred

253. Urban Geography. (5)
Three hours per week. Mr. Vance (W)

254. Population and Natural Resources. (5)
Three hours per week. Mr. Luten (F)

255. Historical Geography. (5)
Three hours per week. Mr. Parsons (F)

256. Climatology. (5)
Three hours per week. Prerequisite: consent of instructor. Mr. Giovinetto (W)

*257. Geomorphology. (5)
Three hours per week. Mr. Oberlander

*258. Biogeography. (5)
(Formerly numbered 201, Sec. c) Three hours per week. Mr. Parsons

*260. History of Geography. (5)
Three hours per week. Mr. Hooson

270. North America. (5)
Three hours per week. Mr. Parsons

*271A-271B. Latin America. (5)
Three hours per week. Seminar on Latin America. (271B, F)

*275. Soviet Union. (5)
Three hours per week. Mr. Hooson

*277. Southwest Pacific. (5)
Three hours per week. Mr. Hooson

280. Advanced Field Study in Geography. (5-10)
All day Saturday. Course may be repeated for credit. The Staff (F, W, Sp)

*287. Advanced Quantitative Methods in Geography. (5)
Three hours lecture and one hour consultation per week. Prerequisite: Geography 187B or equivalent or consent of instructor. A course in computer programming is also desirable. An examination of recent applications of multivariate statistical analysis in geographic research.

289. Problems in Geographical Thought. (5)
Three hours per week. Mr. Hooson (Sp)

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 examination 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.

GEOLGY AND GEOPHYSICS

(Department Office, 301 Earth Sciences Building)

Professors:
Bruce A. Bolt, Ph.D.
Ian S. E. Carmichael, Ph.D.
Carniss H. Curtis, Ph.D.
Charles M. Gilbert, Ph.D.
Richard L. Hay, Ph.D.
Harold C. Helgeson, 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.

Assistant Professors:
Lane R. Johnson, Ph.D.
Mitchell W. Reynolds, Ph.D.
Chi-yuen Wang, Ph.D.
Hans-Rudolf Wenk, Ph.D.

The Department of Geology and Geophysics offers the undergraduate 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.

NOTE: For key to footnote symbols, see page 78.
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. Courses such as 107 (Evolution of Continents and Oceans) and 108 (Advanced Physical Geology) are meant to provide a broad outlook on the whole field of geological inquiry.

THE MAJOR

Lower Division Courses  Geology 5A–5B–5C, Paleontology 1 or equivalent, 40 units of lower division courses in physics, chemistry, mathematics (including statistics and computing), and biological sciences. Chemistry 1A or 4A must be included. Recommended: for students anticipating postgraduate study or a professional career in geology: Chemistry 1A, 1B, 1C or 4A, 4B, 4C and 14; Physics 4A–4B–4C–4D–4E; Mathematics 1A–1B–1C, 51A–51B–51C; Statistics 2 or 20.

Upper Division Courses  Geology 150, 118, and either 108 or 119B (8 units), plus 20 units of upper division courses in geology, geophysics, paleontology, physics, chemistry, mathematics or engineering as approved by the major adviser. Geology 102C, 103A, 103B and 105 are strongly recommended.

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 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–5C; Mathematics 1A–1B–1C, 51A–51B–51C. Recommended: Geology 5B.


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 123 in addition to the regular program.

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).

Graduate Programs

Geology. Thirty units of course work and a thesis are required for the master's
degree. The courses must include at least 12 units of graduate work in the major subject. All incoming graduate students must take Geology 202, Field Study. Ordinarily, one summer is spent in gathering data for the thesis.

There is no formal course requirement for the Ph.D. degree, nor is an M.A. degree prerequisite to it. A candidate for the Ph.D. degree must be able to translate original scientific literature in one foreign language (generally, French, German, or Russian); he must pass an oral qualifying examination covering a broad field of knowledge, and carry out a substantial piece of fundamental research. The department has excellent laboratories and facilities for field and experimental work. It encourages intensive research of an analytical rather than a descriptive nature.

**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*

5A-5B-5C. The Earth. (4-2-4)

5A. Two 1-hour lectures and two 3-hour laboratory periods or field trips per week. (Students enrolling in this course must have the entire afternoon free for field work on the days of their scheduled laboratory periods.) **Prerequisite:** Chemistry 1A or equivalent or consent of the instructor. For students majoring in the earth sciences, physical sciences, or engineering. Introduction to geology through field mapping and laboratory studies. Minerals, rocks, geologic structures and processes.

Mr. Gilbert, Mr. Christensen (F)

5B. Two 3-hour laboratories. Open only to students who have just completed Geology 5A. Laboratory work and completion of field report from Geology 5A. Required of geology majors.

Mr. Gilbert (W)

5C. Three 1-hour lectures and one 3-hour laboratory period per week. **Prerequisite:** Geology 5A. Fundamental concepts of geophysics; earth’s interior, emphasis on the use of geophysical methods and data for an integral study of geology.

Mr. Verhoogen (Sp)

10. Introduction to Geology. (4)

Three 1-hour lectures and one 3-hour laboratory period per week plus one half-day Saturday field trip. Designed for students not majoring in physical science or engineering, not open to students who have completed any college course in geology.

Mr. Berry (F); Mr. Hay (Sp); — (Su)

*Upper Division Courses*

101. Field Geology. (3)

Two 4-hour meetings per week. **Prerequisite:** a course in general geology. Geology of the Berkeley Hills and vicinity. Not open to students who have completed course 5A at Berkeley.

Mr. Reynolds (F)

102A-102B-102C. Mineralogy. (4-4-4)

102A. Two 1-hour lectures and two 3-hour laboratory periods per week. **Prerequisite:** course 150 or equivalent. Geometrical crystallography, symmetry, X-ray crystallography. Sequence beginning (F).

Mr. Wenk (F)

102B. Two 1-hour lectures and two 3-hour laboratory periods per week. **Prerequisite:** course 102A. Crystal chemistry.

Mr. Wenk (W)
102C. Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: course 150 or consent of instructor. Introduction to optical mineralogy. Mr. Reynolds (F), Mr. Gilbert (Sp)

103A–103B. Igneous and Metamorphic Petrology. (4–4)
Two 1-hour lectures and two 3-hour laboratory periods per week. Prerequisite: courses 150, 102C. Study of igneous (105A) and metamorphic (103B) rocks in hand specimen and with the petrographic microscope. Introduction to problems relating to origin and evolution of igneous and metamorphic rocks. 103B. Mr. Turner (W); 103A. Mr. Carmichael (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, 102C. 102C may be taken concurrently. Origin, classification, and relationship of sedimentary rocks. Microscopic examination of sedimentary rocks. Physical stratigraphy. Mr. Hay (F)

106. Mineral Deposits. (4)
Three 1-hour lectures and one 3-hour laboratory period per week. One 2-day and one 1-day field trip will be substituted for three laboratory periods. Prerequisite: courses 5A–5B–5C, 102C, 150 or equivalent. Geological environments of economic mineral deposits. Mr. Meyer (F)

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. The Staff (W)

108. Advanced Physical Geology. (3)
Three 1-hour lectures per week. Prerequisite: senior standing in geology, and consent of instructor. May be repeated for credit, as content will vary from term to term. Selected topics in physical geology, discussed from a point of view that cuts across traditional fields. The Staff (Mr. Verhoogen in charge) (Sp)

110. History of the Earth. (4)
Three 1-hour lectures per week and four days in the field. Prerequisite: Geology 10. A sequel to course 10 designed for non-science majors in the College of Letters and Science. Geological history of the earth and the evolution of its animal and plant inhabitants. Mr. Christensen (Sp)

111. Geology of Fluids. (4)
Two 1½-hour lectures per week and one 3-day field trip. Prerequisite: consent of instructor. Water, oil, and gases within rocks, with emphasis on the physics and chemistry of these fluids. Mr. Berry (Sp)

112. Stratigraphy and Tectonics. (5)
Two 2-hour lecture and discussion periods per week. Prerequisite: consent of instructor. Interpretation of sedimentary rocks and geologic maps with respect to structural history. Paleogeologic studies will be undertaken. Mr. Berry (W)

116. Structural Geology. (4)
Two 1-hour lectures and one 3-hour laboratory period per week plus field studies. Prerequisite: course 5A or 101, and 5B–5C, 150 (may be taken concurrently). Mr. Weiss (Sp)

117. Geomorphology. (4)
Two 1-hour lectures and one 3-hour laboratory period per week. Two weekend field trips. Prerequisite: 5A (or 101), 5B, 150. Weathering, erosion, and development of landscape. Glacial geology and Pleistocene history. Interpretation of topographic maps. Mr. Wahrhaftig (F)

118. Summer Field Course. (8)
Prerequisite: course 5A (or 101), 5B, 5C, 150, or consent of instructor. A detailed geological investigation of a selected area. Five weeks in the field. Mr. Reynolds

119A–119B. Geologic Field Studies. Prerequisite: course 5A (or 101), 5B, 5C, and 150 and consent of instructor.
119A. (2) One to four weekend field trips to localities of geological interest. (F, W; Mr. Christensen Sp)
119B. (8) One five-week field trip to selected area throughout the western United States, for the purpose of studying a variety of geological occurrences. Mr. Christensen

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 (F)

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)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulation listed on page 79. Must be taken on a passed or not passed basis. Mr. Wahrhaftig (F, W, Sp)

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 meetings per week. Prerequisite: course 101 or equivalent and consent of instructor. Supervised field study for graduate students with prior experience. Mr. Wahrhaftig (F)

203. Rock-forming Minerals. (4)
Two 1-hour lectures and one 3-hour laboratory period per week. An intensive survey of the physical properties and chemistry of the rock-forming minerals (including non-silicates), with emphasis on their petrogenetic significance. (F)

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 (W) Mr. Meyer
207. Advanced Regional Geology. (3)
Three hours of lecture per week. Prerequisite: consent of instructor. Detailed studies of specific geologic provinces. Content varies from year to year.
Mr. Reynolds (W)

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)

212. Universal-Stage Petrography. (5)
One 2-hour lecture and two 3-hour laboratory periods per week. Prerequisite: consent of instructor. Use of the universal stage; microscopic fabric analysis; deformed crystals.
Mr. Wahlhaftig

213A–213B. Geomorphology and Pleistocene Geology. (3–3)
One 3-hour lecture per week and one three-day field trip. Rates and Processes of Erosion. The history of the Pleistocene. Sequence beginning (W).
Mr. Berry (F)

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.

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. (F)
215B. Petrology of nonvolcanic sedimentary rocks. Sequence beginning (W) Mr. Hay
215C. Petrology of volcanic sedimentary rocks. Mr. Hay (Sp)

216A–216B–216C. Deformed Rocks. (3–3–3)
One 2-hour lecture per week. Prerequisite: consent of instructor. Naturally and experimentally deformed rocks and minerals.
Sequence beginning (F) Mr. Weiss

237A–237B. Crystal Structure Analysis. (3–3)
237A. One 1-hour lecture and two 3-hour laboratory periods per week. Prerequisite: consent of instructor. Qualitative X-ray diffraction. Basic theories and experimental methods of crystal structure analysis.
Mr. Wenk (F)

237B. One 1-hour lecture and two 3-hour laboratory periods per week. Prerequisite: course 237A. Crystal structure determination by means of selected examples.
Mr. Wenk (W)

280. Research. (2–12)
The Staff (F, W, Sp, Su)

290. Seminar. (2–6)
Topics will be announced each quarter.
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 (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)

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.
Mr. Johnson (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 seismograph; 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. Mr. Johnson (W)

122A–122B. Physics of the Earth. (4–4)
Three 1-hour lectures per week and discussion periods. Prerequisite: Geophysics 104B (may be taken concurrently). Physics 110A–110B is prerequisite to Geophysics 122B.
122A. The earth's gravitational field; density distribution; internal constitution; heat transfer; temperature distribution.
Mr. Bolt-Wong (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: Geophysics 121A-121B-122A. Geophysics 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.
   Instructor: Mr. Wang (F)

199. Supervised Independent Study. (1-5)
   Enrollment is restricted by regulation listed on page 79, plus any additional restrictions established by the instructor supervising the work. Must be taken on a passed/not passed basis.
   Instructor: Mr. Wang (Sp)

Graduate Courses

204A–204B. Elastic Waves. (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.
   Instructor: Mr. Johnson (Sp)

208. Physics of Solids. (3)
   Two 1½-hour lectures per week. Physical properties of solids and equation of state at high pressure; magnetic properties of rocks. Content will vary from year to year.
   Instructor: 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.
   Instructor: 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.
   Instructors: Mr. Johnson (F); Mr. McEvilly (W); Mr. Bolt (Sp)

219. Seminar in Geophysics. (3)
   Two 1½-hour discussion periods per week. Critical study of problems in current geophysical research. Content will vary. Mr. Wang (F)

222. Geochronology. (3)
   One 3-hour lecture and discussion period per week. Radioisotopes in geology; age of the earth; selected problems in geochronology.
   Instructor: Mr. Curtis (W)

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.
   Instructor: The Staff (F, W, Sp, Su)

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.
   Instructor: The Staff (Su, F, W, Sp)

GERMAN

(Department Office, 5317 Dwinelle Hall)

Professors:
   Richard Brinkmann, D.Phil.
   Andrew O. Jászi, Ph.D.
   Michael Mann, Ph.D.
   Philip Motley Palmer, Ph.D.
   Herbert Penzl, Ph.D.
   Heinz Politzer, Ph.D.
   Blake Lee Spahr, Ph.D.
   Frederic C. Tubach, Ph.D.
   Arthur G. Brodeur, Ph.D. (Emeritus)
   Archer Taylor, Ph.D., D.phil. (h.c.), LL.D. (Emeritus)

Associate Professors:
   Marianne Bonwit, Ph.D.
   Bluma Goldstein, Ph.D.
   Gerd Hillen, Ph.D. (Acting Chairman)
   Winfried Kudszus, Ph.D.
   Joseph Mileck, Ph.D.
   Franz Schneider, Ph.D. (Emeritus)

Assistant Professors:
   Daniel Brink, Ph.D.
   Reinhard Hennig, Ph.D.
   R. William Leckie, Jr., Ph.D.
   Hinrich Seeba, Ph.D.
   John P. Snapper, Ph.D. (Holder of Princess Beatrix Chair of Dutch Literature)
   Kenneth D. Weisinger, Ph.D.

Senior Lecturer:
   Klaus A. Mueller, M.A.

Instructor:
   Herbert D. Davy, M.A. (Acting)

The Department of German offers the undergraduate the opportunity to obtain a broad background in the field of German language, literature, and culture, and introduces 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

NOTE: For key to footnote symbols, see page 78.
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 and a 3.5 grade-point average in at least 5 courses (20 units) of upper division German 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, and a comprehensive examination, both oral and written, covering the field. Interested students are urged to consult one of the graduate advisers of 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. **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)

2. **Elementary German (Emphasizing Reading). (5)**
   - Prerequisite: course 1 or its equivalent. Five 1-hour class meetings and two 1-hour sessions in the Language Laboratory per week.
   - Mr. Mueller in charge (F, W, Sp)

3. **Intermediate German. (5)**
   - Prerequisite: course 2 or its equivalent. Five 1-hour class meetings and two 1-hour sessions in the Language Laboratory per week.
   - Mr. Mueller in charge (F, W, Sp)

4. **Intermediate German (Emphasizing Reading). (5)**
   - Prerequisite: course 2, 2R or the equivalent. Five 1-hour class meetings per week.
   - Mr. Mueller in charge (F, W, Sp)

5. **Advanced German. (5)**
   - Prerequisite: course 4, 4R or the equivalent. Five 1-hour class meetings per week. (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. (F, W)

**12B. Intermediate German, Intensive Course. (10)**
   - Prerequisite: course 2 or 12A or the equivalent. Five 2-hour class meetings and two 1-hour sessions in the Language Laboratory per week. This course is equivalent to courses 3 and 4. (W, Sp)

**Upper Division Courses**

**Group I**

Courses given in English and open to all upper division and graduate students.

*133A-133B. German Cultural History and Political Institutions. (4-4)
   - Four 1-hour lectures per week. (F, W)

**140. Introduction to the Linguistic Study of German. (4)**
   - Four 1-hour lectures per week. Mr. Brink (F)

**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: Art and Alienation: Changing social and artistic forms in 19th and 20th century Germany. Miss Goldstein (F)

**190. Freud and Literature. (5)**
   - Three lecture hours and one consultation hour per week. The course is intended to present the theories of depth psychology and explore their validity as well as their limitations as a method of literary criticism. Mr. Politzer (Sp)

**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 (in charge) (F, W, Sp)
103A–103B–103C–103D. Survey of German Literature.
Four 1-hour lectures per week.
103A. To 1500. (4) Mr. Leckie (F)
103B. From 1500 to 1700. (4) Mr. Hennig (W)
103C. Eighteenth Century. (4) Miss Bonwit (F)
103D. Nineteenth Century. (4) Mr. Weisinger (Sp)

106. Lessing. (4)
Four 1-hour lectures per week. Mr. Hillen (F)

109. Schiller. (4)
Four 1-hour lectures per week. Mr. Hillen (W)

112A–112B–112C. Goethe.
Four 1-hour lectures per week.
*112A. 1749–1786. (4) Miss Bonwit (F)
*112B. 1786–1814. (4) Miss Bonwit (W)
*112C. 1814–1832. (4) Mr. Weisinger (Sp)

114. Romanticism. (4)
Four 1-hour lectures per week. Miss Goldstein (Sp)

*115A–*115B. Nineteenth-Century German Drama.
(4–4)
Four 1-hour lectures per week.

118A–*118B. Nineteenth-Century German Prose.
(4–4)
Four 1-hour lectures per week. Mr. Jaszi (W)

*121A–121B. Twentieth-Century German Drama.
(4–4)
Four 1-hour lectures per week. Mr. Mileck (W)

124A–124B. Twentieth-Century German Prose. (4–4)
Four 1-hour lectures per week.
124A: Miss Bonwit (W); 124B: Mr. Kudszus (Sp)

*125. Introduction to Germanic Folklore. (4)
Four 1-hour lectures per week.

*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. Kudszus (W)

130. German Poetry of the Twentieth Century. (4)
Four 1-hour lectures per week. Given every other year. Mr. Weisinger (Sp)

136. German Conversation. (4)
Four 1-hour meetings per week. Not open to native speakers except with the consent of the instructor. Mr. Mueller (in charge) (F, W, Sp)

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. Hennig (F)

145. Introduction to Descriptive German Grammar.
(4)
Four 1-hour lectures per week. Recommended for prospective teachers. All candidates for the M.A. in German must take either German 145 or Linguistics 166. Mr. Brink (W)

148A–148B–148C. Middle High German. (4–4–4)
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.
*148C. Selected readings in Middle High German Literature. Prerequisite: course 148A or equivalent.

*155. Social and Political Rhetoric. (4)
A study of the rhetorical aspects of the language and its use for propaganda purposes. Topics to be covered: 19th century German Nationalism; Third Reich—Concept Utopia; Hitler’s speeches; textbooks in East and West Germany; student pamphlets; Biro Deutsch. Mr. Seeba

191B. Mannerism in German Art and Literature. (4)
Four 1-hour lectures per week. Mr. Spahr (W)

H195. 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. The Staff (Sp)

199. Supervised Independent Study and Research. (1–4)
Enrollment is restricted by regulations listed on page 79. Additional limitation: overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis.

Graduate Courses
(Concerning conditions for admission to graduate courses, see page 24).

Literature: All graduate courses in literature will meet three hours a week: a 2-hour seminar and a 1-hour tutorial.

*200. Proseminar in Bibliography and Textual Analysis. (4)

203. Studies in Middle High German Literature. (4)
Prerequisite: course 148A.
Topics will vary from year to year.
Topic: Literature and History in the German Middle Ages. Mr. Leckie (W)
Topic: Religious and Didactic Literature in the German Middle Ages. Mr. Hennig (F)

*206. German Literature of the Renaissance and Reformation. (4)

209. German Literature of the Seventeenth Century. (4) Mr. Spahr (F)
270. Introduction to the History of the German Language. (4)
Three 1-hour lectures per week. Mr. Palmer (W)

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 (Sp)

273. Gothic. (4)
Two 1½-hour meetings per week. Mr. Penzl (F)

276. Old High German. (4)
Three 1-hour meetings per week. Mr. Palmer (W)

282. Old Saxon. (4)
Three 1-hour meetings per week. Mr. Penzl (Sp)

285. Descriptive German Grammar. (4)
Three class hours per week. Prerequisite: German 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.

290. Seminar in Germanic Linguistics. (4)
Prerequisite: consent of instructor. The subject matter of this course will vary from time to time. Topic: Early New High German. Mr. Palmer (F)
Topic: German Historical Phonology in a Generative Framework. Mr. Brink (W)

299. Individual Study for Graduate Students in Literature or Linguistics. (4)
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)

302. The Teaching of German: Methods and Materials. (4)
Four hours of lecture per week. Prerequisite: graduate standing (or upper division standing with consent of instructor). For all teaching assistants
and credential candidates. Readings, discussions and examination of German teaching materials and methods, observation of classes in session, practice teaching and survey of aptitude and achievement tests.

Mr. Mueller

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, Sp)

Dutch

*39. Literature of the Low Lands in English Translation. (4)
   Four 1-hour lectures per week. Mr. Snapper (W)

101. Elementary Dutch. (5)
   Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Open to freshmen. (F)

102. Elementary Dutch. (5)
   Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Prerequisite: Dutch 101 or equivalent. (W)

103. Intermediate Dutch. (5)
   Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Prerequisite: Dutch 102 or equivalent. (Sp)

HISTORY

(Department Office, 3229 Dwinelle Hall)

Professors:

Paul J. Alexander, Ph.D.
Thomas G. Barnes, D.Phil.
Ganther P. Barth, Ph.D.
Walton 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.
Delmer M. Brown, Ph.D.
Gene A. Brucker, Ph.D. (Chairman)
Natalie Z. Davis, Ph.D.
Gerald D. Feldman, Ph.D.
Tulio Halperin Donghi, Ph.D.
Richard Herr, Ph.D.
Winthrop D. Jordan, Ph.D.
James F. King, Ph.D.
Lawrence W. Levine, Ph.D.
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 Shulter, 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)
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)

NOTE: For key to footnote symbols, see page 78.

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104. Intermediate Dutch. (5)
   Five 1-hour class meetings and one 1-hour session in the Language Laboratory per week. Prerequisite: Dutch 103 or equivalent. Mr. Snapper (F)

130. Advanced Composition and Conversation. (4)
   Four 1-hour meetings per week. Prerequisite: Dutch 104 or consent of the instructor. An intensive course in the development of oral and written style. Mr. Snapper (Sp)

150. Introduction to the Literature of the Netherlands. (4)
   Three hours of lecture and one hour tutorial per week. Prerequisite: Dutch 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)

199. Special Studies in Dutch. (1-4)
   Enrollment is restricted by regulations listed on page 79. Additional limitations; overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis.

Yiddish

*39. Yiddish Literature in English Translation. (5)
   Four 1-hour lectures per week.

Related Courses in Other Departments

Linguistics 166. German Morphology and Syntax.


Comparative Literature 210A–210B. Studies in Medieval Literature.
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, 19, 49A, 49B; one may be a seminar (History 39) in American, Latin American, African, or Asian history.

2. In the junior and senior years five 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), or Economics 113 (Economic History of the United States). In addition, History 101A–101B (Introduction to Historical Method), to be taken if possible in the junior year, and History 103 (Pre-seminar). One historiography course or, with approval of the major adviser, additional sections of History 103 may be substituted for required upper division lecture courses.

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-B. 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 requirement 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 AND DIRECTORY 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.

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)
4B. Medieval. (5)
4C. Renaissance and Reformation. (5)
4D. Enlightenment and Revolutions. (5)

H4. European Civilization. (5)
Two 1½-hour discussion groups each week. Limited to ten students per section. An honors course including reading, discussion, and reports, focusing on selected problems in European history since 1648. Prerequisite: consent of instructor.

H4A. Renaissance and Reformation. (5)
H4C. Enlightenment and Revolutions. (5)

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.

H17A–H17B. The United States. (5–5)
Two-and-one-half-hours' discussion per week. Prerequisite: sophomore standing and consent of instructor. Limited to 10 students per section. An honors course including reading, discussion, and reports, focusing on selected movements and epochs.

18A–18B. Latin-American History. (5–5)
Three hours of lecture and one 1-hour section meeting per week. Prerequisite: sophomore standing.

19. Asian History. (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.

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 beginning undergraduates to problems of historical methods 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. **Prerequisite:** prior consent of instructor.

For precise schedule of offerings see department catalogue during pre-enrollment week each quarter.


See Interdepartmental Studies for the complete description of this course.

**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.)

**110A–110B. Ancient Greece. (5–5)**

Three hours of lecture and 1 hour of consultation per week.

**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 involved in fall of Roman Republic in crucial years between deaths of Sulla and Cicero. Analysis of Cicero’s speeches, essays and correspondence. Political, 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 1 hour of consultation per week.

**118A–118B. Medieval Institutions. (5–5)**

Three hours of lecture and 1 hour of consultation per week.

**120. The Renaissance. (5)**

Three hours of lecture and 1 hour of consultation per week.

**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 (1789–1880). (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.


Three 1-hour lectures and 1 hour of consultation per week. Thought and art considered in their social and political contexts.

**130A. Ancient and Medieval Science. (5)**

Three hours of lecture and 1 hour of consultation per week.

**130B. Scientific Revolution (1450–1750). (5)**

**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.

**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)**

**136C. Russia 1801–1917. (5)**

**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. Medieval England. (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.

Three hours of lecture and 1 hour of consultation per week.

154. British Empire and Commonwealth. (5)
Three hours of lecture and 1 hour of consultation per week. Prerequisite: History 151C or equivalent.

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.

167A. Era of Sectional Conflict. (5)
Three hours of lecture and 1 hour of consultation per week.

167B. Reconstruction and the New Nation. (5)
Three hours of lecture and 1 hour of consultation per week.

168A–168B. Recent History of the United States. (5–5)
Three hours of lecture and 1 hour of consultation per week.

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.
169A. 1550 to 1865.
169B. 1865 to present.

170A–170B. The West in United States History. (5–5)
Three hours of lecture and 1 hour of consultation per week.

171. California. (5)
Three hours of lecture and one hour of consultation per week.

172A–172B. Constitutional History of the United States. (3–3)
Three hours of lecture and 1 hour of consultation per week. Prerequisite: course 17A–17B or consent of instructor.

172C–172D. Constitutional History of the United States. (2–2)
An extra hour of class discussion to be taken only with course 172A–172B.
173A–173B. Diplomatic History of the United States. (5-5)
Three hours of lecture and 1 hour of consultation per week.

175A–175B. Intellectual History of the United States. (5-5)
Three hours of lecture and 1 hour of consultation per week.

177A–177B. The Age of the City. (5-5)
Three hours of lecture and 1 hour of consultation per week. Prerequisite: consent of the instructor. A history of urban life in America in the nineteenth century.

178A–178B. History of Science and Technology in American Society. (5-5)
Three hours of lecture and 1 hour of consultation per week.

180A–180B. Africa. (5-5)
Three hours of lecture and 1 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 1 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 1 hour of consultation per week.

184A–184B–184C. China. (5-5-5)
Three hours of lecture and one hour of consultation per week.
184. 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 1 hour of consultation per week.

186. Southeast Asia. (5)
Three hours of lecture and 1 hour of consultation per week.

187A–187B. India. (5-5)
Three hours of lecture and 1 hour of consultation per week.

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.

189A–189B. Social History of China and Japan. (5-5)
Three hours of lecture and 1 hour of consultation per week. Prerequisite: consent of instructor. 189A. China. 189B. Japan.

Three hours of lecture and one hour of consultation per week. A study of the historical development of Judaism and Christianity (both Catholic and Protestant) with emphasis on the influence of that development with respect to modern man.

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.

101. 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.

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.
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.

SPECIAL INDIVIDUAL STUDY

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis.
Graduate Courses
(Concerning conditions for admission to graduate courses see page 24).

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.

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. 285W, Comparative Studies in East Asian History. A seminar for master's candidates in East Asian history: comparative methods, approaches and topics in Chinese and Japanese history.

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, 178A, 178B, 280S, 285S. Students interested in graduate programs in the history of science should consult the adviser.

ECONOMIC HISTORY

The following courses are acceptable for major credit in history. (For details see the listings in Economics. Students interested in graduate programs in economic history should consult the adviser.)

HUMANITIES

The Humanities Field Major is described under the Division of Interdisciplinary and General Studies (DIGS).

HUNGARIAN

(For courses in the Hungarian language and literature, see listing under Department of Slavic Languages and Literatures.)

INTERDEPARTMENTAL STUDIES

Lower Division Courses

10A–10B–10C. Man and His Environment—Crises and Conflicts. (4–4–4)

Two 1½-hour lectures per week; one hour discussion. 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)

39A–39B–39C. Freshman Seminars. (2–2–2)

Two hours of lecture every other week. Prerequisite: open to freshmen enrolled in Residential Program in History and Literature. Enrollment in each seminar limited to 12. Topics will vary; study of topic will involve directed reading, discussion and oral and written reports. Depending on topic, seminars may be of one, two or three quarters’ duration. In those seminars extending over more than one quarter, credit and grade will be assigned only upon completion of the full sequence.

44A–44B–44C. European History and Literature: Topics in the Greco-Roman, Medieval, and Early Modern Background. (10–10–10)

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)


One tutorial, two lectures, and two seminars per week. Prerequisite: Reading and Composition 1A–1B, History 4C–4D, or equivalents; competence in French, German or Spanish. Detailed study of the history and literature of Europe, especially England, France, and Germany, from 1770 to 1900.

(F, W, Sp)

49. Introduction to Conservation of Natural Resources. (2)

One 1-hour meeting in the first and last weeks of the quarter; three 2-day weekend meetings during the quarter. At least six hours per week of laboratory work—to be arranged. Discussions will attempt to crystallize the student’s interest and educational goals relative to the general fields of population, environment, and resources. Two major papers will be required. Intended primarily for students in the Field Major in Conservation of Natural Resources.

Mr. Dahlsten (F, Sp)
100. Problems in Marine Biology. (15)
See Biology for the complete description of this course.

102. Historians and Chroniclers of the Middle Ages. (4)
Three hours of lecture per week. A survey of the most important sources (studied in translation) from 800 to 1400.
Miss Smalley (F, W, 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 (Sp)

114. Music and Poetry of the Middle Ages. (4)
Formally 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.
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.
Mr. Kerman, Mr. Orgel (F)

136. Biological Deterioration of Wood. (3)
One 3-hour tutorial per week with guided reading. Prerequisite: consent of instructor. Offered in odd-numbered years. 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.
Mr. Crocken (Music); Mr. Jones (English); Mr. Horn (Art) (W)

149. Senior Seminar in Natural Resources. (4)
Two 1-hour meetings per week; two 3-hour discussion groups. Prerequisite: senior standing or consent of instructor. Discussions will provide an opportunity for the student to synthesize an overview of the major. A 1-hour oral presentation and a major paper (considered to be equivalent to a senior thesis) will be required. Intended principally for seniors in the Field Major in Conservation of Natural Resources.
Mr. Gersper (F, Sp)

170. Wildlife Biology and Management. (4)
See Biology for a complete description of this course.
decision-maker. Introduction to the theory of games. (F) 209B. 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) Mr. McGuire, Mr. Marschak (W, Sp)

220. Geological and Engineering Factors in Environmental Planning. (4)
One 3-hour lecture and discussion per week plus field trips. 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. Duncan (W)

222. Natural Environment Evaluation. (4)
One 2-hour lecture and one 4-hour laboratory per week. Prerequisite: consent of instructor. A comprehensive evaluation of the natural environment of a particular site and its surroundings. Site information, field study, maps, and remote sensing imagery will be interpreted for planning, design, and environmental management. Mr. Stone, Mr. Schultz, Mr. Twiss, Mr. Zinke, Mr. Wahrhaftig, Mr. Colwell (F)

240. Nutrition of Population Groups. (3)
One 3-hour lecture per week. Prerequisite: consent of instructor. Study of nutrition in contemporary society, aimed at developing understanding of nutrition needs of groups and programs to meet needs: nutritional status evaluation, nutrition's effect on physical and mental health, environmental factors, preventive and corrective programs. Miss Huenemann, Mr. Margen, Mr. Bradfield, Miss Murai (Sp)

250. Experimental Helminthology. (5)
Two 2-hour lecture and discussion periods and one 4-hour laboratory per week. Prerequisite: consent of instructor; Zoology 156 or Entomology 150, or equivalent recommended. Review and integration of advances in helminthology, with emphasis on physiological and immunological aspects. Laboratory devoted to special projects on selected aspects of helminth biology. Mr. Simmons, Mr. Weinmann (W)

260. Patterns in Collective Bargaining. (3)
Two hours of lecture per week. A course for advanced students in the Department of Economics and the School of Law and School of 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. Enrollment will be restricted. Credit and grade will be awarded at the end of the sequence. Mr. Feller, Mr. Ulman

ITALIAN

Professors:
Louise George Clubb, Ph.D.
Arnolfo B. Ferruolo, Dottore in Lettere
Nicolas J. Perella, Ph.D., (Chairman)
Michele De Filippis, Ph.D. (Emeritus)
Enrico De Negri, Dottore in Filosofia (Emeritus)

Associate Professors:
Gustavo Costa, Dottore in Filosofia
Ruggero Stefanini, Dottore in Lettere

Major Adviser: Mr. Stefanini.
Graduate Adviser: Mr. Ferruolo.

Assistant Professor:
Rudolf Brändli, Dr.Phil.

Lecturers:
Elena Burgess-Servi, M.A.
Catherine Feucht, B.A.
Paola Muto, M.A.
Cecilia Ross, Ph.D.
Angelica Silverstein, M.A.

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 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, 6, or their equivalents.
Upper Division 40 units of upper division courses in the Department including: 101A–101B–101C; 103A–103B.

NOTE: For key to footnote symbols, see page 78.
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 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 at 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) a proficiency in Italian philology to be tested 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 consult 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.

1. Elementary Italian. (5)
   Three 1-hour meetings and one tutorial hour per week.
   Mrs. Burgess-Servi in charge (F, W, Sp)

2. Elementary Italian. (5)
   Three 1-hour meetings and one tutorial hour per week. Prerequisite: Italian 1 or the equivalent.
   Mrs. Silverstein in charge (F, W, Sp)

3. Intermediate Italian. (5)
   Three 1-hour class meetings and one tutorial hour per week. Prerequisite: Italian 2 or 12A or the equivalent.
   Mrs. Muto in charge (F, W, Sp)

4. Intermediate Italian. (5)
   Four 1-hour class meetings per week. Prerequisite: Italian 3 or the equivalent.
   Mrs. Feucht in charge (F, W, Sp)

5. Advanced Italian. (4)
   Three 1-hour class meetings plus discussion sections per week. Prerequisite: Italian 4 or 12B or the equivalent.
   Mrs. Feucht in charge (F, W, Sp)

6. Advanced Italian. (4)
   Three 1-hour class meetings plus discussion sessions per week. Prerequisite: Italian 4 or 12B or the equivalent. An introductory historical perspective of Italian civilization with emphasis on modern Italy. The course provides for individual assignments and group discussions.
   Mrs. Burgess-Servi, Mrs. Silverstein (W, Sp)

12A. Elementary Italian. Intensive Course. (10)
   Three 2-hour class meetings, two 1-hour tutorial meetings, and three to four sessions in the language laboratory per week. This course is equivalent to courses 1 and 2.
   Mrs. Muto (F)

12B. Intermediate Italian. Intensive Course. (10)
   Prerequisite: course 2 or 12A or the equivalent. Three 2-hour class meetings, two 1-hour tutorials, and three to four sessions in the language laboratory per week. This course is equivalent to courses 3 and 4.
   Mrs. Burgess-Servi (W)

Courses in English

   Two 1-hour lectures and one discussion meeting per week. An introduction to the history, institutions, society, literature, music, and fine arts of Italy.
   39A. The Middle Ages.
   Mr. Ferruolo, Mr. Costa (F, Sp)
Three 1-hour meetings per week. Prerequisite: Italian 5 or 6 or the equivalent. This upper division language sequence or a departmentally approved linguistic equivalent is required for the major.
101A. Advanced Grammar and Composition.
Mr. Brändli (F)
101B. Advanced Reading and Recitation.
Mr. Ferruolo (W)
101C. Advanced Conversation. Mr. Brändli (Sp)

103A–103B. Introduction to Italian Literature. (4–4)
Three 1-hour meetings per week. Designed primarily for juniors majoring in Italian. An introduction to the chief currents and authors of Italian literature with selected readings.
103A: Mr. Brändli (F); 103B: Mr. Brändli (W)

109A–109B–109C. Dante’s “Divina Commedia.” (4–4–4)
Three 1-hour meetings per week.
109A. Inferno. (F)
109B. Purgatorio. (W)
109C. Paradiso. (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, Parini, 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 (F)
115B. Romanticism.
Mr. Perella (W)

116. Italian Literature from 1850 to 1900. (4)
Three 1-hour meetings per week. Main trends in poetry and prose.
Mr. Perella (Sp)

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 (F)
117B. The Novel from Svevo to the present.

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 79. 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)

Upper Division Courses in English Translation
The following courses are intended primarily for 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.
Mrs. Clubb (Sp)

*140A–140B. Basic Reading: Petrarch. (5–5)
Two 1½-hour lectures and discussion periods and two 1-hour language drill meetings per week. A two-quarter sequence course of literature and language organized to allow for discussions and analyses of Petrarch’s lyric poetry in the original. Restricted to non-majors. Preference given to graduate students with no previous training in Italian. 140A is prerequisite to 140B. Class limited to 15.
Mrs. Clubb (W, 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 (F)

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)

Graduate Courses and Seminars
200. Italian Syntax and Lexicon. (4)
One 3-hour meeting per week. Required of all candidates for the M.A. in Italian. Mr. Brändli (Sp)

*201A–201B. Historical Grammar. (4–4)
One 3-hour meeting per week.
Mr. Stefanini (F, W)

202. Early Italian Texts. (4)
One 3-hour meeting per week.
Mr. Stefanini (W)
204. Literary Criticism. (4)
One 3-hour meeting per week.
Mr. Brandli (F)

*205. History of the Italian Language. (4)
One 3-hour meeting per week. Mr. Brandli (F)

*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. (W)
Mrs. Clubb (W)

217C. Ariosto. (4)
Mrs. Clubb (W)

*217D. Tasso. (W)
Mr. Ferruolo (F)

*217E. Studies in Poetry. (W)

*217F. Studies in Prose. (W)
Mr. Ferruolo (Sp)

*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. (W)

*221B. Leopardi. (Sp)

221C. Manzoni. (Sp)

*221D. Studies in Poetry. (Sp)

*221E. Studies in Prose. (Sp)
Mr. Brandli (F)

223. Studies in the Twentieth Century. (4)
One 3-hour meeting per week.

*223A. Poetry. (F)

*223B. The Theatre. (W)

223C. Prose. (Sp)

*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, W, Sp)

(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.
Robert W. Desmond, Ph.D. (Emeritus)
Kenneth N. Stewart, B.Litt. (Emeritus)

Associate Professor:
David Littlejohn, Ph.D.

Graduate Advisers: Mr. Bayley, Mr. Pickerell, Mr. Littlejohn, Mr. Taper.
Advisers for Individual Major in Journalistic Studies: Mr. Lyford, Mr. Pickerell, Mr. Littlejohn, Mr. Spaulding.

NOTE: For key to footnote symbols, see page 78.
Undergraduate Individual Major

For information about the individual major in journalistic studies and about graduate work leading to the degree of Master of Journalism (M.J.), see page 68 of this catalogue. For regulations governing the Letters and Science List, see the ANNOUNCEMENT OF THE COLLEGE OF LETTERS AND SCIENCE. For more detailed information on the undergraduate and graduate programs, and for more current information on course offerings, see the ANNOUNCEMENT OF THE GRADUATE SCHOOL OF JOURNALISM, available at the School office, 607 Evans Hall.

Upper Division Courses

100. Introduction to Journalism. (5)
Two hours lecture and two hours laboratory per week. Introduction to news writing. Survey of journalistic principles and practices. Study and practice of methods of gathering, writing, and editing news. The Staff (F, W, Sp)

140. History of American Journalism. (4)
Four hours of lecture and discussion per week. Political, social, economic, technological, and cultural evolution of the press. Mr. Simpson (W)

141. The Mass Media and Society. (4)
Two 1½-hour lectures and discussion per week. Critical analysis and discussion of contemporary trends, problems, and objectives of the media of mass communication. Mr. Lyford

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

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

180. Issues in Television Journalism. (4)
Three hours 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 journalists face working within broadcast industry, role of the FCC, and the future of public television. Mr. Stern

181. Radio News. (4)
Three hours of lecture and laboratory work per week. Prerequisite: consent of instructor. Writing and production of radio news programs.

182. Radio, Public Affairs, and Documentary Production. (4)
Three hours of lecture and laboratory work per week. Prerequisite: course 181. Writing and production of radio documentaries in public affairs.

184. Reporting of Public Affairs. (5)
Three hours of lecture and discussion per week. Prerequisite: course 100 or its equivalent. News of governmental functions, with emphasis upon judicial, legislative, and administrative procedures at the city and county level.

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 performances.

195. The Critical Review. (5)
Three hours of lecture and discussion per week. Prerequisite: consent of instructor. Theory and technique of evaluating the arts: books, film, drama, music, architecture, and the visual arts.

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.

198. Directed Group Study in Journalism. (1–5)
Prerequisite: total grade-point average of not less than 3.0 and consent of committee in charge.

199. Supervised Individual Study and Research. (1–5)
Prerequisite: total grade-point average of not less than 3.0 and consent of committee in charge. Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis.

Graduate Courses

200. News Writing. (4)
Two 1½-hour seminars per week, periodic tutorial sessions. Field work involves outside news reporting assignments. Seminars and assignments in news writing and editing. Required as prerequisite to advanced writing and broadcasting courses. The Staff (F, W)

220. Public Affairs in Perspective. (4)
One hour tutorial once or twice per week. The opinion function in columns and commentary, interpretative reporting, editorials and editorial crusades. Mr. Bayley, Mr. Lyford

225A–225B. Reporting on the American Community and Urban Affairs. (5–5)
Three hours of discussion or laboratory work each week. Prerequisite: course 200 or equivalent. Course 225A is prerequisite to 225B. Examination of the structure and the political and social character of
communities, of the method of journalistic inquiry into urban problems such as education, health, welfare, housing, and administrative government. Field work, individual study projects.

Mr. Taper, Mr. Lyford

226A–226B. Reporting of Science and the Environment. (5–5)
Three hours of discussion and laboratory work each week. Prerequisite: course 200 or equivalent. Course 226A is prerequisite to 226B. Advanced study of methods of reporting developments in such fields as science, education, mental or physical health, psychology, or the environment. Individual study projects and field work.

Mr. Taper, Mr. Lyford

227A–227B. Reporting of Cultural Events. (5–5)
Three hours of discussion and laboratory work each week. Prerequisite: course 200 or equivalent. Course 227A is prerequisite to 227B. Advanced study of reporting and critical writing in fields such as drama, film, music, fine arts, literature, or architecture. Individual study projects and field work.

Mr. Spaulding

228A–228B. Reporting of Politics and Government. (5–5)
Three hours of discussion and laboratory work each week. Prerequisite: course 200 or equivalent. Course 228A is prerequisite to 228B. Study of and practice in reporting politics and government. Individual study projects and field work.

Mr. Bayley

229A–229B. Reporting of Crime and the Courts. (5–5)
Three hours of discussion and laboratory work each week. Prerequisite: course 200 or equivalent. Course 229A is prerequisite to 229B. Study of 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. Pickrell

240. History of English and American Journalism. (4)
Three hours lecture and discussion per week. Development of newspaper and periodical journalism, including important personalities.

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 laboratory work per week. Prerequisite: course 200. Study of investigative reporting, analysis of its techniques, and field work.

251. Literature of Journalism. (4)
One 2-hour seminar and one-hour consultation per week. A study of outstanding men whose journalistic work is of lasting historic and literary worth.

Mr. Littlejohn (F)

252. Magazine Article Writing. (4)
Three hours per week discussion and laboratory. Study and analysis of the techniques of writing for magazines; research, writing, and editing of articles for publication.

Mr. Taper

Three hours lecture and discussion per week. Analysis of the place of mass media in shaping of public opinion; propaganda and information techniques of the mass media and other agencies.

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. Pickrell

270. Economic Organization of the Press. (4)
Three hours lecture and discussion per week. A seminar analyzing the business practices and financial structure of the press and its relationship to the community in which it operates.

282. Introduction to Television Reporting. (5)
Three hours discussion and laboratory each week. Prerequisite: course 200 or equivalent and consent of instructor. A study of the techniques, practices, and methods of handling television news. Field work, with individual and group study assignments.

Mr. Stern

283. Reporting for Television. (5)
Four hours discussion and laboratory each week. Prerequisite: course 282 and consent of instructor. Producing, directing, filming, and writing weekly television news programs.

Mr. Stern

290. International Communications—Foreign Press. (4)
Two 1-1/2-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. Pickrell

295. Critical Writing. (4)
Three hours lecture and discussion per week. Field study and written assignments. Principles and practice of reviewing the arts.

Mr. Littlejohn

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)
Professors:

Thomas G. Barnes, D.Phil.
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.L., LL.B.
Bernard L. Diamond, A.B., M.D.
Albert A. Ehrenzweig, Dr.Jur., Dr.hon.caussa, J.S.D.
Ronan E. Degnan, B.S.L., LL.B.
Bernard L. Diamond, A.B., M.D.
Albert A. Ehrenzweig, Dr.Jur., Dr.hon.caussa, J.S.D.

NOTE: For key to footnote symbols, see page 78.
Theodore R. Meyer, A.B., J.D. (Visiting)
Herman W. Mintz, LL.B. (Visiting)
Marc H. Monheimer, A.B., LL.B. (Visiting)
Eugene Morgan, B.A., J.D. (Visiting)
Edward L. Mulliner, B.S., LL.B. (Visiting)
Robert O. Nagle, B.S., LL.B. (Visiting)
David E. Nelson, A.B., J.D. (Visiting)
Howard N. Nemerovski, B.S.E., J.D. (Visiting)
Victor D. Rosen, B.A., LL.B.
Donald T. Rosenfeld, B.A., LL.B. (Visiting)
James E. Sabine, A.B., LL.B. (Visiting)
Walter G. Schwartz, A.B., J.D. (Visiting)
Sandra J. Shapiro, A.B., J.D. (Visiting)
Peter E. Sitkin, B.A., LL.B.
C. Graham Tebbe, Jr., A.B., LL.B. (Assistant Dean)

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.

For requirements of the School of Law, see the ANNOUNCEMENT OF THE SCHOOL OF LAW.

Professional Curriculum

First Year

200A–200B. Contracts. (3-3)
The law of contracts, dealing with the problems of formation, operation and termination.
Mr. Eisenberg, Mr. Kessler, Mr. Laube, Mr. Sweet

202A–202B. Criminal Law and Procedure. (2-3)
An introduction to criminal law and procedure.
Mr. Foote, Mr. Johnson, Mr. Kadish, Mr. Sherry

206A–206B. Civil Procedure. (3-3)
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. Degan, Mr. Louisell, Mr. Vetter

208A–208B. Property. (3-3)
An introduction to the law of real property including estates and other interests in land, real property marketing and conveying, land-use control, and landlord-tenant problems.
Mr. Coons, Mr. Hetland, Mr. Heyman, Mr. Riesenberg, Mr. Sullivan

212A–212B. Torts. (3-3)
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. Fleming, Mr. Goodman, Mr. Cole, Mr. Sweet

214A–214B. Introduction to Law. (1-1)
Small group and individual instruction in legal research and legal writing, including the preparation of legal memoranda and appellate briefs.

Second and Third Year

219. The Legal Process. (2)
A detailed examination of particular legal problems that illustrate the functions of and the relationship between the courts, the legislature, administrative agencies, and other public and private law-making institutions. Mr. Eisenberg

221A–221B. Law of Business and Nonbusiness Organizations. (2-3)
This course is designed for those 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.

222. 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

222A–222B. Corporations. (3-3)
An introduction to the law of agency and partnership, and the study of corporations, including management-shareholder relations, shareholders' suits, issue of shares, dividends, and capital creation and reduction.
Mr. Jennings

224A–224B. Constitutional Law. (2–3)
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. Louisell, Mr. O’Neil, Mr. Smith, Mr. Cole, Mr. Choper

225. Legal Theory. (2)
The various philosophies of law. Sociology and functions of law. Legal techniques. The language of law. Analysis of legal concepts. Particular attention will be paid to historical development and ethical problems. Mr. Daube

227. Legal History. (2)
Major emphasis on the development of judicial institutions in England, twelfth-eighteenth centuries, the development of English real property law to the end of the eighteenth century, and the emerging pattern of litigation, fifteen-eighteenth centuries, with respect to both substantive and adjective law and the growth of the legal profession in England and the American Colonies. Mr. Barnes

229. 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

232. 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

234. 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

235. Future Interests. (1)
This course will cover the classification and characteristics of future interests; rules restricting the creation of future interests, including the rule against perpetuities; a study of construction and drafting, including conditions of survivorship, class gifts, incomplete dispositions and other recurring problems, and powers of appointment. Mr. Halbach, Mr. Jones

236A–236B. Basic Income Tax. (3–1)
A survey of the statutory, judicial, and administrative material concerning the federal income tax as applicable to individuals, trusts, partnerships, and corporations. Mrs. Barton

237A. Income Taxation I. (3)
A study of the statutory, judicial, and administrative material concerning the federal income tax as applicable to the individual. Mr. Kragen, Mr. McNulty, Mr. Stone

237B. Income Taxation II. (2)
Continuation of the study of federal income tax, the emphasis being upon the taxation of trusts and of business enterprises, including partnerships and corporations. Mr. Kragen, Mr. Stone

239. 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

240. 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

241. International Business Transactions. (2)
Selected problems relating to the organization and operation of enterprises engaged in international business activities and the reciprocal relations of such enterprises with domestic, foreign and supranational government agencies.

241S. International Tax Problems. (2)
This seminar will explore, through the problem methods, various tax aspects of doing business outside of the United States. The emphasis will be on U. S. taxation of foreign income, although some other aspects of international taxation will be explored. Mr. Kragen

242. International Organizations. (2)
An introduction to (1) the international law that affects the United Nations and other worldwide and regional organizations, and (2) the impact of that law on the United States and its lawyers. Mr. Newman

242A. Admiralty. (2)
The jurisdiction of federal and state courts in admiralty and selected aspects of the law applicable to maritime workers and transactions.

242B. International Law. (2)
A study of the nature and sources of international law and its application to international agreements, membership in the international community, nationality, jurisdiction, state responsibility, force, and war. Mr. Newman

242D. International Law Seminar. (2)
An examination of areas of international law of special interest and concern to developing countries, with special emphasis on issues affecting their economic development. Some attention will be given to the internal legal development problems because of the relationships of such problems to the international ones. Particular emphasis will be given to the “legal” character of the claims of developing nations to an increased share of the world’s resources. Mr. Wilkins

242E. International Law (Principally as applied to Foreign Trade, Regional Integration and the Management of International Resources). (2 or 3)
This course deals with the modern legal framework of transnational transactions and maritime commerce as well as the incipient international rules governing the allocation and management of resources outside national sovereignty. It includes treatment of the various forms of regional economic integration (such as EEC, LACFA, the obligations under GATT, the work of the OECD and the U.N. in economic matters, the emerging law of sea-bed, as well as the international aspects of national jurisdiction and immunities. Mr. Riesienfeld
242S. International Human Rights. (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

243S. Law and Society. (2)
Classwork and research in areas of current legal and social concern; mental health proceedings, conscientious objection, school segregation, school finance, slum tenancy and the like.
Mr. Coons

244. Creditors’ Remedies and Debtors’ Protection. (3)
Enforcement of judgments, exemptions, fraudulent conveyances, general assignments, creditors’ agreements, bankruptcy, and arrangements.
Mr. Laube, Mr. Riesenfeld

245. Comparative Jurisprudence. (2)
A comparison of the world’s legal systems with reference to their ideologies, historical bases, sources, and techniques; critical analysis of the “schools” of jurisprudence and of legal concepts, primarily from a psychological viewpoint; practical problems in comparative law (dealing with foreign cases) and jurisprudence (the laws of crimes and torts in the light of current reform and the need for a “little-man’s” procedure).
Mr. Ehrenzweig

245B. Socialist Legal Institutions. (2)
Selected problems in the study of the legal systems of countries ruled by Communist parties, and in the comparison of Communist institutions. Principal topics are the criminal process, changes and continuities in civil law institutions, review of administrative acts, and paralegal sanctions. Legal philosophies and conceptions of international law will be discussed if time permits. Soviet theory and institutions will receive particular attention, with a view of studying their influence in China and Eastern Europe.
Mr. Lubman

245C. 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 criminal and other sanctioning processes, civil dispute-settlement, property, contracts in agriculture and industry, family law, and the organization of China’s foreign trade. Consideration will be given to relevant aspects of pre-Communist Chinese society and ideological and historical factors in the history of Chinese Communism. Some emphasis will be placed on identifying similarities and differences between the Chinese and Soviet legal systems.
Mr. Lubman

245D. Comparative Law. (2)
An introduction to civilian legal systems (primarily in France and Germany), their historical development, and the common features of their organization and institutions. In this context, specific doctrines of the law of contracts will be discussed in comparison with common law analogues.
Mr. Lubman

245E. Comparative Law: Sources of Religious Law. (2)
An examination of reason and authority, analogy and fiction, precedent and innovation in biblical, talmudic, and canonical law.
Mr. Daube, Mr. Noonan

245R. Selected Topics from Roman Law. (2)
Chiefly on private law, its main institutions, sources, historical development, and social and political background. Attention will be paid to selected jurisprudential and comparative rights.
Mr. Daube

245S. Comparative Jurisprudence Seminar. (2)
Discussion and writing on topics covered in Law 245, stressing psychology and law reform.
Mr. Ehrenzweig

246. 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, workmen’s compensation, contracts, property, domestic relations, estates, and business associations.
Mr. Ehrenzweig, Mrs. Kay

246C. International Conflicts. (2)
Selected topics from the international conflicts law of the U. S. in comparison with the conflicts law of other countries.
Mr. Jennings

247A. Securities Regulation. (2)
The course will concentrate 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 will also be 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

247B. Securities Regulation. (2)
This course will concentrate on the regulation of trading of securities on stock exchanges and in the over-the-counter market; broker-dealer regulation; 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

248. Selected Problems in Business Planning. (2)
Investigation of problems relating to the organization, financing and operation 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

248B. 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

249A. Commercial Law I (Sales). (2)
This course will cover principally those portions of the Uniform Commercial Code dealing with sales and other legislation concerned with consumer protection. Particular emphasis will be placed on the problems and protections of the low-income consumer.
Mr. Fleming, Mr. O’Neil
249B. Commercial Law II (Secured Transactions, Documents of Title, Payment Transactions). (2)

This course deals with the topics governed by the 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.

250. Basic Evidence. (2 or 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.

250A–250B. Evidence. (2–2)

A study of the theory and application of the rules of proof, the problem 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. Louisell, Mr. Sherry.

251. Jurisprudence. (2)

An attempt to understand and evaluate the usefulness of some influential generalizations concerning the "nature" of law. Mr. Wilkins.

251S. Contemporary Jurisprudence. (2)

Deciding who is a person in the legal system. Discriminations based on natural characteristics of persons, particularly their age of life. Drawing lines—exception, culpability or responsibility; for cooperation in an evil system. The coercive, channelling, and teaching functions of law. The relationship of law to love. Mr. Noonan.

252. Selected Problems in Constitutional Law. (2)

Legal problems relating to constitutional law and constitutional litigation.

253. 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.

254. Federal Courts. (2 or 3)

Jurisdiction of the federal courts, including the scope of the judicial power of the United States, original jurisdiction of the district courts, removal of causes, the incidents of concurrent jurisdiction, and the appellate jurisdiction of the Courts of Appeal and the Supreme Court. Mr. Smith.

255. Remedies. (2 or 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. Collings, Mr. Hetland.

256–256S. 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 housing, use of joint venture and lease devices, and other subjects affecting land development and urban growth with an emphasis on practical considerations. Mr. Ellman.

257. Insurance. (2)

General principles and current trends in the law and business of insurance. Mr. Degnan.

260E. Environmental Law. (2)

Mr. Heyman.

261. Selected Problems in Family Law. (2)

Intensive analytical treatment of topics drawn from problems arising out of property and other interspousal or parental relationships during the existence of the marriage and on its dissolution. Emphasis is placed on developing the skills of research, analysis, and writing. Mrs. Kay.

261S. Law and Anthropology Seminar. (2)

This course surveys the anthropological material on law, including the work of Maine, Schapera, Llewellyn and Hoebel, Bluckman, Bohannan, Gulick, and Pospisiil. Papers are required that deal with the ethnography of law in Western or non-Western settings. The course is open to advanced students in anthropology, as well as to third-year law students. Mrs. Kay, Mrs. Nader.

262. Labor Law. (3)

The law 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.

262C. Patterns in Collective Bargaining. (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. Enrollment will be restricted. Mr. Feller, Mr. Strauss, Mr. Ulman.

262S. Current Critical Issues in Labor Law. (2)

An examination in depth of selected questions of current interest in the developing law of labor-management relations. Mr. Feller, Mr. Vetter.

264. Modern Social Legislation. (2)

Legal, legislative, and economic problems in legislation designed to assure adequate minimum standards of living. Special consideration is given to old-age, survivors' and disability insurance, unemployment insurance, health insurance, workmen's compensation, and social assistance. Mr. Feller.

265. Canon Law. (2)

This seminar will examine the canon law of the Catholic Church as a legal system, with particular emphasis on the matrimonial tribunals of the Church. While some attention will be given substantive law,
the main focus will be on function, sanction, and obligation in the canonical system. The fundamental questions to be approached are: What are the characteristics of a legal system? What are the appropriate criteria of efficiency for the canonical system?

Mr. Noonan

265C. Sources of Law in Talmudic and Canonical Law. (2)

This seminar will focus on a few specific areas in an examination of what kinds of documents and teaching are taken as "law" in the traditions examined.

Mr. Daube, Mr. Noonan

266. The Lawyer in the Legislative Process. (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

267. 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

268. State and Local Government Law. (2)

Relationship of state, county, and city government; problems of finance, contract, property, and tort in local government; state and local taxation.

Mr. Sato

269. 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

271A–271B. Trial Practice. (1–2)

Study in strategy and tactics in civil litigation, including trial moot court.

Mr. Heafey

272. 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. Riesenberg, Mr. Sullivan, Mr. O'Neil

273. Criminal Procedure. (3)

A comprehensive coverage of criminal procedure designed to give students a thorough background in the rights of criminal defendants and the procedures for asserting those rights.

Mr. Collings, Mr. Kadish, Mr. Johnson, Mr. Smith

273P. California Criminal Trial Practice. (2)

This course combines practical work in a law office with classroom sessions led by guest practitioners. It is designed to give students a first-hand view of local criminal practice.

Mr. Johnston

275. Contracts Drafting Seminar. (2)

A selected enrollment seminar on the law office prelitigation cycle: drafting of contracts, legal memoranda, opinion letters and legal reports to clients; oral presentations, office interviews and conferences; stress upon fact discrimination and development of drafting skills.

Mr. Swoet

276. 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

277. Advanced Criminal Law and Procedure. (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 attempt will be made to select topics which will be of current interest to the group as well as the individual students involved.

Mr. Collings

277C–277D. 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 cases 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.

Mr. Falk

278. Seminar in Criminal Law and Administration. (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. Sherry, Mr. Foote

279. Natural Resources Law. (2)

Acquisition of water rights: federal and state legislation affecting the use of water; interstate water problems; pollution problems.

Mr. Sato

280. 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

281. Estate Planning and Taxation. (3)

The study of estate, gift, and inheritance taxation; advanced study of trusts, future interests and powers of appointment, the impact of income, gift, and death taxes upon inter vivos and testamentary planning of substantial estates.

Mrs. Barton
282. 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

282A. Estate and Gift Tax. (1)
A short course on the statutory, judicial, and administrative material respecting the federal estate and gift taxes.

Mr. Halbach

283. Selected Problems in Estate Planning. (2)
Selected problems in estate analysis and planning; tax-conscious drafting of wills and trusts utilizing future interests, class gifts and powers of appointment; planning of insurance and disposition of business interests. Primary emphasis will be on individual work in planning an estate, from interview to drafting of documents.

Mr. Friedman

284. Selected Problems in the Taxation of Business Enterprise. (3)
Selected federal and state income and other tax problems of business enterprise are prepared, analyzed, and discussed with the cooperation of tax practitioners.

Mr. Kragen

284S. Tax Problems Seminar. (2)
Advanced study of tax problems and planning for individuals.

Mrs. Barton

285. Poverty Law. (2 or 3)
A survey of private and public law problems encountered by poor people in the area of housing, welfare, consumer transactions, and employment. Time permitting, attention will also be given to selected problems of the rural poor. Emphasis will be placed on the relationship between the law and social policy and the adequacy of legal institutions as instruments of social change.

Mr. Goodman

285C. Clinical Studies. (5)
The clinical program will provide an opportunity for a direct working experience with poverty clients in both daily problems and major litigation. The course will be 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

285T. Community Law Practice. (2)
The course deals with the areas of criminal responsibility; discretion as exercised by the prosecutor and trial judge; the role of the defense attorney prior to charge and/or after conviction; landlord-tenant relations; and administrative law problems within the area of social welfare and workers' compensation. The course is centered around clinical work by the participants in the course and discussions with visiting attorneys and judges.

Mr. Ramsey

286S. 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, etc.

Mrs. Barton

287. 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. Feller

290. Appellate Advocacy. (2)
The objective of the course is to combine 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

295. Student-Initiated Courses or Projects.
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 Curriculum Executive Officer and the Dean. Open to students who have completed the first-year curriculum.

296. Legal Dissertation. (6–13)
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.
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

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 approval of the Dean. Open to students who have completed the first-year curriculum.

The Staff

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
LIBRARIANSHIP

Professors:
J. Periam Danton,† Ph.D.
M. E. Maron, Ph.D.
Raynard Coe Swank, Ph.D., LL.D., (hon.)
Donald Coney, M.A. in L.S. (Emeritus)
Edward A. Wight, Ph.D. (Emeritus)

Associate Professors:
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)

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.
   Mr. Harlan in charge (F, W, Sp)

Librarianship

200. Forms and Movements of Publication. (3)
   Three 1-hour lectures per week. The origins in history and present uses of the various materials with which libraries and other information agencies are concerned. Changing concepts of publication. New methods of recording and disseminating knowledge.

   Three 1-hour lectures and one 1-hour exhibit period 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. Harlan (F, W)

203A. Origins and Spread of Printing and Publishing in Europe. (4)
   Three hours of lecture and one hour of laboratory per week. Prerequisite: course 202.
   Mr. Mosher

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 (W)

   Three hours of lecture and one hour of laboratory per week. Prerequisite: course 202.
   Mr. Harlan (Sp)

Note: For key to footnote symbols, see page 78.

Assistant Professor:
Victor Rosenberg, Ph.D.

Associate Professor:
William S. Cooper, Ph.D. (Acting)

Lecturers:
Mae J. Durham, B.L.S.
Grete W. Frugé, Certificate in Librarianship
Allan J. Humphrey, M.A.
Roger Levenson, B.A.

208. The Behavioral Study of Scientific Information Flow. (3)
   Two hours of lecture per week. A behavioral view of the information systems of science. Review of representative studies of information production, dissemination, acquisition, and use. Research methodology for the librarian and information scientist who may conduct or evaluate behavioral studies.

209. Library in the Community. (3)
   Three hours of lecture per week. Prerequisites: courses 282A, 284 or 286A (formerly 207, 206, and 208). Analysis of the community for the librarian. Relationships between various factors and library use. Methods of relating the library with the community.

220A. Reference and Bibliography I. (4)
   Three hours of lecture per week. An introduction to reference service and general reference and bibliographical sources.
   Mr. Held, Mr. Mosher (W)

220B. Reference and Bibliography II. (4)
   Three hours of lecture and one hour of laboratory per week. An introduction to the bibliographical organization and information sources of subject fields. Prerequisite: course 220A or consent of instructor.
   Mr. Held, Mr. Mosher (Sp)

220C. Reference and Bibliography III. (4)
   Three hours of lecture per week. Prerequisite: course 220B or consent of instructor. Studies in bibliographical and reference sources in selected fields.
   Mr. Moler (F)

222. Government Publications. (4)
   Three hours of lecture per week. Prerequisite: course 220B (may be taken concurrently). Selection, acquisition, organization, and use of publications of the federal, state, and local governments, international organizations, and selected foreign governments.
   Mrs. Moler (Sp)

224. Scientific and Technical Literature. (3)
   Three hours of lecture per week. Prerequisite: course 220B. Reference and bibliographical sources, information needs, and dissemination of literature in science and technology.
241. per week. Ground in logic, mathematics, and computing.

242A-242B. mature introduction for students with some background, 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. Rosenberg (F)

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. Cooper (W)

244. Measures of Retrieval Effectiveness. (3)

Two hours of lecture per week. The meaning and logical role of measures of retrieval effectiveness of information searching systems. Survey and critical examination of a variety of measures proposed and described in the current literature. Mr. Cooper (W)

245. Introduction to Bibliography. (8)

Two 1-hour lectures, two 1-hour discussion meetings, and 12 hours of laboratory and tutorial instruction per week or equivalent individual or group study. Intensive analysis of central activities common to library services, bibliographical control and information transfer.

The Staff (Mr. Wilson in charge) (F)

251A. Descriptive Cataloging. (4)

Three hours of lecture and one hour of discussion per week. Open laboratory. Standard techniques of identification and description of bibliographic units. Integration and control of catalog entries. Survey of cooperative and centralized cataloging activities at local, regional, and national levels. Mrs. Frugé (W)

251B. Classification and Subject Cataloging. (4)

Three hours of lecture and one hour of discussion per week. Open laboratory. Principles and techniques of subject access to documents, with emphasis on codes and systems for classification and subject cataloging in libraries. Mrs. Frugé (Sp)

252. Special Problems, Policies, and Developments in Library Cataloging. (4)


242A-242B. Formal Techniques for Intellectual Access. (4-4)

Two hours of lecture and one 1-hour laboratory per week. Prerequisite: a background in mathematical logic, probability, computer organization and programming. Analysis of problems of intellectual access and examination of formal techniques for computing degrees of relevance, for computing measures of statistical closeness and distance between subject fields, for automatic indexing and classification, and for computer searching tactics and strategies. Credit and grade will be awarded upon completion of the sequence. Mr. Maron (W, Sp)

254. Descriptive Bibliography. (3)

Three hours of lecture per week. Prerequisite: course 202 or consent of instructor. Historical and analytical bibliography as methods of investigation, based on McKerrow and Bowes; methods of bibliographical description based on Bowers and Greg; literature of analytical bibliography. Mr. Harlan (Sp)
50. Libraries and Information Agencies. (3)
Three hours of lecture per week. The history, functions, and characteristics of libraries and information agencies; user requirements and socioeconomic factors influencing the design of such agencies; existing and proposed types of agencies; concepts of administration and systems analysis.
Mr. Swank (F)

62. 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 (F)

63A. History of Ancient and Medieval Libraries. (4)
Three hours of lecture per week. Prerequisite: course 262.
Mr. Held (W)

63B. History of Scholarly Libraries. (3)
Three hours of lecture per week. Prerequisite: course 262.
Mr. Danton

63C. History of Popular Libraries. (4)
Three hours of lecture per week. Prerequisite: course 262.
Mr. Held (Sp)

70. Library Administration. (3)
Three hours of lecture per week. Prerequisite: course 260. The principles and practice of library administration. Analysis of the organization and management of modern libraries and information centers of various types.
Mr. Swank (W)

73. Introduction to Information System Design. (3)
Two hours of lecture per week. Prerequisite: courses 220B, 251B. The design and analysis of information systems. Special coding and indexing procedures, punched cards, and microfilm. Application of data processing equipment in libraries.
Mr. Rosenberg (W)

74. Library Systems Analysis. (4)
Three hours of lecture per week. Prerequisite: consent of instructor. Development of probabilistic and statistical models of library functions, e.g., circulation, storage, duplication, catalog maintenance.
Mr. Rosenberg (Sp)

75. Data Processing for Libraries. (3)
Three hours of lecture per week. An introduction to the nature and capabilities of computers and related equipment, with emphasis on applications to library processes.
Mr. Humphrey (W)

76. Survey of Library Automation. (4)
Three hours of lecture and one or more hours of laboratory per week. Prerequisite: course 251A and one of the following: 240, 242A, 274, 275, or consent of instructor. A general survey of current and emerging automation projects in university and public libraries and network processing centers. The MARC project and concepts of bibliographic data processing will be studied in detail.
Mr. Sherman (Sp)

12A. 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 interests. Lectures, readings, reports, and field trips.

282A. Public Library Collections and Services. (3)
Three hours of lecture per week. Prerequisite: course 260. 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 (Sp)

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. Durham (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.

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. Required of all candidates for advanced degrees who intend to specialize in the college and university library field.
Mr. Danton

286C. University Library Administration. (3)
Two hours of lecture per week. Prerequisite: courses 270, 286A or equivalent as determined by instructor. Required of all candidates for advanced degrees who intend to specialize in the college and university library field. Study of current issues in personnel, finance, service, and the organization of materials and work. Individual projects, work periods, consultation, reports, and class discussion.
Mr. Swank (Sp)

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.

292. Seminar in Comparative Librarianship. (3)
Two hours of lecture per week. Prerequisite: consent of instructor. Main streams of library development in selected areas of the world—their underlying social and political causes.
293. Seminar in Library Education. (3)
Two hours of lecture per week. Prerequisite: consent of instructor. Origins, development, and effects of education for librarianship in Europe and the United States.

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, and related fields. Specific topics vary from year to year. May be repeated for credit, with change of content. Some offerings may consist of one quarter (296A); others may consist of a two-quarter sequence (296A–296B) in which case “in progress” grades may be assigned for the first quarter. (F, W, Sp)

LINGUISTICS

(Department Office, 2337 Dwinelle Hall)

Professors:
Madison S. Beeler, Ph.D.
Wallace L. Chafe, Ph.D. (Chairman)
Mary R. Haas, †Ph.D.
Yakov Malkiel, Ph.D., L.H.D.
William S.-Y. Wang, †Ph.D.

Associate Professor:
Karl E. Zimmer, Ph.D.

Assistant Professors:
John J. Ohala, Ph.D.

Richard Stanley, †Ph.D.
Barend A. van Nooten, Ph.D.

Associate Professor:
James A. Matisoff, Ph.D. (Acting)

Lecturer:
Jesse O. Sawyer, Ph.D.

Department Major Advisers: Mr. Sawyer, Mr. Ohala.
Graduate Advisers: Mr. van Nooten (Sanskrit); Miss Haas, Mr. Beeler, Mr. Stanley.

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, 188A–188B, 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).

NOTE: For key to footnote symbols, see page 78.
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 Plan II, as described on page 32 of this catalogue. The student must pass a reading examination in either French or German. Before the comprehensive final examination he must submit two scholarly papers on different subjects, prepared either in a course or independently, acceptable to the examination committee. The final examination is administered at or near the end of the course work by this committee, which has three members, one chosen from outside the department. Further information on requirements is obtainable from the graduate adviser.

**Doctor's Degree in Linguistics** The program follows Plan B, as described on page 38 of this catalogue. The student must pass reading examinations in French and German, with the possibility of substituting Russian for one of these languages with the approval of the graduate adviser. Before the qualifying examination he must submit three scholarly papers on different subjects, prepared either in a course or independently, acceptable to the examination committee. None of these papers may form part of the dissertation. The qualifying examination is administered by a committee of five members, at least one chosen from outside the department. Further information on requirements is obtainable from the graduate adviser.

**Doctor's Degree in Sanskrit** A graduate student in Sanskrit should have completed Linguistics 188A–188B and such other undergraduate work as may be considered to provide a suitable background for the study of Indology. The program follows Plan B, as described on page 38 of this catalogue. The student must pass reading examinations in French and German. The programs will ordinarily include: (1) the reading of texts in classical Sanskrit, the Vedas, Pali, and Prakrit; (2) work in Indo-European comparative grammar and in the ethnology of India; and (3) studies in a related field (e.g., linguistics, ethnology, comparative literature, folklore, philosophy, or the like). The qualifying examination is administered by a committee of five members, at least one chosen from outside the department. All aspects of the program are subject to the approval of the graduate adviser, from whom further information may be obtained.

**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 languages of the world and their relationships. The field of linguistics and its relation to other fields. Mr. Matisoff (F); Mr. Sawyer (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 1/2-hour lectures. Introductory course for nonmajors. Mr. Stanley (Sp)

110. Introduction to Phonetics and Phonology. (5)
Three 1/2-hour lectures and one 1/2-hour section meeting per week. Prerequisite: Linguistics 20 (may be taken concurrently). The use of phonetic symbols. Distinctive features. Underlying and phonetic representations and phonological rules. Mr. Ohala (Sp)

114. The Biological Basis of Language. (4)
Two 1/2-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. Miss Haas (F); Mr. Matisoff (Sp)

115. Articulatory Phonetics. (5)
Three 1/2-hour lectures and one 1/2-hour section meeting. Prerequisite: Linguistics 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 Language Laboratory. Mr. Ohala (Sp)

116. Phonology. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 110. Detailed study of underlying and phonetic representations and the form of phonological rules. Mr. Ohala (Sp)

120. Introduction to Syntax and Semantics. (5)
Three 1/2-hour lectures and one 1/2-hour section meeting per week. Prerequisite: Linguistics 20 (may be taken concurrently). The structure of sentences and words. The distinction between surface structure and deep or semantic structure; transformational rules. Mr. Zimmer (F, Sp)

125. Linguistic Analysis. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 110, 120 (may be taken concurrently). Methods and practice in the analysis of linguistic data. Mr. Sawyer (Sp)

126. Syntax. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 120. The nature of deep or semantic structure. The form of transformational rules and their application in several languages. Mr. Stanley (W)

135. Types of Linguistic Structures. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 110, 120. Discussion of, and practice in working with, several languages of diverse types. Mr. Fillmore (Sp)

145. Comparative and Historical Linguistics. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 110. Methods of reconstruction. Types and explanations of language change. The establishment of language relationships and subgroups. Dialectology. Mr. Malkiel (W)

155. Geographical and Social Dialects. (4)
Two 1/2-hour lectures per week. Prerequisite: Linguistics 20 with a grade of A- or better, or 106. Mr. Becker (F)

165. Indo-European Comparative Linguistics. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 20. Mr. Beeler (F)

175. American Indian Languages. (4)
Three 1/2-hour lectures per week. Mr. Stanley (W)

185. Linguistic Theories in the Twentieth Century. (4)
Three 1/2-hour lectures per week. Prerequisite: Linguistics 10, 120. Mr. Stanley (W)

188A–188B. Elementary Sanskrit. (4–4)
Three 1/2-hour lectures per week. Sequence, beginning (F, W). Mr. van Nooten

189. Advanced Sanskrit. (5)
Three 1/2-hour lectures per week. Prerequisite: course 188A–188B. The texts to be read will vary from quarter to quarter. The course may be repeated at least twice with the consent of instructor. Mr. van Nooten (Sp)

193. Linguistic Theories of the Hindus. (4)
Three 1/2-hour lectures per week. Prerequisite: course 188A. 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 structure, rules and sensibility. Mr. van Nooten (W)

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

196. Undergraduate Colloquium. (1)
One 1/2-hour lecture per week. Discussion by faculty members and advanced graduate student of their current research. May be repeated for credit. The Staff (F, W, Sp)

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 79. Must be taken on a passed or 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.)

194-1913. Linguistic Field Methods. (4-4)
Two 2-hour section meetings per week. Sequence beginning in the fall and winter. Prerequisite: Linguistics 125, 126. Credit and grade will be awarded upon completion of sequence.
Mr. Matsof (W, Sp)

20. Physiological Phonetics. (4)
Two 1½-hour lectures per week. The neurophysiological basis of speech production and perception. Role of autonomous and feedback control of the speech production process. Intrinsic factors in speech reduction. Phonological questions in physiological phonetics.
Mr. Chafe (F)

232. Acoustic Phonetics. (4)
Two 1½-hour lectures per week. Prerequisite: word 115 or its equivalent.
Mr. Chafe (F)

233. Advanced Phonological Analysis. (4)
Two 1½-hour lectures per week. Prerequisite: word 116.
Mr. Wang (F, Sp)

244-2248. Advanced Grammatical Analysis. (4-4)
Two 1½-hour lectures per week. Prerequisite: word 126. May be taken for one or more quarters (F, W).
Mr. Fillmore (F)

254-2258. Generative Semantics. (4-4)
Two 1½-hour lectures per week. Credit and grade will be awarded upon completion of sequence.
Mr. Chafe (W, Sp)

227. English Syntax. (4)
Two 1½-hour lectures per week. Mr. Stanley (Sp)

19. Word Formation. (4)
Two 1½-hour lectures per week. An investigation of selected problems in derivation and compounding of 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)

231. Linguistics of India. (4)
Two 1½-hour lectures per week. (W)

22. Linguistics of the Pacific. (4)
Two 1½-hour section meetings per week.
Mr. Sawyer (Sp)

32. Germanic Linguistics. (4)
Two 1½-hour lectures per week. Prerequisite: at least one of the following: Germanic languages, liology, morphology, and lexicography of the German languages, the sound structure of Proto-Germanic, the History of the Germanic Languages.
Mr. Beeler (F)

34. Advanced Sanskrit. (2-8)
Such texts are read as are suited to the student's needs. Final and Precinct also will be studied as the occasion arises. This course may be repeated for credit with the consent of the instructor.
Mr. van Nooten (Sp)

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.
Mr. Malcolmi (F)

236. Romance Historical Inference. (4)
A 2½-hour lecture per week. Prerequisite: graduate standing and consent of instructor. The key problems of Romance historical and comparative inference, with full attention to their methodological applications.
Mr. Malcolmi (W)

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.
Mr. Malcolmi (Sp)

238. Comparative Grammar of Latin. (4)
One 2½-hour lecture per week. Prerequisite: at least an elementary knowledge of Latin or permission of instructor.
Mr. Beeler (Sp)

239. Comparative Grammar of Greek. (4)
One 2½-hour lecture per week. Prerequisite: at least an elementary knowledge of Greek or permission of instructor.
Mr. Beeler (W)

242. Advanced Diachronic Linguistics. (4)
Two 1½-hour lectures per week. Mr. Han (W)

243. Advanced Dialectology. (4)
Two 1½-hour lectures per week. Prerequisite: course 335 and a reading knowledge of French or German or one other Modern European language.

244. Advanced Indo-European Comparative Linguistics. (4)
Two 1½-hour lectures per week. May be repeated for credit.
Mr. Beeler (W, Sp)

251. Ethnolinguistics. (4)
Two 1½-hour lectures per week.

252. Applied Linguistics. (4)
Two 1½-hour lectures per week.

253. History of Linguistics to 1800. (4)
Two 1½-hour section meetings per week.

254. History of Linguistics Since 1800. (4)
Two 1½-hour lectures per week. Mr. Malcolmi (W)

258. Special Study. (2-8)
Prerequisite: one full year of graduate work at Berkeley or consent of graduate advisor.
The Staff (F, W, Sp)

299. Directed Research. (2-8)
The Staff (F, W, Sp)

610. Individual Study for Master's Students. (1-8)
Individual study for the comprehensive or language requirements in consultation with the field advisor. 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)**
Prerequisite: one full year of graduate work at Berkeley or consent of graduate adviser.
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.

**LOGIC AND THE METHODOLOGY OF SCIENCE**

(Group Office, Evans Hall)

Profsessors:
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 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)

Robert L. Vaught, Ph.D. (Mathematics)
Yuen Ren Chao, Ph.D., Litt.D. (Oriental Languages, Emeritus)

Associate Professors:
Manuel Blum, Ph.D. (Electrical Engineering and Computer Science)
Charles S. Chihara, Ph.D. (Philosophy)
Ronald B. Jensen, Ph.D. (Mathematics)
Jack H. Silver, Ph.D. (Mathematics)

Assistant Professors:
Ralph N. McKenzie, Ph.D. (Mathematics)
George Myro, Ph.D. (Philosophy)
Robert Robinson, Ph.D. (Mathematics)
Hans Sluga, Ph.D. (Philosophy)
Richard Stanley, Ph.D. (Linguistics)

Chairman: Mr. Staal.
Graduate Adviser: Mr. Silver.

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 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 his undergraduate major was philosophy, or in philosophy (other than logic) if his 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.

**NOTE:** For key to footnote symbols, see page 78.
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. (Chairman)
William G. Bade, Ph.D.
Hans J. Bremermann, Ph.D.
Paul L. Chambré, Ph.D.
shing-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.
Alfred L. Foster, 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.
Fosio Kato,‡ D.Sc.
John L. Kelley, Ph.D.
Robion C. Kirby,† Ph.D.
Shoshichi Kobayashi, Ph.D.
R. Sherman Lehman, Ph.D.
Derrick H. Lehmer, Ph.D.
Hans Lewy, Ph.D.
Michel Loève, Docteur ès Sciences
Calvin C. Moore, Ph.D.
Charles B. Morrey, Jr., Ph.D.
Anthony P. Morse, Ph.D.
Andrew P. Ogg, Ph.D.
Edmund Pinney, Ph.D.
Murray H. Protter, Ph.D.
John L. Rhodes, Ph.D.
Raphael M. Robinson,† Ph.D.
Maxwell A. Rosenlicht, Ph.D.
Rainer K. Sachs, Ph.D.
Donald E. Sarason, Ph.D.
Shiro 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.

Associate Professors:

William B. Arveson, Ph.D.
Ronald B. Jensen,† Ph.D.
Oscar E. Lanford, III, Ph.D.
Keith Miller,† Ph.D.
Charles C. Pugh, Ph.D.
Marc A. Rieffel, Ph.D.
Haskell P. Rosenthal, Ph.D.
Hung-Hsi Wu,‡ Ph.D.
Raymond H. Sciobereti, Ph.D. (Emeritus)
Jack H. Silver, Ph.D.

Assistant Professors:

George M. Bergman, Ph.D.
Robert E. Bowen, Ph.D.
Paul R. Chernoff, Ph.D.
F. Thomas Farrell, Ph.D.
David M. Goldschmidt, Ph.D.
Robert R. Kallman,† Ph.D.
Arnold Kas, Ph.D.
Tsit-Yuen Lam, Ph.D.
H. Blaine Lawson, Ph.D.
Jerrold E. Marsden,‡ Ph.D.
Ralph N. McKenzie,† Ph.D.
Robert W. Robinson, Ph.D.
Michael Schlessinger, Ph.D.
Karen K. Uhlenbeck, Ph.D.
John B. Wagoner, Ph.D.
Alan Weinstein,‡ Ph.D.

Associate Professor:

Kenneth Kunen, Ph.D. (Visiting)

Lecturers:

Michael F. Behrens, Ph.D.
Miroslav Benda, M.S.
Stuart B. Cooper, B.A.
Arthur E. Fischer, Ph.D.
Lowell E. Jones, B.A.
Jonathan M. Wahl, M.A.
David W. Wigner, B.A.
Raphael Zahler, M.S.

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.

OTE: For key to footnote symbols, see page 78.
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; 134 or 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 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 regular major requirements, a student in the honors program must: (a) earn a grade-point average of at least 3.5 in upper division and graduate mathematics courses; (b) complete Mathematics 117; (c) pass a graduate mathematics course with a grade of A; (d) receive the recommendation of his major adviser.

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 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. Emphasis is placed on the Ph.D. programs. 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. More detailed and up-to-the-minute information on instructor listings, quarter offerings, course and seminar content, teaching methods, instructors, textbooks, and schedules is available in the MATHEMATICS SUPPLEMENT TO THE GENERAL CATALOGUE, which is issued just before the beginning of each quarter. Copies of this are available to all advisers and may be consulted by students at the Office of the Department of Mathematics.

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

Lower Division Courses

1A–1B–1C. Calculus. (4 or 5, 4 or 5, 4 or 5)
Two 1-hour lectures and two or three 1-hour problem sessions per week. Prerequisite: at least three-and-one-half years of high school mathematics including algebra, geometry, trigonometric and other elementary functions, and some coordinate geometry. Students with weak backgrounds (for example, lacking a modern high school treatment of trigonometric functions or a thorough study of coordinate geometry) should enroll in the course for 5 units instead of 4 for one or more quarters; those taking the course for 5 units will attend an extra meeting each week in which they will receive extra drill and cover topics from elementary functions and coordinate geometry not covered in all high schools. 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.

(H1A–H1B–H1C. Calculus. (4–4–4)
Three 1-hour lectures and one 1-hour problem session per week. Prerequisite: A's or high B's in high school mathematics and English, consent of instructor. 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. (Sequence beginning F) Mr. Rosenthal

10. Mathematics for Liberal Arts Students. (4)
Three 1-hour lectures and one 1-hour problem session 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. Zahler (W)

15. Concepts of Mathematics for Elementary School Teachers. (5)
Three 1-hour lectures and two 1-hour problem sessions 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. Kelley (F, W, Sp)

16A–16B–16C. Analytic Geometry and Calculus. (4–4–4)
Two 1-hour lectures and two 1-hour problem sessions per week. Prerequisite: Two years of high school algebra. For students in the social and biological sciences. (Formerly numbered 113)

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 log, exp, cos, sin.

16B. Integration by substitution and by parts; volumes of solids of revolution and arc length; vector spaces and linear algebra.

16C. Convexity, linear programming, inner product spaces, game theory, further topics as possible.

25. Concepts of Mathematics for Elementary Teachers, II. (4)
Two 1-hour lectures and two 1-hour problem sessions per week. Prerequisite: course 15. Continues the subject matter of course 15. Completes the development of the number system and gives a brief introduction to abstract algebra. Topics in geometry, probability, and statistics are also covered. Mr. Kelley (W)

51A. Introduction to Linear Algebra. (4)
(Formerly numbered 11C)
Two 1-hour lectures and two 1-hour problem sessions 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. R. W. Robinson, Mr. Seidenberg (F, W, Sp)
51B. Calculus of Vector Functions. (4)
(Formerly numbered 12A)
Two 1-hour lectures and two 1-hour problem sessions 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. Chernoff (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. Chernoff, Mr. Wahl (F, W, Sp)

H51A–H51B–H51C. Linear Algebra, Calculus of Vector Functions, and Differential Equations. (4–4–4)
Four 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. The subject matter of 104A is covered in H51A–H51B–H51C. (Sequence beginning F) Mr. Bade

Related Courses in Another Department

Philosophy 12A–12B–12C. Introduction to Logic.

Upper Division Courses

104A. Introductory Analysis. (4)
Three hours of lecture per week. Prerequisite: courses 51B and 51C or consent of instructor. Sets and functions, real numbers, metric spaces, continuous functions, theory of differentiation, Riemann integration, interchange of order of limit operations. Students who have completed H51C have covered the materials of this course.
Mr. Hirsch, Mr. Kato, Mr. Kelley, Mr. Morrey, Mr. Rosenthal, Mr. Wu (F, W, Sp)

104B. Intermediate Analysis. (4)
Three hours of lecture per week. Prerequisite: course 104A. Approximation to continuous functions, Arzela's theorem, fundamental theorems of partial differentiation, implicit function theorems, existence theorems, multiple integrals, change of variable, further topics. Mr. Behrens (F, W, Sp)

105. Integration. (4)
Three hours of lecture per week. Prerequisite: course 104A. Lebesgue integral and measure, convergence theorems, Fubini's theorem, functions of bounded variation, absolutely continuous functions, connection between integration and differentiation.
Mr. Hochschuld, Mr. F. Wolf (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. Lawson, Mr. Rieffel (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. This 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. Bowen, Mr. Marsden (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. Arveson, Mr. Farrell, Mr. Fary, Mr. Lehman, Mr. Oggy, Mr. Pugh

113C. Abstract Linear Algebra. (4)
Three hours of lecture per week. Prerequisite: course 113B. Students may not receive credit for both 112 and 113C. Dual vector spaces, determinants, characteristic values, similarity, canonical forms, unitary spaces, unitary similarity, quadratic forms.
Mr. Behrens, Mr. Zahler (F, W, Sp)

115A. Introduction to Number Theory. (4)
Three hours of lecture per week. Prerequisite: course 51A. Divisibility, congruences, numerical functions, theory of primes.
Mr. Lehman, Mr. Lehmer (F, W, 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. Lehmer (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. Bowen (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.


120B. Holomorphic functions, regularity, contour integration and residue theory. Analytic continuation and Riemann surfaces.

theory. Special functions and partial differential equations of mathematical physics.

(Each part offered each quarter) Mr. Cordes
Mr. Finney, Mr. Simon

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, 185 or 120A—B—C.

121A. Orthogonal functions and eigenfunction representations, ordinary differential equations, special functions of mathematical physics.

121B. Partial differential equations: Laplace equation, wave equation, diffusion equation, Green's function. Functions of a complex variable.

(Each part offered each quarter) Mr. Chambré, Mr. Taub

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. Smale (Sp)

125A—125B. Mathematical Logic. (4—4)
Three hours of lecture per week. Prerequisite: course 113A or consent of instructor. Sentential and quantification logic. Formal grammar, semantical interpretation, formal deduction, and their interrelation. Applications to formalized mathematical theories. Selected topics from model theory or proof theory. (Sequence beginning F and W) Mr. Henkin,
Mr. R. W. Robinson (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.

Mr. Feldman (W)

128A. Numerical Analysis. (5)
Three hours of lecture per week and one 3-hour laboratory. Prerequisite: courses 51B and 51C. 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. Feldman (F, W)

128B. Numerical Analysis. (5)

Mr. DeVogelaere, Mr. Feldman (W, Sp)

129A. Computational Algebra. (5)
Three hours of lecture per week and problem sessions. Prerequisite: course 51A or 111 and a working knowledge of either ALGOL or FORTRAN. Round-off errors. Approximation by interpolation. Solution of nonlinear equations in one unknown. Systems of linear equations, least squares fitting, eigenvalues. Systems of nonlinear equations. Students may not receive credit for both 129A and 128B.

Mr. Lanford (F, W)

129B. Computational Analysis. (5)
Three hours of lecture per week and problem sessions. 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, elliptic partial differential equations. Students may not receive credit for both 129B and 128A.

Mr. Lanford (W, Sp)

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, inverse geometry.

Mr. Kobayashi, Mr. Wigner (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, inverse geometry, symplectic geometry, geometric algebra, integral geometry, convexity, and elementary topology.

Mr. Pugh (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. Kas (Sp)

134. Number Systems. (4)
Three hours of lecture per week. Prerequisite: course 1C. 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. Benda (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. Jensen, 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. Frenet formulas and winding numbers for curves, local theory of surfaces in Euclidean space, global treatment of intrinsic surface theory.

Mr. Chern, Mr. Schlessinger (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
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)

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.

163. Tutorial in Upper Division Mathematics. (4)
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.

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.

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.

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. Course 190D prepares students for course 104A.

190A. Analytic geometry, differential and integral calculus.

190B. Calculus of several variables (partial differentiation, extremum problems), complex numbers and trigonometry, vectors and vector spaces.

190C. Linear algebra.

190D. Infinite series, differential and difference equations, multiple integration, Kuhn-Tucker theorem.

191. Experimental Courses in Mathematics. (1–5)
Prerequisite: consent of instructor. 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. The Staff (F, W, Sp)

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.

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis.

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.

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.

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-Nikodym theorem.

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.


Graduate Courses

202A. General Topology. (4)

202B. Function Spaces. (4)

203. Measure and Integration. (4)
205A–205B. Theory of Functions as 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. Lawson (205A: W; Sp; 205B: Sp)

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. Sarason, Mr. Arveson (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. Arveson, Mr. Sarason (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. Feldman (Sp)

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. Kas (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.

(Sequence beginning F)


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. Zahler (215A: F; 215B: W; Sp; 215C: Sp)

217. Special Functions and Asymptotic Integration. (4)

Three hours of lecture per week. Prerequisite: course 185. Properties of the Bessel, Legendre, and hypergeometric functions and the asymptotic evaluation of integrals by the method of stationary phase and steepest descents.


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, Poincaré-Bendixson theorem, perturbation theory, Sturm-Liouville theory, Fuchsian equations, asymptotic expansions.

(219A: W; 219B: Sp)


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 120A–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.

Mr. F. Wolf (Sp)

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.

(Sequence beginning F) Mr. Potter

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.

(Sequence beginning F) Mr. Potter


Three hours of lecture per week. Prerequisite: courses 112 or 113C; and either 104A and 185, or 121A–B, or 120A–B.


224C: Special topics chosen by students and instructor.

(Sequence beginning F, W)
225A–225B–225C. Metamathematics. (4–4–4)


(Sequence beginning F, W) Mr. Henkin

226. Mathematical Logic and Computers. (4)

Three hours of lecture per week. Prerequisite: course 125A. Boolean functions and switching circuits, combinatory computing elements, finite automata, Turing machines, introduction to recursive functions and unsolvable combinatorial problems.

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, degrees of unsolvability. The recursion theorem. Constructive ordinals, the hyperarithmetical and analytical hierarchies. Recursive objects of higher type.

(Sequence beginning W) Mr. Jensen

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. J. F. E. Kennedy

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. Silver


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.

(Sequence beginning F) Mr. V. Goldstern

236A–236B. Metamathematics of Set Theory. (4–4)

Three hours of lecture per week. Prerequisite: courses 223C 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 problem and axioms of strong infinity.

Mr. Vaught

240A. Differential Geometry. (4)

Three hours of lecture per week. Prerequisite: course 202A. Differential manifolds and maps, abstract vector bundles, tangent bundle, vector fields, flows, Lie derivative, exterior forms, Frobenius theorem, Stokes theorem.

Mr. Thomas (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. Thomas (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. F. W. Newcomb

241B. Complex Manifolds. (4)

Three hours of lecture per week. Prerequisite: course 241A. Transcendental methods in algebraic geometry, Kähler manifolds, Hodge and Dolbeault theorems, fiber bundles and characteristic classes in algebraic geometry, abelian varieties and analytic surfaces.

Mr. Wigner (Sp)


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 algebra. Applications of general notions to groups, rings, fields, lattices, Boolean algebras, etc.

(Sequence beginning F) Mr. Bergman

250A. Groups and Rings. (4)

Three hours of lecture per week. Prerequisite: course 113C. Group theory through the Jordan–Barker–Schreier theorem, homomorphic theorems for rings and modules, structure of modules over principal ideal domains.

Mr. Lam, Mr. Moore (F, W)

250B. Field Theory and Related Topics in Algebra. (4)

Three hours of lecture per week. Prerequisite: course 250A. Field theory, including algebraic and transcendental extensions, Galois theory. Topics from ring theory, multilinear algebra.

Mr. Lam, Mr. Moore (F, 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.

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.
253. Homological Algebra. (4)
Three hours of lecture per week. Prerequisite: course 250B. Modules over a ring, homomorphisms and tensor products of modules, functors and derived functors, homological dimension of rings and modules.

254. Algebraic Number Theory. (4)
Three hours of lecture per week. Prerequisite: course 250B. Valuation theory in number fields and relation to ideal theory, local fields, unit theorem and finiteness of class number, ramification theory.

Mr. Ogg (Sp)


Mr. Tarski (255A: W; 255B: Sp)

256A–256B–256C. Algebraic Geometry. (4–4–4)
Three hours of lecture per week. Prerequisite: course 250B. Algebraic varieties, dimension, correspondences, normalization, simple points, linear systems, Riemann-Roch theorems for curves, cohomology of coherent sheaves and theory of schemes.

(Sequence beginning F) Mr. Wahl

259. Transformation Groups. (4)
Three hours of lecture per week. Prerequisite: courses 215A and 240A, or consent of instructor. Topological groups, Haar measure, general theory of topological transformation groups, the existence of slices and applications, the Smith theory of periodic transformations.

Mr. Hsiang (W)

260A. Topological Groups. (4)
Three hours of lecture per week. Prerequisite: courses 202A and 250A. General topological groups, Haar measure, compact groups, Mr. Hochschild (W)

*260B. Abstract Harmonic Analysis. (4)
Three hours of lecture per week. Prerequisite: courses 206A and 260A. Banach algebras, convolution algebras, group representations.

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 F) Mr. J. Wolf

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.

272. Topics in Differential Topology. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes as in the case of seminars. Hence it may be repeated for credit.

Mr. Farrell, Mr. Hirsch (F, W)

274. Topics in Algebra. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars. Hence it may be repeated for credit.

Mr. Rosenlicht, Mr. Satake (F, W, Sp)

275. Topics in Applied Mathematics. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars. Hence it may be repeated for credit.

Mr. Landford, Mr. Rhodes, Mr. Smale, Mr. Simon (F, W, Sp)

276. Topics in Topology. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars. Hence it may be repeated for credit.

Mr. Wagoner (W)

277. Topics in Differential Geometry. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars. Hence it may be repeated for credit.

Mr. Hirsch, Mr. Rieffel (F, W, Sp)

278. Topics in Analysis. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars. Hence it may be repeated for credit.

Mr. Kobayashi, Mr. Wu (F, W)

*279. Topics in Partial Differential Equations. (4)
Three hours of lecture per week. Advanced topics chosen by the instructor. The content of this course changes, as in the case of seminars. Hence it may be repeated for credit.

Mr. Hirsch, Mr. Rieffel (F, W, Sp)

Three hours of lecture per week. Prerequisite: course 140 or consent of instructor. Special theory of relativity, spinor representation of the Lorentz group, reformulation of classical physical theories in relativistic form, principle of equivalence, Einstein theory of gravitation, cosmological problems.

(Sequence beginning F) Mr. Taub

290. Seminars. (2–8)
One 2-hour lecture per week. Credit and grade will be awarded at termination of seminar. Topics in foundations of mathematics, theory of numbers, numerical calculations, analysis, geometry, topology, algebra, and their applications, by means of lectures and informal conferences; work based largely on original memoirs.

Mr. Benda, Mr. Dubins, Mr. Farrell, Mr. Foster, Mr. Hochschild, Mr. Hsiang, Mr. Kobayashi, Mr. Kunen, Mr. Marsden, Mr. Morse, Mr. Pugh, Mr. Rhodes, Mr. Rieffel, Mr. R. W. Robinson, Mr. Schlessinger (F, W, Sp)

295. Individual Research. (2–8)
By appointment. Intended for candidates for the Ph.D. degree.

The Staff (F, W, Sp)
299. Reading Course for Graduate Students. (2–8)
By appointment. Investigation of special problems under the direction of members of the department.
The Staff (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. (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)

Logic Colloquium. (No credit)
Reports on current research and scholarly work by members of the staff, visitors, and graduate students.

Mathematics Colloquium. (No credit)
Meetings for the presentation of original work by members of the staff, visiting mathematicians, and graduate students.

[Box: MEDICAL PHYSICS]

(Division Office, 103 Donner Laboratory)

Professors:
Hans J. Bremermann, Ph.D.
Kenneth S. Cole, Ph.D., Sc.D.
John W. Gofman, M.D., Ph.D.
Hardin B. Jones, Ph.D.
Thomas H. Jukes, Ph.D.
Aharon Katchalsky, Ph.D.
Robert K. Mortimer, Ph.D.
Alexander V. Nichols, Ph.D. (Vice-Chairman)
Cornelius A. Tobias, Ph.D. (Chairman)
John H. Lawrence, M.D., Sc.D. (Emeritus)
John H. Northrop, Ph.D., Sc.D., LL.D. (Emeritus)

Associate Professor:
Howard C. Mel, Ph.D.

Assistant Professor:
Robert M. Glaser, Ph.D.

Professors:
Henry Borsook, Ph.D., M.D. (Visiting)
Seymour Fogel, Ph.D.
A. Douglas McLaren, Ph.D.
Harvey Patt, Ph.D.
Kurt S. Spiegler, Ph.D.
Sheldon Wolff, Ph.D.

Assistant Professors:
Marcos F. Maestre, Ph.D. (Acting)
George F. Oster, Ph.D. (Acting)

Lecturers:
Alan J. Bearden, Ph.D.
H. John Burki, Ph.D.
Ernest L. Dobson, Ph.D.
Thomas L. Hayes, Ph.D.
Lola S. Kelly, Ph.D.
Howard D. Maccabee, Ph.D.
Donald J. Rosenthal, M.D.
John C. Schooley, Ph.D.
Roger W. Wallace, Ph.D.
Harry S. Winchell, M.D., Ph.D.

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

Related Courses in Other Departments

Computer Science 246. Special Topics in Numerical Analysis.

Related Programs

Computer Science See Department of Computer Science and Department of Electrical Engineering and Computer Sciences.

Logic See Group in Logic and the Methodology of Science and Department of Philosophy.

Statistics See Department of Statistics.

NOTE: For key to footnote symbols, see page 78.
to some of the quantitative physical problems and approaches in biology and medicine. Courses 10 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 M.P. H195. 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 Division Office, 103 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 Natural Science 1A–B–C, 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, Sp)

11. Mood Altering Drugs. (3)
Alternate lectures and discussions presenting practical information about the effects of mood altering drugs: nature of drug action on central nervous system; habitation, addiction, and sensual perversion; social dynamics of drug abuse; rehabilitation. Mr. Jones (F, Sp)

Upper Division Courses

101. Radiation and Tracer Biophysics. (4)
Two 1-hour lectures, one 1-hour discussion, one 3-hour laboratory per week. Prerequisite: Physics 6C or 4D, Chemistry 1B, Biology 1C, 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. Nichols (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; electrochemical, electrokinetic, and bioelectric phenomena; physical and biological transport processes. Mr. Mel (F)

102B. Biological kinetics. Biophysics of colloidal systems and surfaces; reaction rate theory and biological catalysts; photobiology. Mr. McLaren (W)

103. Human Biology. (4)
Three 1-hour lectures and one 1-hour discussion per week. Prerequisite: Biology 1A–B–C or Biology 11A–11B or Natural Science 1A–B–C, or consent of instructor. A presentation of scientific concepts explaining structure; function and development of the body, the nature and origin of disease, the aging process, demographic and dynamic aspects of human populations. Mr. Jones (W)

121. Molecular Physics and Biological Structure. (5)
Four 1-hour lectures per week and one 1-hour discussion per week. Prerequisite: Biology 1C, 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. Nichols in charge) [F, W, Sp]
199. Supervised Independent Study and Research. 

(1–5)

Enrollment is restricted by regulations listed on page 79. Additional limitation: Overall grade-point average of at least 2.5. Must be taken on a passed or not passed basis.

The Staff (Mr. Nichols 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 1¼-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–203C. Nucleic Acids and Information Transfer. (2–2–2)

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. Mr. Maestre (F)

203B. Genetic transcription and control mechanisms, Enzymatic synthesis of RNA in vitro. Modification of RNA; methylation, processing and transport. Mr. Maestre, Mr. Jukes (W)

203C. 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 organismal level. Enrollment limited. 204A is not prerequisite for 204B. 204B is not prerequisite for 204C.

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

**Radiation Biophysics**

211. Molecular Radiation Biology. (3)

Two 1¼-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, radionemetic chemicals, intracellular repair of radiation damage in nucleic acids.

Mr. Burki (F)

212. Mutagenesis and Radiation Genetics. (3)

Three 1-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 1¼-hour lectures per week. Mammalian radiation syndrome, including cellular effects, long term recovery, immunological and hemopoietic effects, internally deposited isotopes; environmental and public health aspects.

Mr. Burki (W)

214. Radiological Physics. (3)

Two 1¼-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 121A–B or consent of instructor. Selected examples of mathematical and simulation models of metabolic systems, ecological systems, and nerve nets. Survey of useful mathematical methods.

Mr. Bremermann (W)

222. Self-Organizing Systems. (4)

Two 1½-hour lectures and one 1-hour discussion session per week. Prerequisite: courses 102A–102B and 221, or consent of instructor. Information theory; physical theory of nerve action; biological servomechanisms; self-organizing systems; memory; learning and logic in neural nets; neurobiophysics.

Mr. Tobias, 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. Katchalsky (F)

**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. Rosenthal (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. Atherosclerosis. Evaluation of atherogenetic phenomena, occurring in the arterial system of man and other mammals, which lead to circulatory impairment and sequelae affecting the life span of man. Cellular and tissue responses to injury will be considered together with the interaction of such responses with the metabolism of key biological substances such as lipids, carbohydrates, and proteins. The status of knowledge of atherogenesis, with a focus upon the outstanding unsolved problems will be evaluated in detail.

Mr. Gofman, Mr. Nichols (Sp)
Current topics in the biophysical sciences, Faculty of the Graduate Group in Biophysics and Medical Physics (Mr. Bremermann in charge) (F, W, Sp)

290A–290B–290C–290D. Seminar. (1–3)
290A. Progress in Cellular Biophysics.
290B. Progress in Medical Physics.
290C. Progress in Radiation Biophysics.
290D. Progress in Theoretical Biophysics.
Mr. Tobias and Staff (F, W, Sp)

299. Individual Research: Medical Physics and Biophysics. (1–16)
The Staff (Mr. Tobias in charge) (F, W, Sp)

MILITARY SCIENCE

(Department Office, 151 Harmon Gymnasium)

Professor:
Wyndham H. Banmer, B.Gen.Ed. (Chairman)

Associate Professors:
Keith F. Eubanks, B.S., Major, Infantry
James R. Hisey, B.G.S., Major, Artillery

For further information about the Reserve Officers’ Training Corps, consult the Professor of Military Science in Room 149, Harmon Gymnasium.

Lower Division Courses

11A–11B. Introduction to the Theory of Warfare. (2–2)
Survey and analysis of the causes and nature of war. Discussion of the principles of war as propounded by major theorists. 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)

21A–21B–21C. American Military History. (2–2–2)
Prerequisites: 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 (sequence beginning 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. Tobias in charge) (F, W, Sp)

G. Staff Seminar in Medical Physics. (No credit)
Weekly presentation by members of the staff and visitors.
The Staff (Mr. Tobias in charge) (F, W, Sp)

6. Staff Seminar in Military Physics. (No credit)
Weekly presentation by members of the staff and visitors.
The Staff (Mr. Tobias in charge) (F, W, Sp)

Assistant Professors:
Charles W. Donaldson, B.S., Captain, Armor
Dennis F. Hoffman, B.S., Captain AD
Richard J. Lane, B.S., Captain IN
Richard A. Lowe, B.S., Captain, Ordnance Corps

Upper Division Courses

131. Theory of Instruction. (2)
Fundamentals of educational processes; interrelationships of stress, fatigue, instructor-student rapport, audiovisual principles, semantic correlation and group evaluation of heterogeneous adult groups. Student seminars, critiques, and discussions to evaluate principles.
The Staff (F)

133. Theory of Organizational Behavior. (2)
Survey of group dynamics; analysis of relationships between individual motivation, individual and group needs and behavior, individual-group conflicts and reactions to authoritarian, democratic, and laissez-faire leadership patterns in varying situations.
The Staff (Sp)

142A–142B. Managerial Theory. (2–2)
Prerequisite: course 133 or consent of instructor. Analysis of dynamics of large organizations, planning, organizing, 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)
Analysis and discussion of the military legal system as an element of United States Criminal Law; Constitutional guarantees; the Uniform Code of

NOTE: For key to footnote symbols, see page 78.
Military Justice; rules of evidence; pretrial, trial, and appellate processes. Summary, Special and General Courts-Martial, Non-Judicial punishment.

The Staff (Sp)

Professional Courses

431. Fundamentals and Dynamics of the Military Team. (2)
Discussion of advanced tactics; emphasis on platoon and company operations to include capabilities, organization and equipment, and missions; familiarization with the principles and means of communications, to include communications security. Analysis of principles and nature of Internal Defense Development. Two field trips to active installations.

The Staff (W)

440. Advanced Summer Camp. (6)
A field training camp held at an active military installation for a six-week period. Practical application of the theoretical material presented in residence.

MOLECULAR BIOLOGY

(Staff Office, 229 Molecular Biology and Virus Laboratory)

Professors:
Melvin Calvin, Ph.D., Sc.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)
Roger Y. Stanier, Ph.D.
Wendell M. Stanley, Ph.D., Sc.D., LL.D.,
Docteur h.c. (Paris)

Gunther S. Stent, Ph.D.
Robley C. Williams, Ph.D.
Associate Professors:
Michael J. Chamberlin,†, Ph.D.
Alvin J. Clark, Ph.D.
John C. Gerhart, Ph.D.
Assistant Professors:
Richard Calendar, Ph.D.
Peter H. Duesberg, Ph.D.
Theodore Gurney, Ph.D.
John R. Roth, 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>
<th>Courses</th>
<th>Quarter Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td></td>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>General (4A-4B-4C)</td>
<td>15</td>
<td>Calculus (Math. 1A-1B-1C)</td>
<td>12</td>
</tr>
<tr>
<td>Organic (12A-12B-112)</td>
<td>8</td>
<td>Biology</td>
<td></td>
</tr>
<tr>
<td>Physical (110A-110B)</td>
<td>6</td>
<td>General (Biology 1A-1B-1C)</td>
<td>15</td>
</tr>
<tr>
<td>Biochemistry (102,102L or 100A-100B-100C)</td>
<td>9</td>
<td>Additional</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td></td>
<td>Undergraduate work including</td>
<td></td>
</tr>
<tr>
<td>General (Physics 4A-4B-4C-4D)</td>
<td>15</td>
<td>genetics</td>
<td>9</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 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.

NOTE: For key to footnote symbols, see page 78.
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 Course**

10. **Introduction to Molecular Biology.** (3)

Three one-hour lectures per week. Prerequisite: Molecular Biology 200A or 200B; Biology 1A–1B–1C. An introduction to the molecular basis of the structure and function of the hereditary substance of living forms, with particular emphasis on insights gained from the study of viruses and bacteria.

Mr. Fraenkel-Conrat (Sp)

**Upper Division Courses**

110. **Molecular Basis of Heredity.** (5)

Four one-hour lectures per week. Prerequisite: Chemistry 8A–8B; Biology 1A–1B–1C. An introduction to the molecular basis of the structure and function of the hereditary substance of living forms, with particular emphasis on insights gained from the study of viruses and bacteria.

Mr. Roth (Sp)

120. **Introduction to Molecular Virology.** (4)

(Formerly numbered 111)

Four one-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 79. Additional limitation: overall grade-point average of at least 3.0. Must be taken on a passed or not passed basis.

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

**Graduate Courses**

200A–200B. **Introduction to Molecular Biology.** (4–4)

Four one-hour lectures per week. Prerequisite: Biology 1A–1B–1C or equivalent, or Bacteriology 100A; Biochemistry 100A or 102, and a course in physical chemistry (these courses may be taken concurrently); one year of college mathematics or consent of the instructor. Two-quarter sequence beginning in the fall.

200A. Genetic and functional characteristics of prokaryotic cells and of viruses, biosynthesis of nucleic acids and proteins, macromolecules, metabolic regulation. Mr. Calendar, Mr. Echols, Mr. Gerhart (F)

200B. Fine structure and organization of eukaryotic cells. Molecular and cellular processes involved in the formation and function of differentiated multicellular systems. Mr. Rubin, Mr. Duesberg, Mr. Gurney, Mr. Williams (W)

201. **Molecular Biology Laboratory.** (5)

(Formerly numbered 211A–211B)

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.

Mr. Calendar (Sp)

210. **Special Topics in Molecular Biology.** (1–3)

(Formerly numbered 209)

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. **Biology of Viruses.** (3–3)

Three one-hour lectures per week. Prerequisite: Biology 1A–1B–1C or equivalent, or Bacteriology 100A; Biochemistry 100A or 102 (may be taken concurrently); one year of college mathematics.

Two-quarter sequence beginning in the winter.

*220A. Structure, dynamics of growth, and genetics of bacterial, and other aspects of bacteriophage-host interaction. (W)

220B. Structure, growth dynamics, and cellular effects of animal 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.

(W)
"230. Bacterial Genetics. (3)
(Formerly numbered 231)
Three hours of lecture per week. Prerequisite: course 200A or 220A, or consent of instructor. An advanced course in bacterial genetics emphasizing current concepts.
Mr. Clark (F)

"231. Bacterial Genetics Laboratory. (5)
(Formerly numbered 230)
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.
(W)

241. Techniques in Animal Cell Culture. (5)
One hour of lecture and nine 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)

MUSIC

(Department Office, 104 Morrison Hall)

Professors:
David D. Boyden, M.A., Mus.D. (h.c.)
Edward T. Cone, M.F.A. (Ernest Bloch Professor)
Alan Curtis, Ph.D.
William D. Denny, M.A. (Vice-Chairman)
Vincent H. Duckles,† Ph.D.
Arnold Elston, Ph.D.
Daniel Heartz, Ph.D. (Chairman)
Andrew W. Imrie, M.A.
Joseph Kerman, Ph.D.
Lawrence Moe, Ph.D.
Joaquin Nin-Culmell
Edgar H. Sparks, Ph.D.
Charles C. Cushing, M.A. (Emeritus)

Associate Professors:
Philip Brett,† Ph.D.
Richard L. Crocker, Ph.D.
Richard Felciano,† Ph.D.
Michael Senturia, A.B.

Assistant Professors:
James E. Cunningham,† M.M.
Edwin Dugger, M.F.A.
Olly Wilson, Ph.D.

Lecturers:
Bernhard Abramowitsch (Piano)
James Berdahl, M.A. (Director of Bands)
Estelle Caen (Piano)
Jacqueline R. Clark, A.B.
Elizabeth Davidson, M.A.
Deno Gianopoulos (Piano)
Lauretta Goldberg, B.Mus. (Harpischord)
Merrill Jordan (Flute)
Daniel Livesay, A.B. (Trombone)
Margaret Lucchesi, M.A. (Perussion)
James Matheson, A.B. (Oboe)
Raymond Ojeda (Bassoon)
Detlev Olshausen, A.B. (Viola)
Marjorie Gear Petray, A.B.
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.
Abe Sherman, A.B.
Philip Shoptaugh, (Trumpet)
E. Rollin Silfies, M.A.
John M. Swackhammer, A.B.

Departmental Major Advisers: Mr. Cunningham, Mr. Denny, Mr. Senturia.
Graduate Advisers: Composition, Mr. Nin-Culmell (M.A. and Ph.D.); History and Literature, Mr. Crocker (Ph.D.), Mr. Sparks (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

NOTE: For key to footnote symbols, see page 78.
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 101–199 (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. Elston. 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 101–199; 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 Chapter III 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 Chapter III 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 (Mrs. Clark in charge) (F, W, Sp)

*25A–25B. Introduction to Music Theory. (4-4)

Three 1-hour meetings per week. A writing course, based on traditional harmony. Beginning linear and vertical analysis. For general students.

**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. Crocker (F); Mr. Kerman (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. Crocker (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 or consent of instructor. The evolution of musical style from Beethoven to the present day. Mr. Crocker (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, 1971. Mr. Boyden (F)

128B. The Symphonies of Beethoven. (4)

Three 1-hour lectures per week. **Prerequisite:** course 27. Mr. Sparks (W)

128C. Contemporary Music. (4)

Three 1-hour lectures per week. **Prerequisite:** course 27. Mr. Swackhamer (F)

**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.

**128H. G. F. Handel. (4)**

Three hours of lectures per week. **Prerequisite:** course 27.

**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 (Sp)

**128L. Hindustani Music. (4)**

Two 1¼-hour lectures per week. An introduction to the basic principles of North Indian classical music through detailed study of a limited number of related ragas and talas.

**128M. Carnatic Music. (4)**

Two 1¼-hour lectures per week. An examination of some important features and problems of South Indian classical music. **Prerequisite:** course 128L or consent of instructor.

**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 1¼-hour rehearsals and one section hour per week. Mr. Berdahl (F)

143. University Concert Band. (2)

Two 1¼-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 1¼-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, Miss Davidson (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. Cunningham (F), Mr. Curtis (W, Sp)

146. Chamber Music Ensemble. (2)
Chamber music for strings, winds, piano, and voice. Mr. Berdahl, Mrs. Petray (F, W, Sp)

147. Contemporary Chamber Music Ensemble. (2)
Four hours per week.
Mr. Dugger (F, Sp) Mr. Wilson (W)

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 (Mr. Sherman 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. Petray in charge)

*G. Musicianship for Graduate Students. (0)*
Two 1½-hour classes per week.

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. Elston 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. Nin-Culmell in charge)

*2G. Harmony for Graduate Students. (0)*
Three hours of lecture per week.

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. Sparks

**Upper Division Courses**

**THEORY**

100A. Advanced Musicianship. (2)
Three class hours per week. Prerequisites: course F, 2C, and consent of instructor. Mr. Sherman (F)

100B. Keyboard Harmony. (2)
Formerly numbered 102A. Three class hours per week. Prerequisite: course 2C and consent of instructor. Mr. Sherman (W)

100C. Score Reading. (2)
Formerly numbered 102B. Three class hours per week. Prerequisite: course 2C and consent of instructor. Mr. Sherman (Sp)

101A–101B. Tonal Counterpoint. (4–4)
Three 1-hour classes per week. Prerequisite: course 2C. Sequence beginning (W), Mr. Denny

*101C. Tonal Counterpoint for Graduate Students. (0)*
Three one-hour classes per week.

105A–105B–105C. Composition. (4–4–4)
Three class hours per week. Prerequisite: course 2C and consent of instructor. Sequence beginning (F) Mr. Nin-Culmell

106A–106B. Canon and Fugue. (4–4)
Two 2-hour classes per week. Prerequisite: course 101B. Sequence beginning (F), Mr. Denny

107A–107B. Studies in Musical Analysis. (4–4)
Two 1½-hour classes per week. Prerequisite: course 2C. Sequence beginning (F) Mr. Elston

108. The Relation of Musical Analysis to Performance. (4)
Three class hours per week. Prerequisite: course 2C and consent of instructor. An investigation of musical structure in its various aspects, with emphasis on the implications for instrumental and vocal performance. Mr. Cone (Sp)

*109A–109B. Orchestration. (4–4)
Two 2-hour classes per week. Prerequisite: courses 2C and 101A. Mr. Denny

112A. Choral Conducting. (4)
Two 2-hour classes per week. Prerequisite: consent of instructor. Miss Davidson (W)

112B. Instrumental Conducting. (4)
Two 2-hour classes per week. Prerequisite: courses 109A and 112A or consent of instructor. Mr. Senturia (Sp)

**HISTORY AND LITERATURE**

IDS 104. Storm and Stress in Opera and Drama. (4)
See Interdepartmental Studies for the complete description of this course.

See Interdepartmental Studies for the complete description of this course.
The Performance of Medieval and Renaissance Music. (4)
Prerequisite: Experience in playing an instrument or in singing. Three class hours per week.
Mr. Brett (Sp)

116E. The Performance of Baroque Music. (4)
Prerequisite: experience in playing an instrument or in singing. Three class hours per week.
Mr. Curtis (F)

116F. The Organ Music of J. S. Bach. (4)
Three hours of lecture per week.
Mr. Moe (W)

116G. J. S. Bach. (4)
Three hours of lecture per week.
Mr. Brett

116H. Purcell. (4)
Three hours of lecture per week.
Mr. Brett

117A. The Symphonies of Mozart. (4)
Three class hours per week.
Mr. Sparks

117B. The Operas of Mozart. (4)
Mr. Sparks

117C. The String Quartets of Beethoven. (4)
Three class hours per week.
Mr. Sparks (Sp)

118B. Piano Music of the Romantic Period. (4)
Three class hours per week.

119D. Chamber Music of the Twentieth Century. (4)
Mr. Imbrie (Sp)

119E. Contemporary Music. (4)
Three class hours per week.
Mr. Dugger

120A–120B. The History of Musical Instruments. (4–4)
Three hours of lecture per week. Prerequisite: courses 2C and 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 (F) Mr. Boyd

150. Instrumental and Vocal Instruction. (1)
(Formerly numbered 430)
Open only to majors in music. Private instruction in piano, voice, and string, woodwind, and brass instruments. 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 1½-hour meetings per week. Open to senior honor students who have at least a 3.2 average in the major.
Mr. Elston (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. Denny in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Additional limitation: overall grade-point average of at least 3.0. Must be taken on a passed or not passed basis.
The Staff (Mr. Denny 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 24.

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. Heartz, Mr. Kerman

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. Dugger (Sp)

One 3-hour meeting per week. Mr. Dugger (W)

203. Seminar in Composition. (4)
One 3-hour meeting per week.
Mr. Imbrie (F, W, Sp)

*204. Studies in Musical Analysis. (4)
One 3-hour meeting per week.
Mr. Imbrie (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.
210. The History of Musical Instruments. (4)
One 3-hour meeting per week. A continuation of course 120A–120B which will involve cataloguing instruments in the Department's collections.
Mr. Boyden (Sp)

212A–212B. Seminar: Medieval Studies. (4-4)
One 3-hour meeting per week.
Sequence beginning (W), Mr. Crocker

213A–*213B. Seminar: Studies in the Sixteenth Century. (4-4)
One 3-hour meeting per week.
Mr. Sparks (F)

215A–*215B. Seminar: Research in Music History. (4-4)
One 3-hour meeting per week. The topic for 1972 will be the operas of Rameau.
Mr. Curtis (Sp)

*218A–218B–218C. Seminar: Studies in Classic and Romantic Music. (4-4-4)
One 3-hour meeting per week. The topic will be the origins and evolution of Wagner's musical style. This research seminar extends over two consecutive quarters. A final grade will be assigned upon completion of both quarters. Sequence beginning (F).

*220. Seminar: Problems in Criticism. (4)
Mr. Kerman

298. Group Special Studies. (2–8)
The Staff (Mr. Crocker 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. Sparks in charge) (F, W, Sp)

NATURAL SCIENCE
(Office, 101C Lewis Hall)

Professors:
Melvin Calvin, Ph.D. (Chemistry)
William B. Fretter, Ph.D. (Physics)
William A. Jensen, Ph.D. (Botany)
Robert Karplus, Ph.D. (Physics)
Walter D. Knight, Ph.D. (Physics)
Henry Rapoport, Ph.D. (Chemistry)
Frederick Reif, Ph.D. (Physics)

Associate Professors:
John E. Hearst, Ph.D. (Chemistry)
Patricia St. Lawrence, Ph.D. (Genetics)
Herbert L. Strauss, Ph.D. (Chemistry)
Richard C. Strohman, Ph.D. (Zoology)

Assistant Professors:
Robert M. Glaser, Ph.D. (Biophysics)
W. Martin McClain, Ph.D. (Chemistry)

Field Major in Physical Sciences
This program serves the needs of students who can profit from broader training in the physical sciences than is possible in a departmental major. Two plans are offered by the College of Letters and Science. Plan A is designed primarily for students who

NOTE: For key to footnote symbols, see page 78.

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. Boyden 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), Miss Caen

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), Miss Caen

428A–428B–428C. Vocal Technique. (2–2–2)
Two ½-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).

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.
Mr. Sillies (F, W, Sp)
I N A TURAL S CIENCE; N AVAL S CIENCE

wish to prepare for careers in the teaching of physical science at either the high school or junior college level; however, others may find the program of interest. Plan B is designed for those students who have not chosen a departmental field of specialization but may wish to do so either at the senior or graduate level with a minimum of difficulty.

Plan A (Preparation for teaching in high school or junior college):

Lower Division Courses. The following courses are required as preparation for the upper division program: Mathematics 16A, 16B, 16C; Physics 6A, 6B, 6C; Chemistry 1A, 1B, 1C.

Upper Division Courses. Physics 121, 115; Physics 116A, 116B, 116C (Intermediate Physics); Chemistry 109A, 109B. Electives in chemistry or physics to complete a total of 36 upper division units. Education 198 (Science Education for Physical Science Majors) is recommended.

Plan B (Planned program of related courses in several departments):

Lower Division Courses. The following courses provide required preparation for the upper division program: Mathematics 1A, 1B, 1C, 51A, 51B; Physics 4A, 4B, 4C, 4D, 4E; Chemistry 1A, 1B, 1C or 4A, 4B, 4C; Chemistry 14.

Additional Required Courses. Astronomy 127A or Geology 5A.

Upper Division Courses. Chemistry 110A, Physics 105A, 137A. Electives to complete a total of 36 upper division units: mathematics, physics, and chemistry (any upper division course approved by the adviser); Astronomy 127B, 127C, 127D; Geology 102A, 102B, 102C, 103A, 103B, 116, 119. Certain other courses not listed here may be approved as electives by the adviser.

Honors Program. See the major adviser.

1A–1B–1C. Contemporary Natural Science. (4-4-4)

Three 1-hour lectures and two hours of discussion and/or laboratory per week. This course, intended primarily for students who are not majoring in one of the natural sciences, is an integrated presentation spanning the areas of physics, chemistry, and biology. It is designed to stress fundamental concepts, to indicate what modern scientists do, and to point out occasional philosophical or social implications. Credit for this course will be given ordinarily if the student has had no prior college course in either physics, chemistry, or the following courses in the biological sciences: Biology 1A, 1B, 1C, Biology 11A, 1B, Botany 10, Physiology 10, and Zoology 10. Exceptions can be made with consent of instructor upon approval of the Dean. If all three quarters are completed successfully, the course will satisfy four courses for the Letters and Science breadth requirement.

Contemporary Technology.

See Engineering 2A–2B–2C.

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:
Edward E. Kerr, M.S., Captain, U. S. Navy (Chairman)

Associate Professor:
Richard J. Morin, M.S., Commander, U. S. Navy

Assistant Professors:
Ervin "J" Crampton, B.A., Major, U. S. Marine Corps
Joe P. Harrison, M.S., Lieutenant Commander, U. S. Navy
Howard E. Koss, B.S., Lieutenant Commander, U. S. Navy
Philip E. Porter, B.A., Lieutenant Commander, U. S. Navy

The Department of Naval Science and the Naval Reserve Officers Training Corps (NROTC) offer two 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.

NOTE: For key to footnote symbols, see page 78.
The Naval ROTC Non-Scholarship Program normally is entered during the fall quarter of the freshman year. Entering male students between the ages 17–21 are selected locally from voluntary applicants during registration week based on their physical qualifications and demonstrated motivation for becoming an officer in the naval service.

Students enrolled in the Naval ROTC Non-Scholarship Program are supplied uniforms and Naval Science textbooks without charge on a loan basis. The Navy pays at least $50 per month to upper division students, and requires one summer training period. Upon graduation, students who have successfully completed all requirements are offered a Reserve commission in either the Navy or U. S. Marine Corps (as elected by the student), and are obligated to serve on active duty for three years.

The Naval ROTC Scholarship Program offers a commission in the Regular Navy or Marine Corps. Students are selected by the Secretary of the Navy on the basis of motivation toward a career in the Naval Service, physical standards, and academic achievement. Students selected are designated Reserve Midshipmen and are granted the compensations and benefits authorized by law for a period not exceeding four years. During this period the Navy pays full University tuition, incidental and other fees of an instructional nature, and an allowance of at least $50 per month. Textbooks for all university courses are provided to scholarship students on a loan basis. Like the non-scholarship program students, during drill periods and summer cruises, the midshipmen wear government-furnished uniforms. They participate in three summer training cruises, and upon graduation are obligated to serve four years on active duty as a Line, Supply or Civil Engineer Corps or U. S. Marine Corps officer as chosen by the student.

The NROTC instructional program consists of the University major and University courses specified by the Navy, including those of the Department of Naval Science. Navy-specified courses include those in mathematics, physical science, computer science, American Military Affairs and National Security Policy. Also, upper division students are encouraged, but not required, to take civilian flight training through a Navy-sponsored Flight Indocination Program at a local civilian airport. Private pilots licenses are awarded to students successfully completing this program.

Naval ROTC Scholarship Program and Naval ROTC Non-Scholarship Program students are required to take approximately 29 quarter hours of courses instructed by Naval Science personnel. In addition to taking academic courses for credit in the Naval Science Department, NROTC students participate in one or two hours (depending on their year group) of noncredit laboratory or seminar sessions each week. They are also encouraged to participate in extracurricular activities which will further their leadership training.

For further details contact the Professor of Naval Science in Callaghan Hall.

Lower Division Courses

A-4B. Naval Ships Systems. (3-3)
Three hours of lecture per week. Types, structure and purpose of naval ships. Theory of thermodynamic cycles in marine propulsion systems. Theory of ship design, stability, electrical, and control systems.
Mr. Porter (F, W)

American Military Affairs. (4)
Three hours of lecture per week. An introductory survey of U. S. military affairs from the American evolution 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. Crampton (F)

National Security Policy. (4)
Three hours of lecture per week. Prerequisite: Naval Science 5 or consent of instructor. An analysis of the formulation and implementation of national security policy. American military history is studied to determine factors bearing on the development of defense structure. The method of formulation of national security policy and the role of governmental components concerned with security affairs are analyzed. The elements of national power are reviewed.
Mr. Porter (Sp)

Upper Division Courses

111. Naval Operations Analysis. (3)
Three hours of lecture per week. Prerequisite: Math 1A–1B–1C or H1A–H1B–H1C or 16A–16B or Stat 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. Koss (F)
112A—112B. Navigation. (3-3)

Three hours of lecture per week. Prerequisite: Trigonometry. 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. Koss (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. Koss (Sp)

124A. Naval Weapons Systems I. (3)

Three hours of lecture per week. The concept of weapons systems and systems approach. Introduction to analysis of ballistics. Analysis of elements of the weapon delivery problem. Weapons systems theory illustrated by particular systems.

Mr. Harrison (W)

124B. Naval Weapons Systems II. (3)

Three hours of lecture per week. Prerequisite: NS 124A. Dynamics of the basic components of control systems investigated as transfer functions. Design, control, and delivery functions. Weapons system management and evaluation.

Mr. Harrison (W)

125. Advanced Naval Weapons Systems. (3)

Three hours of lecture per week. Prerequisite: NS 124A; Natural Science 1A—1B—1C or equivalent; Math 1A—1B—1C or equivalent. Theory of weapons control problem utilizing the linear systems analysis concept including propulsion systems, trajectories, methods of solution. Design and testing of weapons components. Management principles and evaluation of weapon systems and components.

Mr. Harrison (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. Crampton

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 beginning in academic year 1971—72.

Mr. Crampton

114A—114B. Navigation. (3-3)

114A. The principles of modern 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. Koss (W)

114B. Nautical Astronomy. The principles of celestial navigation. The laboratory work includes the various methods of solution of celestial problems and sight reduction.

Mr. Koss (Sp)

NEAR EASTERN LANGUAGES

(Chairman)

Wolfgang J. Heimpel, Ph.D.
Leonard H. Lesko, Ph.D.
Bruce R. Pray, † Ph.D.
Gordon C. Roadarmel, † Ph.D.
Martin Schwartz, Ph.D.
Gideon Shunami, Ph.D.
Talat Tekin, Ph.D.

Assistants:

Francis I. Andersen, Ph.D.
Victor R. Gold, Ph.D.

Associate Professors:

Andrea Grosman
Usha R. Jain, M.A.
Linda G. Israeli, B.A.
Ora Mayrose, B.A.

NOTE: For key to footnote symbols, see page 78.
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 and South Asian civilizations. The department is one of several participating in the recently formed Graduate Program in Ancient History and Mediterranean Archaeology (see page 86 for full description of program).

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, and Semitic epigraphy and philology.

The Major

I. In Arabic, Hebrew, Persian, Turkish, Hindi, and Urdu: 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. 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.

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, Hindi, Urdu, 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.

The M.A. degree is obtained according to Plan II (see page 32). 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.

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-men-
tioned 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 B (see page 38).

For further details, consult the regulations of the Graduate Division and the Graduate Adviser in 1229 Dwinelle Hall.

*151. Jewish Civilization. (4)

Three 1-hour lectures 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 nineteenth century.

Mr. Anderson, Mr. Gold (F, W, Sp)

*152A–152B–152C. The Literature of Ancient Israel. (4-4-4)

Three 1-hour meetings per week. 150A, the Patriarchal age through 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)

*153A–153B. Hebrew Literature in Translation. (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 Mishnah, Medieval philosophy.

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, Mr. Greenfield (F, W)

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 Sasanid 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 (F), Mr. Schwartz (F, W)

*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. Mr. Algar (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 (F, W)

*168A–168B. Turkish Literature in Translation. (4-4)

Three 1-hour lectures per week. Turkish literature in translation from its origins in folklore through classical literature to the literature of the modern period. No knowledge of Turkish is required.

Mr. Tektin (F, W)

170A–170B. Ancient Mesopotamian Society and Religion. (4-4)

Two 1½-hour 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)

*171A–171B–171C. Ancient Western Asia. (4-4-4)

Three 1-hour lectures per week. Civilization of Mesopotamia and adjacent regions from its origins to the period of the Persian Empire. Mr. Greenfield, Mr. Heimpel, Mrs. Kilmer, Mr. Stefanini (F, W, Sp)
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 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)

74. Religion of Ancient Egypt. (4)
Three 1-hour lectures per week. A study of the mythological and mortuary literature of the ancient Egyptians.

80A–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.

82A–182B. Arabic Literature in Translation. (4-4)
Three 1-hour meetings 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.

98. Directed Group Study for Upper Division Students. (1-4)
Tutorial instruction in areas not covered by regularly scheduled courses.

99. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations shown on page 79. Must be taken on a passed/not passed basis.

510A–510B–510C. Architectural History of India. (4-4-5)
Three 1-hour meetings per week. A survey of the history of architecture of India from the earliest period to modern and contemporary periods. A study of the architectural developments and changes through the ages. Pre-requisite: course 510A–510B–510C or equivalent. Mr. Pray (Sp)

*122. The Origin and Development of Hindi and Urdu. (4)
(Formerly numbered 192)
Three 1-hour meetings per week. The historical and linguistic background of modern Hindi and Urdu. Mr. Pray (Sp)

*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.

Graduate Course

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 (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).

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–1C, or equivalent. Sequence beginning (F).

Mr. Khouri (in charge) (F, W, Sp)

101A–101B–101C. Selected Readings from Classical and Modern Arabic. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. Mr. Bloch (F, W, Sp)

102A–102B–102C. Early Islamic Texts. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or equivalent.

Mr. Brinner (F, W, Sp)

103A–103B–103C. Classical Arabic Poetry. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or equivalent. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

104A–104B. Modern Arabic Prose: Novel, Drama, Essay. (4-4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or equivalent. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

105A–105B–105C. Modern Arabic Poetry. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 101A–101B–101C or equivalent. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

South Asian

Upper Division Courses

21A–121B–121C. Literary and Cultural Traditions of India. (4-4-4)
Three 1-hour lectures per week. The development of certain basic concepts and ideas as illustrated by ancient, classical, medieval, and modern Indian literature. Analogies will also be drawn from the other arts. Mr. Staal, ———- (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)

Prerequisite: enrollment is restricted by regulations listed on page 79. Must be taken on a passed or 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: course 106A-106B-106C or equivalent. The Staff (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. Colloquial Arabic. (4-4-4)

Three 1-hour meetings per week. Prerequisite: at least two years of Arabic or equivalent. Intensive study of a particular dialect, e.g., Syrian, Egyptian, Moroccan, varying from year to year. May be repeated for additional credit. Mr. Bloch (F, W, Sp)

203A-203B-203C. Classical Arabic Prose. (4-4-4)

Three 1-hour meetings per week. Prerequisite: course 102A-102B-102C or equivalent. May be repeated for additional credit. Mr. Bloch (F, W, Sp)

*204A-204B-204C. Abbasid Authors. (4-4-4)

Three 1-hour meetings per week. Prerequisite: course 103A-103B-103C or equivalent. Centering on intensive study of major Abbasid poets or prose writers. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

205A-205B-205C. Contemporary Arabic Literature. (4-4-4)

Three 1-hour meetings per week. Prerequisite: course 105A-105B-105C or equivalent. May be repeated for additional credit. Mr. Khouri (F, W, Sp)

290. Special Study. (1-12)

Variable sections, 1-5 units each. 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 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). Mrs. Kilmer (F, W, Sp)

*101A-101B-101C. Intermediate Akkadian. (4-4-4)

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 100A-100B-100C 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. Introduction to Cuneiform Sumerian 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 79. 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. Mrs. Kilmer (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). Mr. Heimpel (F, W, Sp)

290. Special Study. (1-12)
Variable sections, 1–5 units each. 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)

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). Mr. Schubert (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). Mr. Schubert (F, W, Sp)

101A–101B–101C. Literary Tamil. (3-3-3)
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."
Mr. Schubert (F, W, Sp)

102A–102B. Seminar in Comparative Dravidian Linguistics. (3-3)
Two 1/2-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 Indic-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.
Mr. Schubert (W, Sp)

Graduate Courses

201A–201B–201C. Later Stages of Egyptian. (4-4-4)
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)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations shown on page 79. Must be taken on a passed or not passed basis.
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)

198. Directed Group Study for Upper Division. Students. (1-4)
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.
Mr. Lesko (F, W, Sp)

201A–201B–201C. Intermediate Egyptian. (4-4-4)
Three 1-hour meetings per week. Middle Egyptian grammar and texts.
Sequence beginning (F). Mr. Lesko (F, W, Sp)

*101A–101B–101C. Intermediate Egyptian. (4-4-4)
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)

Egyptian

Upper Division Courses

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)

102A–102B–102C. Elementary Egyptian. (4-4-4)
Three 1-hour meetings per week. Middle Egyptian grammar and texts.
Sequence beginning (F). Mr. Lesko (F, W, Sp)

Graduate Courses

202A–202B–202C. Egyptian Texts. (4-4-4)
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)

290. Special Study. (1-12)
Variable sections, 1–5 units each.
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)
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) Mrs. Grosman (F, W, Sp)

20A–20B–20C. Intermediate Hebrew. (5-4-4)
(Formerly numbered 100A–100B–100C)
Five 1-hour recitation sessions per week. Prerequisite: course IA–1B–1C, or equivalent.
Sequence beginning (F). Mrs. Mayrose (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.
The Staff (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.
Mr. Milgrom (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.
Mr. Friedman (F, W, Sp)

*103A–103B–103C. Medieval 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.
Mr. Friedman (F, W, Sp)

104A–104B–*104C. Modern 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.
Mr. Shunami, Mr. Alter (F, W, Sp)

*105A–105B–105C. Grammar Review and Composition. (4-4-4)
Three 1-hour meetings per week. Prerequisite: course 104A–104B–104C and either 101A–101B–101C, 102A–102B–102C or 103A–103B–103C.
Mr. Greenfield (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 79. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses

*201A–201B–201C. Advanced Biblical Hebrew. (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. Milgrom (F, W, Sp)

202A–202B–202C. Advanced Rabbinic Hebrew. (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. (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. (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. Credit and grade will be awarded upon completion of the full sequence.
Mr. Shunami (F, W, Sp)

*205. Studies in Hebrew Linguistics. (4)
Three 1-hour meetings per week. Prerequisite: consent of instructor.
Mr. Greenfield (Sp)

290. Special Study. (1–12)
Variable sections, 1–5 units each.
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 the instructor.
The Staff (F, W, Sp)

Hindi-Urdu

Lower Division Course

1A–1B–1C. Elementary Hindi-Urdu. (4-4-5)
Seven 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). Mrs. Ohala (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.

*103. Advanced Hindi Conversation. (4)
(Formerly numbered 103A–103B–103C).
Three 1-hour meetings per week. Prerequisite:
course 100A–100B–100C or equivalent. May be repeated for additional credit but not in consecutive quarters. 

(F, W, Sp)

111A–111B–111C. Advanced Urdu. (4–4–4)

Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit. Texts selected according to individual requirements. (in charge) (F, W, Sp)

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. Selections will be available in both the Urdu and Devanagari scripts. Mr. Pray (W)

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 79. Must be taken on a passed or not passed basis.

The Staff (F, W, Sp)

Graduate Courses

201A–201B–201C. Readings in Hindi Literature. (4–4–4)

Three 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. May be repeated for additional credit. A is not a prerequisite for B, nor B for C. (F, Sp)

202. Medieval Hindi Texts. (3)

Two 1-hour meetings per week. Prerequisite: course 100A–100B–100C or equivalent. Readings in medieval Hindi poetic texts, emphasizing poetic theory, literary conventions and linguistic variations. (W)

290. Special Study. (1–12)

Variable sections, 1–5 units each.

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)

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). Mr. Algar (in charge) (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) Mr. Algar (in charge) (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. Mr. Algar (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.

Mr. Algar (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. Texts from the Vendidad and the Yashts; Achaemenid inscriptions.

Mr. Schwartz (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 79. 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, Manichaean and Buddhist texts. Mr. Schwartz (F, W, Sp)

290. Special Study. (1–12)

Variable sections, 1–5 units each.

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 the 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)
Prerequisite: courses 1A, 1B, 1C or equivalent.
Five 1-hour recitation sessions per week.
Sequence beginning (F). Mrs. Sumukti (F, W, Sp)

Semitics
Upper Division Courses
100A–100B–100C. Aramaic (4–4–4)
Three 1-hour meetings per week. Prerequisite: Biblical Aramaic 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. Bloch, 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 79. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

Graduate Courses
Three 1-hour meetings per week. Prerequisite: 18 upper division units in a Semitic language or consent of instructor. Studies in Comparative morphology and lexicography of the Semitic languages and the historical development of the various languages. May be repeated for additional credit. Sequence beginning (F). (F, W, Sp)

*205A–205B–205C. Ugaritic. (4–4–4)
Three 1-hour meetings per week. Prerequisite: Hebrew 100A–100B–100C, or equivalent. Study of the Ugaritic languages and literature (found at Resh-Shamra in Syria) with special reference to the development of early Hebrew literature. Sequence beginning (F). Mr. Andersen (F, W, Sp)

*210A–210B–210C. 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)

290. Special Study. (1–12)
Variable sections, 1–5 units each. 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)

Turkish
Lower Division Course
1A–1B–1C. Elementary Modern Turkish. (4–4–5)
Five 1-hour recitation sessions per week. Sequence beginning (F). Mr. Tekin (in charge) (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). Mr. Tekin (in charge) (F, W, Sp)

(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. Tekin (in charge) (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-Ataturk Period. Mr. Tekin (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 79. 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. (F, W, Sp)
*201A–201B. Old Turkic, (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. Mr. Tekin (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. Mr. Tekin (F, W, Sp)

290. Special Study. (1–12)

Variable sections, 1–5 units each. 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 credit with consent of the instructor. The Staff (F, W, Sp)

NUTRITIONAL SCIENCES

(Department Office, 119 Morgan Hall)

Professors:

George M. Briggs, Ph.D.
Doris H. Calloway, Ph.D.
Maynard A. Joslyn, Ph.D.
Judson T. Landis, Ph.D.
Richard L. Lyman, Ph.D.
Gordon Mackinney, Ph.D.
Sheldon Margen, M.D. (Chairman)
E. L. Robert Stokstad, Ph.D.
Jessie V. Coles, Ph.D. (Emeritus)
Bessie B. Cook (Bessie Cook Jeffers), Ph.D. (Emeritus)
Helen L. Gillum, 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 Professor:

George W. Chang, Ph.D.
Eleanor F. Eckstein, Ph.D.

Undergraduate Major Adviser: Miss Kennedy.
Graduate Adviser 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 60), as follows:

DIETETICS

This field of study prepares students for hospital internship programs required for membership in the American Dietetics Association and for graduate work in nutrition. Study programs are flexible within the major requirements to permit the student to prepare for a research-oriented career, or for one with emphasis on administrative and therapeutic dietetics.

NOTE: For key to footnote symbols, see page 78.
Major requirements:

*Humanities and Social Sciences*, 36 units as follows: economics (4); English, rhetoric, or comparative literature (8); psychology (4); additional courses (20).

*Physical Sciences and Mathematics*, 28 units as follows: chemistry—inorganic with laboratory (12) and organic with laboratory (8); additional courses (8).

*Biological and Agricultural Sciences*, 23 units as follows: bacteriology with laboratory (5); biochemistry (4); physiology with laboratory (5); additional courses (9).

*Major Field*, 49 units as follows: introduction to nutritional sciences (5); food science (14); human nutrition (5); therapeutic nutrition (4); experimental nutrition (6); quantity food service (15).

*Additional courses*, 44 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.

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 major adviser and one of the graduate advisers. He also must fulfill a requirement of two quarters as a Teaching Assistant if he is working for his Ph.D. in nutrition. 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 IA. Intended primarily for majors, Introduction to nutrition, with emphasis on metabolism and the nutritional requirements of man.
The Staff (Mr. Stokstad in charge) (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. Mackinney (F)

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)

14A. The Experimental Study of Food Systems. (3)
Lectures, two hours per week; laboratory, three hours per week. Prerequisite: courses 2 and 30 (may be taken concurrently) and Chemistry 8A or 12A. Study of the effects of ingredient and environmental variables on the acceptability and preparation of foods. Sensory and objective methods of evaluating, product quality.
Recipe standardization methods and controls.
Miss Eckstein (Sp)

14B. The Experimental Study of Food Systems. (4)
Lectures, two hours per week; laboratory, six hours per week. Prerequisite: course 14A. Study of the effects of ingredient, environmental, and individual variables on the acceptability and preparation of foods. Sensory and objective methods of evaluating, product quality.

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. Briggs (Sp)

101. Food Analysis. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: Chemistry 1C and SB. Principles of quantitative analysis applied to food materials; chemical analysis of typical carbohydrate, fat, and protein foods.
Miss Kennedy (F)

106. Food Chemistry. (3)
Lectures, 3 hours per week. Prerequisite: course 2 and Chemistry SB. Chemistry of food proteins, carbohydrates, fats, and other constituents of foods.
Miss Kennedy (W)

106L. Food Chemistry Laboratory. (4)
Lecture, one hour per week; laboratory, nine 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 (W)

107. Principles of Food Preservation and Processing. (4)
Lectures, three hours per week; one field trip. Prerequisite: course 30, or Bacteriology 102 and 102L, and Chemistry SB. Recommended: Biochem-
istry 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. Joslyn (F)

108. Introduction to Food Research. (2)
Lecture, 2 hours per week. Prerequisite: course 101 or Chemistry 5. Proseminar on current research in the chemistry of food composition, preparation, and control. Miss Kennedy (Sp)

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. Miss Eckstein (F)

122. Quantity Food Production and Service Laboratory. (5)
Lectures, 2 hours per week; laboratory, 8 hours per week. Prerequisite: course 121. Laboratory and additional discussion periods and outside assignments, covering the practical application of theoretical content of course 121. Miss Eckstein (W)

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. Miss Eckstein (Sp)

140. Nutrition. (5)
Lectures, 5 hours per week. Prerequisite: Chemistry 1A or high school chemistry; Physiology 1. Primarily for students who are 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 Eckstein (Sp)

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. (5)
Lectures, 5 hours per week. Prerequisite: course 150, or Biochemistry 102. Scientific principles of meeting the metabolic and nutritional needs of normal individuals throughout the life span. 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. Mr. Margen (Sp)

161L. Therapeutic Nutrition Laboratory. (2)
One hour discussion per week; laboratory, 3 hours per week. Prerequisite: course 161 (may be taken concurrently). Mr. Margen (Sp)

170. Experimental Nutrition Laboratory. (4)
Discussion, one hour per week; laboratory, 9 hours per week. Prerequisite: course 150 or 160 (may be taken concurrently); Biochemistry 102L. Principles and techniques used in research in human and animal nutrition. Mr. Lyman, Mrs. Ostwald (W)

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 79. Must be taken on a passed or not passed basis. The Staff (Mr. Margen in charge) (F, W, Sp)

IDS 10A–10B–10C. Man and His Environment—Crises and Conflicts. (4–4–4)
See Interdepartmental Studies for complete description of this course.

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, one hour per week; one 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. (3)
Lectures, 3 hours per week. Prerequisite: Biochemistry 100A–100B–100C, or 102, or consent of instructor. Nutrition of proteins relative to their structure and chemical properties. Staff (Sp)

206. Innovations in Food Processing. (2)
Lectures, two hours per week. Prerequisite: course 106 and 107. Current and new methods for efficiently resolving requirements for improved nutrition, non-polluted, more convenient and freshtasting foods, pressures of competitive cost reduction and increasing sanitary and wholesomeness regulations. Mr. Morgan (W, Sp)

211. Research Methods in Nutritional Sciences, Instrumentation. (5)
Lecture, one hour per week; laboratory, twelve 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 (F)

212. Research Methods in Nutritional Sciences, Biological. (5)
Lecture, one hour per week; laboratory, twelve hours per week. Prerequisite: graduate standing and consent of instructor. Effects of nutrition on biochemical and physiological responses of various biologic systems. Advanced techniques for metabolic experiments and their application to individual problems of nutritional research. Mrs. Ostwald, 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)

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 240. Nutrition of Population Groups. (3)

See Interdepartmental Studies for complete description of this course.

Family Sociology

Upper Division Courses

137. Marriage and the Family. (4)

Lectures, 4 hours per week. Contemporary family life, with attention to personality development and mental health, psychological interpretations of social and sexual roles; cultural contrasts and marriage; dynamics of marriage interaction and parent-child relationships. Mr. Landis (F, Sp)

*138. The Contemporary American Family. (4)

Lectures, 4 hours per week. Impact of modern culture upon the family, with emphasis upon family types, member relationships, family dynamics in relation to personality, social change, and social values. Mr. Landis (W)

139. Sociology of Child Development. (4)

Lectures, 4 hours per week. Various social factors, social groupings, and social contexts in relation to the social development of the child. Mr. Landis (F)

Graduate Course

237. Seminar in Family Sociology. (1-4)

Mr. Landis (Sp)

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 Professor:
Darrell B. Carter, Ph.D.

Associate Professor:
Robert B. Mandell, Ph.D.

Associate Clinical Professor:
Morton D. Sarver, M.S.

Assistant Professors:
Anthony J. Adams, Ph.D.
Theodore Cohn, Ph.D.
Ralph Freeman, Ph.D.
Jack R. Hobson, B.S., (Emeritus)

Assistant Clinical Professors:
Elizabeth Caloroso, M. Opt.
Michael G. Harris, M.S., O.D.

Assistant Clinical Professors:

Marshall Atkinson, M.D.
Ferd T. Elvin, A.B.
Michael J. Jauregui, M. Opt.
Frank V. Johnson, M. Opt.
Arthur Layton, M.A.
Robert W. Lester, B.S.

Lecturers:

George Keranen, M.D.
Richard Kapash, Ph.D.
Richard Neumaier, M. Opt., M.P.H.
Albert L. Pierce
John Semmlow, Ph.D.
Kangavkar Shantinath, DOMS
Edward Tamler, M.D.
Richard Webber, D.D.S.

Clinical Instructors:

Harvey Arnold, B.S.
William Baron, O.D.
Roy H. Brandreth, B.S.
James Crosby, B.S.
Ronald Emrich, M. Opt.
Bernard H. Faibish, O.D.
Bercine Flom, B.S.
Allan N. Fried, M. Opt.

NOTE: For key to footnote symbols, see page 78.
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.

Graduate Major Courses 204, 206, and 208 are required of all graduate students and should be completed as early as possible. The first two years of graduate study are normally spent preparing for the departmental examination. This preparation should include passing of at least one foreign language examination, and the completion of seminars and other courses which will provide an appropriate background.

For further details on the requirements for the M.S. and Ph.D., please consult the adviser of the Group in Physiological Optics.

**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 lecture per week. Prerequisite: junior standing. The profession of optometry, its history and present status. Mr. Morgan (F)

104. **Ophthalmic Optics.** (3)
   Two 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Optometry 105. 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: Optometry 104. Continuation of Optometry 104. Mr. Kors (F)

127. **Refraction of the Eye.** (5)
   Three 1-hour lectures, two 2-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, ophthalmoscopy, visual acuity, subjective refraction, amplitude of accommodation. 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: Optometry 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: Optometry 128. A survey of disease processes and systematic disorders with special reference to peculiar 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: Optometry 127. Detection, measurement, classification, etiology, symptomatology, signs and prognosis of the latent and manifest disorders of binocular fixation, both comitant and noncomitant; 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: Optometry 128 and 131. Introduction to ocular diseases 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)
Five 1-hour lectures. Prerequisite: Physics 106A. Gaussian optics. Aberrations and methods of correction, chromatic aberration and dispersion, oblique astigmatism, "corrective curve", lens design and characteristics of ophthalmic instruments.
Mr. Adams (F)

158A–158B. Vision Rehabilitation. (4–4)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: Optometry 127 and 453. Aniseikonia, low vision and geriatric optometry. Orthoptics, pleoptics and pediatric optometry. Sequence beginning (W), Mr. Mandell (W); Mrs. Caloroso (Sp)

161. Contact Lenses. (5)
Three 1-hour lectures and two 3-hour laboratories per week. Prerequisite: Optometry 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. Keranen, 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. Seminow (Sp)

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. Kors 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: Optometry 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: Optometry 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: Optometry 455. Optometric examination, dispensing, consultation, and follow-up vision care of patients performed independently by student clinicians (interns) under supervision of the clinic staff. 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: Optometry 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. 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: consent of instructor and completion of Optometry 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. Kors and Staff

491. Applications of Electronics and Computers in Physiological Optics and Optometry. (3)
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)

498. Group Studies, Seminars or Group Research. (1–8)
One to eight 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 (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, Su)

**Physiological Optics**

**Upper Division Courses**

101. Anatomy of Eye and Orbit. (5)
Three 1½-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. (5)
Three 1-hour lectures and two 2-hour laboratories per week. **Prerequisite: Physiological Optics 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; photochemistry. The characteristics of drugs producing miosis, mydriasis, cycloplegia, accommodative spasm, and anesthesia of ocular surfaces. Mr. Fatt (F)

129. Motility of the Eye. (5)
Three 1½-hour lectures and one 2-hour laboratory per week. **Prerequisite: Physiological Optics 105.** 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, version, vergences; accommodation; accommodative-convergence; convergence accommodation. Mr. Semmlow (W)

132. Visual Stimuli. (5)
Three 1½-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 1½-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 1½-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 79. 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. Semmlow 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. Stark (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. Mandell (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. --- (F)

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. --- (W)

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 (W)

207. Simulation of Visual Systems. (4)
Two hours of lecture and six hours of laboratory per week. Prerequisite: graduate standing or 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. --- (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. Flom in charge (F, W, Sp, Su)

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. Flom (F, W, Sp, Su)

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. Flom (F, W, Sp, Su)

ORIENTAL LANGUAGES

(Department Office, 102 Durant Hall)

Professors:
Cyril Birch, Ph.D.
Kun Chang, Ph.D.
Shih-Hsiang Chen, B.Litt.
William H. McCullough, Ph.D.
Michael C. Rogers, Ph.D. (Chairman)
Edward H. Schafer, J¹ Ph.D.
Peter A. Goodberg, Ph.D. (Agassiz Professor, Emeritus)
Denzel Carr, Ph.D. (Emeritus)
Yuen Ren Chao, Ph.D., Litt.D., I.L.D.
(AGassiz Professor, Emeritus)

Associate Professors:
Haruo Aoki, Ph.D.

NOTE: For key to footnote symbols, see page 78.

James E. Bosson, Ph.D.
Francis T. Motofuji, Ph.D.

Assistant Professors:
Ching-mao Cheng, Ph.D.
John C. Jamieson, Ph.D.
Lewis R. Lancaster, M.Th., Ph.D.

Lecturers:
Helen C. McCullough, Ph.D.
Susumu W. Nakamura, M.A.

Instructor:
Shou-hsin Teng, M.A. (Acting)
Departmental Major Advisers: Mr. Jamieson (Chinese), Mr. Nakamura (Japanese); Mr. Bosson (Altaic Languages).

Graduate Advisers: Mr. Schafer (Chinese); Mr. Motofuji (Japanese); Mr. Bosson (Altaic Studies).

The Department of Oriental Languages at Berkeley offers a thorough training in the classical and modern languages and literatures of Eastern Asia. 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 three undergraduate majors programs (in Chinese, Japanese, and Altaic languages) have recently (1971) been extensively revised. Detailed descriptions of the requirements in each of these programs can be obtained from the Department of Oriental Languages.

Honors Program

An undergraduate student who has completed 21 units of language courses in the department and has an overall grade-point average of 3.0, may apply to the departmental chairman for admission to the honors program. If 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 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.

Prospective graduate students are urged to acquire an active command of their 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. Further details may be obtained from the departmental secretary.

M.A. Degree  Candidates must achieve broad competence in four fields: (1) textual criticism, philology, and the classics; (2) linguistics; (3) cultural history; (4) literary history and criticism; by reading, by course work and by participation in graduate seminars. Students specializing in Chinese must also study Japanese; students specializing in Japanese must also study Classical Chinese. All must demonstrate a reading knowledge of French, German, or Russian. After advancement, the M.A. may be completed either by a thesis or by a comprehensive examination. If the former option is elected, the candidate is advised to emphasize quality rather than quantity, and to choose a topic which he explores thoroughly rather than a broad subject permitting only general treatment. Textual or linguistic study in the broadest sense should constitute a major element in the preparation of the thesis. The comprehensive examina-
tion consists of four parts, corresponding to the four areas of broad competence mentioned above. Each part is one and one-half hours long.

**Ph.D. Degree** Special requirements include an essay comparing some aspect of Far Eastern civilization with a comparable aspect of another culture; a year of an Oriental language other than Chinese and Japanese, or two courses in European literature or criticism; demonstration of reading ability of German, French, Chinese, and Japanese; oral examination before a committee and a dissertation.

**Oriental Languages**

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.

Mr. Boodberg (F, W, Sp)

*112. Survey of Chinese Literature and Literary Criticism. (4)*

Two 1½-hour meetings per week. The general characteristics, main currents, and representative works of Chinese literature in the classical tradition. Texts and references in English translation will be critically analyzed. When not given, see Comparative Literature 162. Students may receive credit in either course but not in both.

Mr. Chen (F)

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 (Sp)

140–143. Civilizations of Eastern Asia, (4)

Three 1-hour meetings per week.

*140. China. (Formerly numbered 142C.) Prerequisite: junior standing. Mr. Schafer (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. M. 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.

Mr. McCullough (F)

*170. Introduction to Buddhism. (4)*

Three 1-hour meetings per week. A survey of the beliefs and practices of Buddhists from the beginning to the present.

Mr. Lancaster (F)

171. The Development of Buddhism in the Far East. (4)

Three 1-hour meetings per week. Prerequisite: junior standing.

Mr. Lancaster (W)

172. Survey of Chinese Vernacular Literature. (4)

Three 1-hour meetings per week. Fiction and drama from early times to the present with assigned readings in English translation.

Mr. Birch (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. Jameson (F), Mr. Chang (W), Mr. Teng (Sp)


(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).

Mr. Birch (F), Mr. Cheng (W), Mr. Teng (Sp)

11A–11B. Introduction to Classical Chinese. (5–5)

(Formerly 6C) Five 1-hour meetings per week. Prerequisite: Chinese 1C or Japanese 10B. 11A is prerequisite to 11B. Primarily for majors.

Mr. Schafer (F, W)

12A–12B. Elementary Classical Chinese. (5–5)

Five 1-hour meetings per week. No prerequisite. 12A is prerequisite to 12B.

Mr. Boodberg (W, Sp)

13. Introduction to the Study of Chinese Characters. (5)

Five 1-hour meetings per week. No prerequisite.

Mr. Boodberg (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: Chinese 10C.

100A. Emphasis on journalistic and political writings.

Mr. Cheng and Mr. Teng

100B. Expository writings in pai-hua and literary styles.

Mr. Cheng and Mr. Jameson

100C. Bellotristic writings in pai-hua and literary styles.

Mr. Chen (Sp)

*103. Classical Chinese: Medieval Texts (Cultural and Literary). (4)*

Three 1-hour meetings per week. Prerequisite: Chinese 11B.

Mr. Schafer (Sp)


Three 1-hour meetings per week. Prerequisite: 103 or 113 and 8 additional units of upper division Chinese or Japanese. Topics and texts will vary
105. Advanced Mandarin. (4)
Three 1-hour meetings per week. Prerequisite: Chinese 10B. Reading and discussion in Chinese of contemporary materials. Designed to increase competence in handling the modern language.
Mr. Lancaster (F, W, Sp)

*110A–110B–110C. Readings in Chinese Buddhist Texts. (4–4–4)
Two 1½-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. Jamieson (Sp)

113. Classical Chinese: Historical Texts. (4)
Three 1-hour meetings per week. Prerequisite: 11B.
Mr. Schaler (F)

*120. Readings of Chinese Buddhist Texts. (4)
Two 1-hour meetings per week. Prerequisite: 110A or 110B or 110C or three quarters of classical Chinese.
Mr. Lancaster (F)

*125. Chinese Dialectology. (4)
Two 1½-hour meetings per week. Prerequisite: 100B and Linguistics 20 (P/F).
Mr. Lancaster (F)

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 1½-hour meetings per week. Prerequisite: 100B.
Mr. Chang (F, W, Sp)

*135. Phonology of Ancient Chinese. (4)
Two 1¼-hour meetings per week. Prerequisite: 103 or 113.
Mr. Chang (W)

136A–136B. Chinese Neoclassical Literature Since 1400. (4–4)
Two 1½-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)
(Formerly numbered 123)
Two 1½-hour meetings per week. Prerequisite: 100B and Linguistics 20.
Mr. Chang (Sp)

156. Readings in Chinese Vernacular Literature. (4)
Three 1-hour meetings per week. Prerequisite: 100B.
Mr. Cheng (F)

165. Readings in Chinese Linguistics. (4)
Two 1½-hour reading sessions per week. Prerequisite: 100 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 1½-hour meetings per week. Prerequisite: Linguistics 20. An exploration into the genetic relations among Chinese, Thai, Tibetan, Burmese, and other Asian languages.
Mr. Chang (W)

183A–183B–183C. Masterpieces of Chinese Literature and Literary Criticism. (4–4–4)
(Formerly numbered 193A–193B–193C)
Two 1½-hour meetings per week. Prerequisite: 103 or 113. 183A: Verse. 183B: Belles lettres, 183C: Essays and classical fiction. 183A is not prerequisite to 183B; 183A and 183B are not prerequisite to 183C.
Mr. Chen (F, W, Sp)

185. History of Chinese Linguistics. (4)
Two 1½-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.
Mr. Boodberg (F)

Japanese

Lower Division Courses

1A–1B–1C. Elementary Japanese. (5–5–5)
(Formerly numbered 11–2–3)
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)

(Formerly numbered 41–51–61)
10A. Five 1-hour meetings and one 1-hour laboratory per week. Prerequisite: 1C.
10B–10C. Five 1-hour meetings per week. 10A is prerequisite to 10B; 10B is prerequisite to 10C.
Mr. Motofuji (F, W, Sp)

Three 1-hour meetings per week. Practice in speaking and writing modern Japanese. Prerequisite: 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. 100C. Belles lettres. Prerequisite: 100A or 100B. 100A is not prerequisite to 100B.
Mr. McCullough (F, W), Mrs. McCullough (Sp)

Two 1½-hour meetings per week. Prerequisite: 10A.
Mr. Cheng (Sp)

Three 1-hour meetings per week.
129A. Prerequisite: 10C.
129B–129C. Prerequisite: 129A. 129B is not pre-

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: 10C. 149A is not prerequisite to 149B. 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)

**Altai and Tibetan**

Lower Division Courses

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.  
Prerequisite: 1A is prerequisite to 1B; 1B is prerequisite to 1C.  
Mr. M. Rogers (F, W, Sp)

Upper Division Courses

100. Intermediate Korean. (4)  
(Formerly numbered 107)  
Three 1-hour meetings per week. Prerequisite: 1C. May be repeated for credit.  
Mr. M. Rogers (F, W, Sp)

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 1¾-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: 164A–164B.  
Mr. Lancaster (F, W)

174A–174B–174C. Intermediate Tibetan. (3-3-3)  
Two 1½-hour meetings per week. Prerequisite: 164A, 164B, 164C. Emphasis on doctrinal Buddhist texts.  
Mr. Bosson (F, W, Sp)

176. Old Turkish: Uighur. (4)  
Two 1½-hour meetings per week. Prerequisite: NEL Old Turkish (2 quarters).  
Mr. Bosson (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: 144A, 144B, 144C. The linguistic classification 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: 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: 174A, 174B, 174C. Extensive reading in historical and literary texts. May be repeated for credit.  
Mr. Bosson (F, W, Sp)

**Special Upper Division Courses**

187. Philological Laboratory.  
Three 1-hour meetings per week. Philological analysis of an Oriental language, using textual material.  
The Staff

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 79. Additional limitation: 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: 100A-100B-100C. Japanese reference works for literature and history. Mr. McCullough (F)

(Formerly 137)
Two 1½-hour meetings per week. Prerequisite: Korean 1C; 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. Mr. Birch (W)

210. Seminar in Buddhism and Buddhist Texts. (4)
One 2-hour seminar per week, May be repeated for credit with consent of instructor. Mr. Lancaster (W, Sp)

212. Seminar in Chinese Literary History. (4)
One 2-hour seminar per week. Textual and aesthetic criticism. Mr. Chen (F, W)

213. Seminar in Philological Analysis of Ancient Chinese Texts. (4)
One 2-hour seminar per week. Mr. Boobberg (F, W)

214. Reading in Altaic Texts. (4)
One 2-hour seminar per week. Mr. Bosson (W, Sp)

216. Texts on the Civilization of Medieval China. (4)
Two 1-hour seminars per week. Mr. Schafer (W)

217. Seminar in Philological Analysis of Koryo and Yi Dynasty Sources. (4)
One 2-hour seminar per week. Mr. M. Rogers (F, W)

229. Seminar in the Classical Civilization of Japan. (4)
One 2-hour seminar per week. Prerequisite: 129B or 129C. Mr. McCullough (Sp)

236. Seminar in Chinese Linguistics. (4)
One 2-hour seminar per week. Prerequisite: one or more of the following: 125, 135, 145, 165, 185. Mr. Chang (Sp)

239. Seminar in Japanese Linguistics. (4)
One 2-hour seminar per week. Prerequisite: 139B. 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: 139. Mr. Bosson (F, W)

299. Thesis Preparation and Related Research. (1-8)
(Formerly numbered 250)
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 unit 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 unit requirements for the Ph.D. degree. Must be taken on a satisfactory/unsatisfactory basis. The Staff (F, W, Sp)

PALAEONTOLOGY

(Department Office, 3 Earth Sciences Building)

Professors:
Zach M. Arnold, Ph.D.
William B. N. Berry, Ph.D.
J. Wyatt Durham, Ph.D.
Joseph T. Gregory, Ph.D.
Robert M. Kleinpell, Ph.D.
Donald E. Savage,† Ph.D.

Departmental Major Adviser: Mr. Durham.
Graduate Adviser: Mr. Clemens

Charles L. Camp, Ph.D. (Emeritus)

Associate Professors:
William A. Clemens, Jr., Ph.D.
Wayne L. Fry, Ph.D.

Lecturer:
Samuel P. Welles, Ph.D.

The department offers instruction in invertebrate and vertebrate paleontology, micropaleontology, paleobotany, and stratigraphic paleontology. Professional oppor-

NOTE: For key to footnote symbols, see page 78.
tunities 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–1C, Biology 1A–1B–1C, 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 102C, 150, 118, Paleontology 111, 112, 114, Biology 150, and four additional courses in geology, zoology, or paleontology (Genetics 100, Zoology 109, 157, Physiology 123–123L, and Geology 105, 107 are recommended).

Paleobiological emphasis requires Chemistry 8A–8B as additional preparation, and 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, 120–121, 125–126; (b) Botany 105, 110; Zoology 155, 108A–108B or 157, 106–106L; (c) Botany 144, Physiology 123–123L, Zoology 131–131L; and one additional advanced course related to the major. Geology 150, Zoology 109 and 107A–107B are also recommended.

Honors Program Honors students may apply to the adviser at the beginning of the senior year for admission to the honors program. Students accepted for this program 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.

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

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. Fry, coordinator) (F, 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–1C, 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. Emphasis on the distribution and interrelationships of diverse marine Cenozoic faunas. To be given alternate years with course 239. Mr. Kleinpell, Mr. Berry (W)

113. Stratigraphic Chorology of the Cenozoic. (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. Mr. Kleinpell (F)

114. Micropaleontology. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 112 or 113 or consent of the instructor. Biological and paleontological principles in the study of microfossils, with emphasis on the Foraminifera. Mr. Arnold (Sp)

*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. Kleinpell (F)

120. Paleobotany. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: consent of instructor. To be given alternate years with course 220. 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)
To be offered alternate years, in same years as 120. 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–1C 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–1C or Biology 11A–11B. Development and morphology of skeleton and dentition. Mr. Gregory (W)

*131. Stratigraphy of Superjacent Series of Pacific Coast. (4)
Three 1-hour lectures per week and term report. Prerequisite: course 112. To be given in alternate years with 237. Mr. Durham (F)

136. Paleozoic and Early Mesozoic Stratigraphy of North America. (4)
Three 1-hour lectures and term report. Prerequisite: course 112. 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 standing. To be offered alternate years with courses 224, 225. Discovery and development of ideas, principles and methods; modern trends and theories. Mr. Gregory (Sp)

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 79. 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. To be given alternate years with course 120. Prerequisite: advanced training in plant anatomy and systematics. Advanced study of plants represented in the geologic record. Mr. Fry (F)

224. Paleontology and Evolution of Fish. (4)
Two hours of lecture and two 3-hour laboratory sessions per week. Prerequisite: Paleontology 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: Paleontology 125 and 126 or Zoology 106 or equivalent. Mr. Gregory (W)

226A–226B. Evolution and Classification of Mammals. (4–4)
Two 1-hour lectures and two 3-hour laboratories
227. History and Paleoeconomy of Higher Vertebrates. (4)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 226A–226B.

Mr. Savage, Mr. Clemens

*229. Field Studies in Mammalian Stratigraphy. (4)
Lectures, demonstrations, and problem-solving in the field. Term report and examinations. Prerequisite: course 227. Mr. Savage, Mr. Clemens

*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 palaeoecological, zoogeographic and tectonic interpretations of North American Palaeozoic faunal and stratigraphic record. Mr. Berry

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 palaeontology and stratigraphy. Mr. Durham

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

*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. Mr. Kleinpell

250. Seminars in Paleontology. (2)
Advanced study and current literature in various fields of paleontology. Topics vary from year to year. (a) Mr. Berry (F); (b), Mr. Kleinpell (F, W); (c), Mr. Clemens (W); (d) Mr. Gregory (F); (e) Mr. Durham (W, Sp); (f), Mr. Fry (W, Sp); (g), Mr. Arnold (W, Sp); *(h) Mr. Savage (F, Sp)

299. Research in Paleontology. (1–9)
The Staff

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

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

PARASITOLOGY

For courses in Parasitology, see Entomology and Parasitology.

PHILOSOPHY

(Deartment Office, 314 Moses Hall)

Professors:
Ernest W. Adams, Ph.D.
Karl Aschenbrenner, Ph.D.
William Craig, Ph.D.
Paul K. Feyerabend, Ph.D., L.H.D.
H. Paul Grice, M.A.
Benson Mates, Ph.D.
Wallace I. Matson, Ph.D.
David Rynin, Ph.D.
John R. Searle, D.Phil.
Michael Scriven, D.Phil.
Frits Staal, Ph.D.
Joseph Tussman, Ph.D.
Isabel Hungerland, Ph.D. (Emeritus)
Stephen C. Pepper, Ph.D., L.H.D., L.L.D. (Mills Professor, Emeritus)
Edward W. Strong, Ph.D. (Mills Professor, Emeritus)

Associate Professors:
Charles S. Chihara, Ph.D.
Thompson Clarke, Ph.D.
Hubert L. Dreyfus, Ph.D.
Barry G. Stroud, Ph.D.

Assistant Professors:
Michael Frede, Ph.D.
Stephen R. Schiffer, D.Phil.
Hans Sluga, B.Phil.
George Myro, Ph.D.
Bruce J. Vermazen, Ph.D.

Professors:
William P. Alston, Ph.D. (Visiting)
Dagfinn Føllesdal, Ph.D. (Visiting Mills Professor of Intellectual and Moral Philosophy and Civil Polity)
The Major


**Upper Division**  104, 134A.

A total of 60 units is required in the major program. Twenty-seven units are required in the upper division in addition to the two required upper division courses 104 and 134A. The student must take at least two courses in each of groups A, B, and C. The required courses 104 and 134A in groups A and B, respectively, will satisfy the A and B requirements in part, but may not be counted toward satisfaction of the 27-unit requirement.

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 24 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**

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. Rynin, Mr. Scriven, Mr. Tussman (F, W, Sp)

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. Stroud, Mr. Hoffman (F, W, 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.
   11A, (W); 11B, (Sp); Mr. Rynin

12A–12B. **Introduction to Logic.** (4-4)
   Two 1-hour lectures and two section meetings per week. Course 12A in itself should not be regarded as a terminal course in logic.
   Mr. Chiara, Mr. Adams, Mr. Craig, Mr. Mates, Sequence beginning (F, W, Sp)

12C. **Introduction to Logic.** (4)

25A. **Ancient Philosophy.** (5)
   Three 1-hour lectures per week and one weekly section meeting.
   Mr. Sluga (F)

25B. **Medieval and Early Modern Philosophy.** (5)
   Three 1-hour lectures per week and one weekly section meeting.
   Mr. Frede (Sp)

25C. **Modern Philosophy to Kant.** (5)
   Three 1-hour lectures and one section meeting per week.

**Upper Division Courses**

*General Prerequisites.*—Students enrolling in any restricted upper division course must have completed 8 units in courses 2, 4, or 25A, 25B, and 25C, or have completed, under conditions specified below, course 101. Additional prerequisites are indicated in certain courses.
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. Sluga, ———— (F, W, Sp)

Restricted Courses

Group A.—Courses concerned with a critical analysis and appraisal of specific human interests, such as art, literature, morality, religion, science, and society.

104. Ethics. (5)
Three hours of lectures and one hour of consultation per week. Moral values; the concepts of good and right; the criteria of conduct.
Mr. Scriven, Mr. Vermazen, Mr. Sluga (F, W, Sp)

*106. Philosophy in Literature. (5)
Three hours of lecture and one hour of consultation 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. (5)
Three hours of lecture and one hour of consultation per week. Prerequisite: at the discretion of the instructor, the general prerequisite may be waived for students in literature. Works such as those of Dostoyevsky, Kafka, and Malraux, as expressions of Christian, agnostic, and atheist existential attitudes. Playwrights such as Ionesco, Pinter, and Beckett, as expressing in their form, the existentialist rejection of the traditional conception of reason.
Mr. Dreyfus (Sp)

108. Social Philosophy. (5)
Three hours of lectures and one hour of consultation 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.
Mr. Searle (Sp)

112. Philosophy of Religion. (5)
Three hours of lectures and one hour of consultation per week. The nature and the validity of religious ideas.
Mr. Rynin (Sp)

118. Philosophy of Law. (5)
Three hours of lecture and one hour of consultation per week. Philosophical problems arising in the legal context.
Mr. Tussman (F)

*124. Theory of Historical Inquiry. (5)
Three hours of lecture and one hour of consultation per week.

*125. Theory of Value. (5)
Three hours of lecture and one hour of consultation per week. The principles of evaluation in relation to both individual and social problems.
Mr. Rynin (Sp)

126A-126B. Aesthetics. (5)
Three hours of lecture and one hour of consultation 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. Mr. Vermazen (W)
126B. Literature and Music.

127. Philosophy of History. (5)
Three hours of lecture and one hour of consultation per week. Theories of history: Auguste価, Vico, Hegel, and others.
Mr. Scriven (W)

128. Political Philosophy. (5)
Three hours of lecture and one hour of consultation per week. Analysis of political obligation and related problems.
Mr. Tussman (F, W)

129. Aesthetic Theories. (5)
Three hours of lecture and one hour of consultation per week. A study of aesthetic theories based on historical and recent materials.
Mr. Aschenbrenner (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.

131. Metaphysics. (5)
Three hours of lecture and one hour of consultation per week.
Mr. Schiffer (Sp)

*132. Philosophy of Mind. (5)
Three hours of lecture and one hour of consultation per week. Mind and matter; other minds; the concept "person."

133A–133B. Philosophy of Language. (5–5)
Three hours of lectures and one hour of consultation per week.
133A. Mr. Searle (W); 133B. Mr. Schiffer (Sp)

134A–134B. Theory of Knowledge. (5–5)
Three hours of lecture and one hour of consultation per week.
134A. Mr. Stroud (W)

135. Philosophy and Linguistics. (5)
Three hours of lecture and one hour of consultation 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.
Mr. Staal (Sp)

*140A–140B. Philosophy of the Natural Sciences. (5–5)
Three hours of lecture and one hour of consultation per week.

141. Philosophy of the Social Sciences. (5)
Three hours of lecture and one hour of consultation per week. Philosophical problems arising in the social sciences, such as the nature and theory of explanation in the social sciences, nature and explanatory power of models, axiomatization, etc.
Mr. Scriven (F)
142. Probability and Induction, (5)
Three hours of lecture and one hour of consultation per week. Different approaches to the foundations of probability; inductive confirmation of scientific theories.

143A–143B. Logic, (5–5)
Three hours of lecture and one hour of consultation per week. Prerequisite: course 12A–12B or equivalent. Sequence beginning (F) Mr. Craig

144. Philosophy of Mathematics, (5)
Three hours of lecture and one hour of consultation per week. Foundations of mathematics: logicism, intuitionism, formalism. Set theoretical paradoxes, definition of number, problems of continuum. Mr. Chihara (F)

*145. Modal Logic, (5)
Three hours of lecture and one hour of consultation per week.

*146. Philosophical Logic, (5)
Three hours of lecture and one hour of consultation 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, (5)
Three hours of lecture and one hour of consultation per week. Aristotelian and Stoic logic; problems in medieval logic; Leibniz; the nineteenth century to Frede. Mr. Sluga (F)

*150. Anglo-American Philosophy, 1900–1945, (5)
Three hours of lecture and one hour of consultation per week.

151. Anglo-American Philosophy Since 1945, (5)
Three hours of lecture and one hour of consultation per week. (W)

152A–152B. Phenomenology and Existentialism, (5–5)
Three hours of lecture and one hour of consultation 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

155A–*155B. Philosophies of India, (5–5)
Three hours of lecture and one hour of consultation per week. Prerequisite: Philosophy prerequisite will be waived for students who have taken Linguistics 188A.
155A: The philosophies in India, Hindu as well as Buddhist, from the Vedic period until the present.
155B: Special emphasis on logic and the philosophy of language. Sequence beginning (F) Mr. Staal

*159. Semantics, (5)
Three hours of lecture and one hour of consultation per week Prerequisite: 8 units of Philosophy, or equivalent at the discretion of instructor. Recommended: an acquaintance with the truth-tables techniques of elementary propositional 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 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 prerequisite to courses in this group.

160A–160B. Plato, (5–5)
Three hours of lecture and one hour of consultation per week. Mr. Mates (F) Mr. Frede (W)

161. Aristotle, (5)
Three hours of lecture and one hour of consultation per week. Mr. Frede (Sp)

*168. Medieval Philosophy, (5)
Three hours of lecture and one hour of consultation per week.

*170. Descartes, (5)
Three hours of lecture and one hour of consultation per week.

*171. Hobbes, (5)
Three hours of lecture and one hour of consultation per week.

*172. Spinoza, (5)
Three hours of lecture and one hour of consultation per week.

173. Leibniz, (5)
Three hours of lecture and one hour of consultation per week. Mr. Sluga (Sp)

*174. Locke, (5)
Three hours of lecture and one hour of consultation per week.

175. Berkeley, (5)
Three hours of lecture and one hour of consultation per week. Mr. Mates (W)

176. Hume, (5)
Three hours of lecture and one hour of consultation per week. Mr. Stroud (F)

178A–*178B. Kant, (5–5)
Three hours of lecture and one hour of consultation per week. Mr. Aschenbrenner, sequence beginning (F)

*180. Philosophy of the 19th Century, (5)
Three hours of lecture and one hour of consultation per week.

*181. Classical American Philosophy, (5)
Three hours of lecture and one hour of consultation per week. Readings in A. B. Johnson, C. Peirce, W. James, J. Royce, G. Santayana, J. Dewey, and others.

182A–*182B. Marxism, (5–5)
Three hours of lecture and one hour of consultation per week. A critical appraisal of the philosophical
cal foundations and implications 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 development of Marxian thought.

182A: Mr. Hoffman (F)

*183. Materialism and Naturalism. (5)
Three hours of lecture and one hour of consultation per week. Historical and critical studies of the chief philosophical materialists from Democritus to Dewey.

*184. Nietzsche. (5)
Three hours of lecture and one hour of consultation per week.

191. Experimental Course. (1–5)
Topics to be announced. Mr. Hoffman (F); Mr. Follesdol (F); Mr. Kripke (W, Sp)

*191A. Computer Philosophy. (5)
Three 1½-hour lectures per week. Philosophical, social, and conceptual problems arising from computer science. Primary attention will be given to the simulation problems, but a number of other problems will be discussed. Mr. Dreyfus, Mr. Scriven (W)

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, submitting written work on topics designated by the tutor. (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. Vermazen (W)

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 79. Must be taken on a passed/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-

**PHYSICAL EDUCATION**

(Department Office, 103 Harmon Gymnasium)

Professors:

G. Lawrence Rarick, Ph.D.
Debold B. Van Dalen, Ph.D. (Chairman)
Anna S. Espenschade, Ph.D. (Emeritus)
Franklin M. Henry, Ph.D. (Emeritus)
Pauline Hodgson, Ph.D. (Emeritus)

Carl L. Nordly, Ph.D. (Emeritus)

Associate Professors:

Helen M. Eckert, Ph.D.
Mary Lou Norrie, Ph.D.
Joseph Royce, Ph.D.

NOTE: For key to footnote symbols, see page 78.
Assistant Professor:
Barbara J. Hoepner, Ph.D.

Supervisors:
Frances L. Bloland, M.S.
Kooman Boycheff, Ph.D. (Coordinator of Men's Intramural Sports and Recreation)
Lance Flanagan, Ed.D.
Harold J. Frey, Ph.D.
Charles J. Keeney, A.B. (Coordinator of Men's Physical Activities)
Chester W. Murphy, Ed.D.
Julius Pallfy-Alpar, Maître d'Armes
Robert J. Park, Ph.D. (Coordinator of Women's Physical Activities)
Frederica Bernhard, M.S. (Emerita)
Louise S. Cobb, Ph.D. (Emerita)

Lucile K. Czarnowski, M.S. (Emerita)
Marie H. Glass, A.B. (Emerita)
Ralph D. Miller, M.A. (Emeritus)
Heber A. Newsom, M.A. (Emeritus)
Charles A. Pease, A.B. (Emeritus)

Associate Supervisors:
Peter J. Cutino, M.S.
Alvin R. Kyte, M.A.
Joan Parker, M.A.
Doris White, M.A.
Eleanor E. Bartlett, A.B. (Emerita)

Assistant Supervisors:
C. Richard Crawford, M.A.
William Martell, M.S.
Kyung Min, M.E.
M. Kathryn Scott, M.A.

Departmental Major Advisers: for women, Miss Hoepner (sophomores), Miss Norrie (seniors), Miss Eckert (juniors); for men, --- (sophomores), and Mr. Boyce (juniors and seniors).

Graduate Advisers: Mr. Van Dalen, Mr. Rarick.

Teacher Education Advisers: for women, Miss Park and Miss White; for men, Mr. Flanagan.

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 esthetic nature. The role of athletics, dance and other physical activities, both historical and contemporary, in the United States and certain other cultures is examined.

The Major

Lower Division High School chemistry or equivalent; Elementary Statistics; Anatomy 104 and Physiology 1 (or equivalent) or Physiology 108A–108B and 109A; Physics 10; Psychology 1; Physical Education 1, 12, or 26. Recommended: History 4A or 4B, or 17A or 17B; Sociology 1.

Upper Division Physical Education 101, 135A, 105A–B, 110, 130, 120 or 140, 111 or 135B; 6 units selected from: Anthropology 140, 149, 152; Physiology 132, 152, 153; Psychology 140, 142; Sociology 148.

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 the Standard Teaching Credential with a major in physical education see the School of Education Bulletin. Work on an M.A. degree in physical education can be done concurrently.

Preparation for Graduate Study Students planning to continue toward the M.A. or doctorate degree should include course 135B in their programs. Related courses in anthropology, physiology, and psychology are recommended. Transfer students must complete the equivalent of the undergraduate major.

The Graduate Major

Course 200 is required of all graduate students. 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. A program of study with joint majors in education and physical education leads to the Ed.D. degree. Candidates for the latter degree 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 ice skating, 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 for Men. (½)

Sections meet two hours per week.

Sports Classes. Instruction in the following activities is offered to men in acceptable physical condition; aerobics, badminton, basketball, bowling, circuit training, diving, fencing, general conditioning exercise, golf, gymnastics, handball, judo, karate, lacrosse, soccer, squash, swimming, lifesaving, tennis, track and field, volleyball, weight training, and wrestling.

Sports Teams. Advanced instruction and coaching for intercollegiate competition in the following sports is open to men accepted by the intercollegiate team coach and the Student Health Service: baseball, basketball, crew, cross country, football, golf, gymnastics, rugby, swimming, soccer, tennis, track and field, water polo, and wrestling. A sport “in season” may be taken for one unit.

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

5. First Aid. (2)

One 1½-hour lecture and one 1½-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)

12. Physical Education Activities for Men and Women. (½)

Sections meet two hours per week. Instruction in the following activities is offered to men and women in acceptable physical condition.

Sports: archery, badminton, bowling, fencing, figure skating, golf, tennis, sailing, trampoline, and judo-karate.

Dance: modern, folk, ballet, and social.

Elementary School Activities: dance and games.

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

26. Physical Education Activities for Women. (½)

Sections meet two hours per week. Instruction in the following activities is offered to women in acceptable physical condition.

Sports: badminton, basketball, field hockey, golf, life saving, softball, soccer, tennis, swimming, volleyball and officiating.

General Exercise: apparatus, gymnastics, and rhythmic conditioning exercises.

Individual Exercise: aerobics, body mechanics, posture and fitness exercises adapted to individual needs.

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. Falify-Alpar (W)

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 25 (or 104) or equivalent (e.g. Physiology 108A-108B, 109A); Physics 10. Physical structure and muscular movements in various physical activities. Anatomical concepts and physical laws related to joint and muscle action.

Mr. Royce (F, W)
102. Adapted Physical Education. (3)

Two 1½-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.

Miss Norrie (Sp)

105A–105B. Physiological Hygiene. (4–4)

Three 1-hour lectures and one 3-hour laboratory per week. Prerequisite: Physiology 1 or Physiology 108A–108B and 109A. The physiology of exercise: diet, ventilation, training, fatigue, and health in relation to physical activity. Individual differences in cardiovascular and respiratory function. Limitations of work in relation to altitude and climate.

105A (F, Sp) 105B (W)

110. Psychologic Bases of Physical Activity. (4)

Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: Psychology 1, course 135A. Perception, motivation, learning, and emotion as factors in physical activity; reaction time and coordination; the psychology of competition.

Miss Eckert (F, W)

111. Motor Development. (3)

Three 1-hour lectures per week. Prerequisite: Psychology 1, course 135A. 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 Norrie and Miss Hoepner (Sp)

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.

(W); Miss Hoepner (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.

Miss Hoepner (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.

Mr. Rarick (W)

135A–135B. Measurement and Evaluation in Physical Education. (4–4)

135A. Three 1-hour lectures and 2 hours of laboratory per week. Prerequisite: a course in elementary statistics.

Miss Eckert (F, Sp)

135B. Three 1-hour lectures per week and one 3-hour 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.

Miss Hoepner (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. Bioland (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)

165B. 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.

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 25. 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 (W)

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 (Mr. Van Dalen 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.

Mr. Van Dalen (F, W, Sp)

199. Supervised Independent Study and Research for Undergraduates. (1–5)

Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis.

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

Mr. Flanagan (Sp)

Graduate Courses

200. Seminar in Physical Education. (3)

One 3-hour meeting per week. Critical review of literature and research methods. Mr. Rarick (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 (Sp)

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. (F, W)

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 (W, Sp)

PHYSICS

(Department Office, 366 LeConte Hall)

Professors:

Luis W. Alvarez, Ph.D.
Kinsey A. Anderson, 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. Fetterer, Ph.D.
Donald A. Glaser, Ph.D.
Gerson Goldhaber, Ph.D.
Irwin L. Hahn, Ph.D.
August C. Helmholtz, Ph.D.
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.
Stanley Mandelstam, Ph.D.
Richard Marrus, Ph.D.
Forrest S. Mozer, Ph.D.
Alan M. Fortis, Ph.D.
P. Bu ford Price, Ph.D.
Frederick Reif, Ph.D.
John H. Reynolds, Ph.D.
Paul L. Richards, Ph.D.
Arthur H. Rosenfeld, Ph.D.
Rainer K. Sachs, Ph.D.

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. Rarick (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. Administration of Physical Education. (3)

One 3-hour meeting per week. Prerequisite: course 131. Administrative and curricular problems in physical education.

Mr. Van Dalen (Sp)

290. Research. (2-6)

Hours to be arranged.

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

298. 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 (Mr. Van Dalen 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 (Mr. Van Dalen 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 (Mr. Van Dalen in charge) (F, W, Sp)

NOTE: For key to footnote symbols, see page 78.
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, and Chemistry 1A–1B, or preferably Chemistry 4A–4B. Those who have taken a substantial chemistry course in high school need not take the chemistry courses.

The physics major includes the following courses: Physics 105A, 105B; Physics 110A, 110B, 110C; Physics 112; Physics 137A, 137B; Physics 111A, 111B, 111C (two of the three courses); 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, 152, and Atmospheric and Space Sciences 150. 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 three quarters of Physics H190, and the recommendation of the departmental advisers. Special research work, which may be taken as Physics 199, may be substituted for one or two quarters of Physics H190.

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. Mollenauer.

Field Major in Physical Sciences Students interested in this major please see Natural Science page 347 for the 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 210ABC and 221ABC 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, 11A–11B, and Natural Science 1A–1B–1C are 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, 11A–11B, and Natural Science 1A–1B–1C should have completed trigonometry.

*Contemporary Natural Science (Natural Science 1A–1B–1C). (4–4–4)

Three 1-hour lectures and two hours of discussion and/or laboratory per week. This course, intended primarily for students who are not majoring in one of the natural sciences, is an integrated presentation spanning the areas of physics, chemistry, and biology. It is designed to stress fundamental concepts, to indicate what modern scientists do, and to point out occasional philosophical or social implications.

Credit for this course will be given ordinarily only if all three quarters are passed by the student, and if the student has had no prior college course in either physics, chemistry, or the following courses in the biological sciences; Biology 1A,B,C, Biology 11A,B, Botany 10, Physiology 10, and Zoology 10. Exceptions can be made with consent of instructor upon approval of the Dean. If all three quarters are completed successfully, the course will satisfy four courses for the Letters and Science breadth requirement.

Physics 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. Helmholtz, Mr. Sachs (F, W, Sp)

**Physics 4B. Physics for Scientists and Engineers. (3)**

Three 1-hour lectures and one 1-hour discussion section per week. **Prerequisite: course 4A, Mathematics 101 should be taken concurrently.** Electrodynamics, conductors and currents, magnetic fields and induction, Maxwell's equations.

Mr. Kip, Mr. Rosenfeld (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. Davis, Mr. Kip, Mr. Portis (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, Mr. Morrison, Mr. Portis (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. Rochlin, Mr. Price (F, W, Sp)

**6A–6B–6C. Introductory Physics. (4–4–4)**

Four 1-hour lectures per week, five 3-hour laboratories per quarter. **Prerequisite: Mathematics 16A, Mathematics 190A, or consent of instructor.** An introductory physics course using the rudiments of calculus and covering mechanics, electricity and magnetism, optics, heat, thermodynamics, atomic and nuclear physics. Topics of biological interest will be emphasized. Laboratory work to accompany the lectures. Students with credit for Physics 2A, 2B, or 2C will receive 2 units of credit for 6A, 6B, or 6C. Students with credit in Physics 4 will not receive credit in corresponding quarters of Physics 6.

Sequence beginning (F, Sp)

Mr. Ely, Mr. Reif, Mr. Mozer

**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 2A–2B–2C, 4A–4B–4C–4D–4E, 6A–6B–6C, 11A–11B, Natural Science 1A–1B–1C, or equivalent. A brief presentation of some of the more important phenomena in physics, with experimental illustrations.

Mr. Karplus, Mr. Rochlin (F, W, Sp)

**11A–11B. Foundations of Physical Science. (4–4)**

Three 1-hour lectures and one 3-hour laboratory period per week. To receive credit toward the natural sciences requirement of the College of Letters and Science, both quarters must be completed. Not ordinarily open for credit to students who have completed other courses in the departments of Chemistry and Physics. Students who have completed Physics 10 may receive 4 credits on completion of Physical Sciences 11A–11B.

Selected topics in basic physics and chemistry which relate to a central theme in physical science. Basic topics have included Newtonian mechanics, electromagnetism, relativity, thermodynamics, kinetic theory, quantum theory, physical optics, X-rays, crystals, stoichiometry, chemical reactions. Themes have included interactions between radiation and matter, the solar system, the atmosphere. Necessary mathematics is introduced. Not given every year.

Sequence beginning (F) Mr. Reynolds


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. Karplus (Sp)

**105A–105B. Analytic Mechanics. (3–3)**

Statics, oscillations, central force problems, motion 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. Thornton

**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 the application; laboratory work to accompany the lectures.

Mr. Crawford (W)

**110A–110B–110C. Electromagnetism and Optics. (3–3–3)**

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. Ross, Mr. Sachs, Mr. Trilling

111. Modern Physics and Advanced Electrical Laboratory. (3)

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. Shugart, 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. Jeffries, Mr. Kittel, Mr. Commins (F, W, Sp)

115. Introduction to Quantum Mechanics. (4)

Prerequisite: courses 105A or 116A–116B–116C and Physics 121. The classical background, basic ideas, and methods of quantum mechanics, with applications to atomic physics.

Mr. Fetter (W)


Three hours of lecture per week. Prerequisite: courses 6A–6B–6C, Mathematics 16A–16B–16C, or the equivalent. Not open for credit to those with credit in 4A–4B–4C. This sequence satisfies the prerequisite for course 121. Vector mechanics, invariances and conservation laws; applications, including central forces, motion of charged in fields; small oscillations. Special relativity; electrodynamics, magnetostatics, electromagnetic induction; circuits; transients and forced oscillations. Maxwell’s equations; waves, linear superposition, wave equation; reflection, interference and diffraction; waves in material media; dielectrics; acoustic and electromagnetic waves. (Sequence beginning F) Mr. Kerth

121. Introduction to Atomic Physics. (4)

Prerequisite: course 4A–4B–4C–4D–4E or 116A–116B–116C. Intended primarily for engineers. The phenomena of atomic physics, introduction to quantum mechanics; selected topics dealing with nuclei, atoms, molecules, and the solid state.

Mr. Fetter, Mr. Shapiro (F, W Sp)

124. Introductory Nuclear Physics. (4)

Prerequisite: course 137A or 121. 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. Stevenson (F, Sp)

29A–129B. Nuclear Physics Sequence

Course. (4–4)

Prerequisite: course 137A and 137B. Thorough coverage of nuclear physics, employing the elements of quantum mechanics; mesons and high energy phenomena. Sequence beginning (W)

Mr. Segre, Mr. Crowe

132. Modern Physics. (4)

Prerequisite: course 6A–6B–6C, 11A–11B, or equivalent 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. Helmholtz (Sp)

137A–137B–137C. Quantum Mechanics and its Applications to Atomic Physics. (3–3–3)

It is recommended that course 105A be taken concurrently with course 137A. 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. Mollenauer, Mr. Richards, Mr. Segre

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 semiconductor crystals. Dielectric, thermal, magnetic, conductive, and mechanical properties. Superconductivity, ferromagnetism, defects in solids.

Mr. Kip, Mr. Jeffries (W)

141A–141B. Solid-State Physics. (4–4)

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. Kunkel (W)

*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. Kunkel (Sp)

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.

(F, W)

H190. Physics Honors Course. (2)

A seminar 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)

Mr. Halpern, Mr. Judd, 205A. (F, W); 205B. (W, Sp)

205A–205B. Advanced Dynamics. (2–3)


Mr. Halpern, 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. Davis (F)


Three hours of lecture per week. Prerequisite: Physics 208 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. Shen


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. Halpern, 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. Hahn, 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.

Mr. Watson (Sp)

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. Steiner

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. Sachs, Mr. Wichmann (F, Sp)

223. Group Theory and Quantum Mechanics. (4)

Three hours of lecture per week. Prerequisite: 221A–221B–221C, or consent of 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)

224A–224B–224C. Dynamics of Strong Interactions. (3–3–3)

Prerequisite: the equivalent of 221A and 221B and of either 124 or 129A. Completion of, or at least concurrent registration in, 221C is recommended. The theory of strong nuclear interactions, beginning with the basic conservation laws and symmetries, and describing hadrons both stable and unstable, their origins and mutual interactions, first in the framework of nonrelativistic theory and leading to the relativistic S-matrix based on analyticity and unitarity.

Sequence beginning (F) Mr. Suzuki


Prerequisite: course 221A–221B–221C or the equivalent. 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. Bardakci, Mr. Halpern

231. Theory of General Relativity. (4)

An introduction to Einstein’s theory of gravitation with applications to cosmology and astrophysics.

Mr. Sachs, Mr. Wichmann (F)


Three hours of lecture per week. Prerequisite course 221A–221B and course 141A–141B or the equivalents; or consent of instructor. Phonon, magnon, plasmon, polaron, and electron fields in solids and their interactions; superconductivity, many-body techniques; Green’s functions; Brillouin zone
and symmetry; excitons; impurity states; transport processes; Fermi surfaces; neutron scattering; recoilless emission; theoretical methods in magnetism.

Sequence beginning (F) Mr. Cohen

Prerequisite: course 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.

Mr. Kaufman

245A–245B–245C. Elementary Particles and Resonances. (3–3–3)
Prerequisite: course 221A–221B–221C (221C may be taken concurrently with 245A). Theories and phenomenology of strong and weak interactions. Classification of the properties of elementary particles and resonances according to mass, spin, parity, isotopic spin, unitary spin. Systematization of experimental data on particle production and decay. One quarter is customarily devoted entirely to weak interactions.

Sequence beginning (F) Mr. Jackson

246. Topics in Scattering Theory. (4)
Prerequisite: course 221A–221B–221C or consent of instructor. Wave packets and asymptotic fields; rearrangement collisions, analytic structure of scattering matrices, application of variational principles.

Mr. Schwartz (Sp)

248. Selected Topics in Astrophysics. (3)

Mr. Commins (W)

250. Special Topics in Physics. (2–3)
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. Goldhaber (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 necessarily to be given every quarter.

Mr. Chinowsky (F, W, Sp)

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 nonlaboratory 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 requirements for the doctoral degree. Must be taken on a satisfactory/unsatisfactory basis.

The Staff (F, W, Sp)

MEDICAL PHYSICS (see page 336)

PHYSIOLOGY–ANATOMY (Department Office, 2549 Life Sciences Building)

Professors:
Forace Barlow, M.D.
Valter J. Freeman, M.D. (Chairman)
Jardin B. Jones, Ph.D.
Robert J. Macey, Ph.D.
Gello Pacey, Ph.D.
ester Packer, Ph.D.
awson L. Rosenberg, Ph.D.
Gola S. Timiras, M.D., Ph.D.
erald Westheimer, Ph.D.

OTE: For key to footnote symbols, see page 78.
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.

The Major Biology 1A–1B–1C (5–5–5); Chemistry 1A–1B (4–4), 8A–8B (4–4); Mathematics 1A–1B–1C (4–4–4) recommended, or 16A–16B (4–4); Physics 6A–6B–6C (4–4–4); Physiology 101A–B–C (3–2–2), 102A–B–C (4–3–2), 103A–B–C (3–3–3); 3 additional upper division or graduate courses, which will include two in the department and one in a related biological science. Recommended: 3 additional quarters of course work in either physics, mathematics, or chemistry.

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.

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 14 (3), 109 (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 three languages: French, German, Russian. 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.

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–1C (5–5–5); 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). An adequate reading knowledge of either French or German is also required.

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 101A–B–C (3–2–2); 102A–B–C (4–3–2); 103A–B–C (3–3–3); Biochemistry 102 (4). An adequate reading knowledge of both French and German 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.

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

### Physiology

#### Lower Division Courses

1. **Introductory 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. (Su); (Sp)

2. **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. Land, Mr. Steinbach (F)

#### Upper Division Courses

1. **General Physiology. (3)**
   - Three 1-hour lectures per week. **Prerequisite:** one year of calculus, Biology 1A. Recommended: Physics Chemistry 109. Applications of thermodynamics and kinetics to mass and energy transport problems in physiology. Emphasis on metabolism, membrane transport, secretion, and bioelectricity. Mr. Macey (F)

2. **Cell Physiology. (2)**
   - Two 1-hour lectures per week. **Prerequisite:** Biology 1A, 1B, 1C. Recommended: Biochemistry 102. The structure and function of cells and their organelles. Mr. Satir (F)

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**101C. Cell Physiology Laboratory. (2)**

One 4½-hour laboratories per week. **Prerequisite:** concurrent or previous enrollment in Physiology 101 (A or B) or Zoology 104. Mr. Macey, Mr. Satir (F)

**102A. Mammalian Physiology. (4)**

Three 1½-hour lectures per week. **Prerequisite:** Biology 1A, B, C. Physics 6A, B, C or equivalent. Detailed study of the physical and chemical basis of cardiovascular, respiratory, gastrointestinal, renal, and metabolic function. Mr. Rosenberg in charge (W)

**102B. Histophysiology. (3)**

One 1½-hour lecture and 4½-hour laboratory per week. **Prerequisite:** Biology 1A, B, C. Discussion and practical examination of fresh and preserved histological material from cardiovascular, respiratory, gastrointestinal, renal, and integumentary systems of the mammal. Mr. Evans (W)

**102C. Mammalian Physiology Laboratory. (2)**

One 4½-hour laboratory per week. **Prerequisite:** Physiology 102A should be taken concurrently. Mr. Rosenberg in charge (W)

**103A. Endocrinology. (1)**

One 1½-hour lecture per week. **Prerequisite:** Physiology 102A, B, C. Detailed study of the function and structure of the endocrine control systems of the body. Mr. Rosenberg (Sp)

**103B. Neuroanatomy. (1)**

One 1½-hour lecture per week. **Prerequisite:** Physiology 102A, B, C. Detailed study of the structure and function of the nervous system. Mrs. Diamond (Sp)

**103C. Neurophysiology. (1)**

One 1½-hour lecture per week. **Prerequisite:** Physiology 102A, B, C. Detailed study of the structure and function of the central nervous system. Mr. Freeman (Sp)
103L. Neural and Endocrine Control Mechanisms

Laboratory. (2, 4, or 6)

Maximum nine hours of laboratory per week. Prerequisite: Physiology 103A–103B–103C to be taken concurrently. May be repeated for credit up to a maximum of six units.

Mr. Freeman, Mr. Rosenberg


(4–4)

Three 1½-hour lectures per week. Prerequisite: Chemistry 1A–1B. Mechanisms of life processes by the study of integrated structure and function of cells, tissues and organ systems. Emphasis will be placed on man. Fall: Focus on Anatomy. Winter: Focus on Physiology.

Mr. Barlow, Mrs. Diamond, Mr. Land (F, W)

109A–109B. Introductory Anatomy and Physiology,

Laboratory. (2–2)

One 3-hour laboratory, and one 1½-hour recitation per week. Prerequisite: course 108A and 108B should be taken concurrently. Laboratory experiments demonstrating the structural features and functional mechanisms underlying life processes in mammalian systems. Fall: Focus on Anatomy. Winter: Focus on Physiology.

Mr. Barlow, Mr. Satir, Mr. Land (F, W)

*110. Introduction to Neurobiology. (3)

Three 1-hour lectures per week. Prerequisite: Biology 1A–1B–1C 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, B, C 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. Dobson (Sp)

123L. Comparative Physiology, Laboratory. (4)

One 8-hour laboratory per week at the Bodega Marine Laboratory for the first third to one-half of the quarter. The remainder of the quarter will be devoted to individual research projects. Prerequisite: course 123 should be taken concurrently.

Mr. Jones, Mr. Dobson, Mrs. Kelly (F)

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. Face (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)

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.

Mr. Freeman (F, W, Sp)

198. Directed Group Study. (2–3)

The Staff (F, W, Sp, Su I)

199. Supervised Independent Study and Research. (1–5)

Enrollment is restricted by regulations listed on page 79. 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 (Mr. Freeman in charge) (F, W, Sp)

Graduate Courses

202. Neural Integration and Coordination. (3)

Three 1½-hour lectures each week. Prerequisite: Zoology 225, Physiology 201, or consent of 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 and coordination in learning and ontogeny. Outlines available.

Mr. Land, Mr. Barlow (Sp)

202L. Advanced Laboratory in Neural Integration and Coordination. (3)

One 4½-hour laboratory per week. Prerequisite: Zoology 225, Physiology 202 (may be taken concurrently) or consent of instructor. Advanced laboratory involving use of electrophysiological and psychophysical tools in the investigation of neural integration and coordination. Prospective students should consult instructors before considering this course.

Mr. Barlow, Mr. Land (Sp)

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: Physiology 101–103 or equivalent, e
216. Seminar in Neuroendocrinology. (2)
One and a half hours of lecture per week. Prerequisite: Physiology 101–103, Physiology 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: Physiology 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)

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)

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 organismic 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.
The Staff (Mr. Freeman 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 (Mr. Freeman in charge) (Su, F, W, Sp)

491. Physiological Surgery. (2)
One 4½-hour laboratory per week. Prerequisite: courses 103, and graduate standing in physiology, or consent of the instructor. Techniques of anesthesia and sterile surgical procedure, with practice in making special physiological research preparations.
Mr. Pace (F)

492. Physiological Instrumentation—Mechanical. (4)
Two 4½-hour laboratories 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. Packer (W)

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 (Mr. Freeman in charge) (Su, F, W, Sp)

Anatomy

Upper Division Courses

104. Functional Human Anatomy. (4)
Two 1½-hour lectures, and one 4½-hour laboratory per week. Prerequisite: a college course in biology or chemistry. Prepared human dissections, models and microscopic preparations.
——— (Su)

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 79. 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)
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)
William C. Snyder, Ph.D.
William N. Takahashi, Ph.D.
Stephen Wilhelm, Ph.D.
Cecil E. Yarwood, Ph.D.
Peter A. Ark, Ph.D. (Emeritus)
Max W. Gardner, Ph.D., D.Sc. (hon. c.) (Emeritus)
Thomas E. Rawlins, Ph.D. (Emeritus)
H. Earl Thomas, Ph.D. (Emeritus)

Associate Professors:
Field: W. Cobb, Jr., Ph.D.

Undergraduate Adviser: Mr. Weinhold.
Graduate Advisers: Mr. Cobb, Mr. Gold, Mr. Hancock.

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.

NOTE: For key to footnote symbols, see page 78.
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.

**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. Forest Pathology. (3)
Lecture, 1 hour per week; laboratory, 6 hours per week. Prerequisite: Biology 1A–1B–1C. Diseases of forest plants. Mr. Cobb (Sp)

120. Plant Diseases. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: Biology 1A–1B–1C or consent of instructor. A general course on the nature, cause, and control of plant diseases. Mr. Raabe (F)

198. Directed Group Study. (1–5)
Prerequisite: consent of instructor. Special topics will be offered from time to time.
The Staff (Mr. Hancock in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis. The Staff (Mr. Weinhold in charge) (F, W, Sp)

IDS 10A–10B–10C. Man and His Environment—Crises and Conflict. (4–4–4)
See Interdepartmental Studies for complete description of this course.

IDS. 136. Biological Deterioration of Wood. (3)
See Interdepartmental Studies for a complete description of this course.

Graduate Courses

201. Seminar in Plant Pathology. (1)
The Staff (F, W, Sp)

202. Fungi in Relation to Plant Diseases. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 120 and consent of instructor. Advanced study of fungi as plant pathogens, with special emphasis on structural and ecological adaptations, patterns of behavior and distribution, mechanisms and significance of variability, and problems in collection, cultivation, and identification. Mr. Parmeter (W)

204. Bacteria in Relation to Plant Diseases. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 120; Biochemistry 102; Bacteriology 2 or consent of instructor. Biology and pathogenesis of bacterial diseases of plants. Mr. Schroth (Sp)

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. Mr. Gold (Sp)

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. Mr. Schlegel (W)

210. Plant Disease Control. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. Prerequisite: course 120. Dosage relations; graphic methods; control by exclusion, eradication, protection, immunization, and therapy. Mr. Yarwood (F)

212. Advanced Plant Pathology. (4)
Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: course 120. Principles broadly applicable to fungus, bacterial, virus, and nutritional diseases of plants. Mr. Wilhelm (W)

214. Ecology of Plant Diseases. (4)
Lectures, 3 hours per week; laboratory, 3 hours per week. Prerequisite: course 120 and consent of instructor. Principles emphasizing the relationship of the physical and biological environment. (Sp)
### 216. Physiology of Plant Pathogens. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. **Prerequisite:** Chemistry 5 and 8A–8B, or equivalent. **Recommended:** Botany 140; Biochemistry 102. Physiology and biochemistry of plant pathogenic fungi.
Mr. Hancock (F)

### 218. Physiology of Plant Diseases. (4)
Lectures, 2 hours per week; laboratory, 6 hours per week. **Prerequisite:** Chemistry 5 and 8A–8B, or equivalent. **Recommended:** Botany 140; Biochemistry 102. Physiology and biochemistry of host-pathosite relations.
Mr. Weinhold (W)

### 220. History and Literature of Plant Pathology. (4)
Lectures, 4 hours per week. **Prerequisite:** consent of instructor. The development of concepts in plant pathology.
Mr. Baker (F)

### 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.
Mr. Snyder, Mr. Weinhold (F, Sp)

## POLITICAL SCIENCE
(Department Office, 210 Barrows Hall)

### Professors:
- Eric C. Bellquist, Ph.D.
- Reinhard Bendix, † Ph.D.
- Ernst B. Haas, Ph.D.
- Warren F. Ilchman, Ph.D.
- Norman Jacobson, Ph.D.
- Chalmers A. Johnson, Ph.D.
- Victor Jones, † Ph.D.
- Eugene C. Lee, † Ph.D.
- George Lenczowski, LL.M., J.S.D.
- Albert 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)
- 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:
- Robert M. Axelrod, † Ph.D.
- Robert L. Ayres, Ph.D.
- William E. Bicker, † Ph.D.
- Gaylor M. Bonham, Ph.D.
- Jacob Citrin, M.A.
- Kenneth T. Jowitt, Ph.D.
- Todd R. La Porte, Ph.D.
- Michael A. Leiserson, † Ph.D.
- Andrew S. McFarland, † Ph.D.
- J. Merrill Shanks, Ph.D.
- Ralph H. Retzlaff, Ph.D.
- Michael P. Rogin, Ph.D.
- Peter W. Sperlich, Ph.D.

### Associate Professors:
- Wilfrid E. Rumble, Jr., Ph.D. (Visiting)

### Assistant Professor:
- David H. Tabb, Ph.D. (Visiting)

### Assistant Professors:
- George W. Breslauer, M.A. (Acting)
- Abdul A. Jalloh, Ph.D. (Visiting)
- Robert M. Price, M.A. (Acting)
- John B. Starr, M.A. (Acting)

### Lecturers:
- William H. Gardner, † M.S.
- Samuel H. Kentner, M.A.
- Gail W. Lapidus, M.A.
- Stefan A. Riesenfeld, LL.B., Dott. in giur., S.J.D.
- Leo E. Rose, Ph.D.

**NOTE:** For key to footnote symbols, see page 78.
The American Institutions Requirement  
This requirement may be satisfied by completing an approved course, or by passing an examination. See page 22.

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 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.

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 hours of lecture and one 2-hour seminar per week. Prerequisite: two courses in lower division political science, or consent of instructor. Major themes in the study of politics. (F, 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. Kernell (F, W); ———— (Sp)

103A–103B–103C. American Studies. (5–5)  
One 1-hour lecture and one 2-hour seminar per week. Prerequisite: open to sophomores; limited to ten 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 103A–103B–103C and History 103A–103B–103C).

(F, W, Sp)

1. Experimental Course. (1–5)  
Prerequisite: consent of instructor. Topics, experimental in nature, will vary from year to year.

Upper Division Courses

101A–101B. Political Inquiry. (5–5)  
Three hours of lecture and one hour of conference per week. Prerequisite: preenrollment; enrollment in full two-quarter sequence with same instructor. 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. Credit and grade will be awarded upon completion of the full sequence.

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 theForeign 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.

108. The American Legislative Process. (5)  
Two 1½-hour lectures and one 1-hour conference per week. A study of the organization and functioning of the legislative bodies, with particular attention to Congress and state legislatures; functions; membership; committee system; executive-legislative relations; pressure groups; lobbying; movement for reform.

Mr. Wolfinger (F)

109. The American Legal System. (5)  
Two 1½-hour lectures and one 1-hour conference per week. The nature of the American legal system; the interrelationships of judges, lawyers, police,
110. State Governments. (5)
Two 11/2-hour lectures and one 1-hour conference per week. Comparative study of politics in American states, federal-state relations, elections; policies; administrative problems.

111A–111B. Urban Government and Politics. (5–5)
Two 11/2-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, Sp)

112. Basic Problems in American Government. (5)
Two 11/2-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.

(F, W, Sp)

113A–113B. American Political Theory. (5–5)
Two 11/2-hour lectures and one 1-hour conference per week. Prerequisite: 113A: consent of instructor. 113B: 111A or consent of instructor. Basic problems of political theory as viewed within the context of American history and institutions. Mr. Regin (W, Sp)

Mr. Jones (W, Sp)

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. Rumble (F)

118B. Early modern theories up to the French Revolution, including Machiavelli, Hobbes, Locke, and Rousseau. Mr. Rumble (W)

118C. Modern theories of the nineteenth century including Hegel, Burke, the Utilitarians, and Marx. Mrs. Pitkin (W)

118D. Recent and contemporary political theories. Mrs. Pitkin (Sp)

120. International Relations. (5)
Two 11/2-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. Waltz (F); Mr. Bonham (W); Mr. Jalloh (Sp)

Mr. Bonham (F)

122A–122B. International Law. (5–5)
Two 11/2-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; jurisdiction over places and persons. Diplomatic and consular intercourse; treaties and executive agreements; pacific settlement; war and neutrality. Mr. Riesenfeld (F, Sp)

123. Regional Communities. (5)
Two 11/2-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.

Mr. Jalloh (Sp)

Two 11/2-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 (F)

128. American Foreign Policy. (5)
Two 11/2-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.

Mr. Seabury (W)

129. Soviet Foreign Policy. (5)

Mrs. Lapidus (Sp)

139. Totalitarianism and Dictatorship. (5)
Two 11/2-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. Jowitt (Sp)

140A–140B. Comparative Analysis of Political Systems. (5–5)
Two 11/2-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.

Mr. Jowitt (W); Mr. Price (Sp)

141A–141B. Government and Politics in the Soviet Union. (5–5)
Two 11/2-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.
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.” Mr. Jowitt (F)

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; terms and concepts, nationalism, existentialism and democratic theory.

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, Sp)
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. Johnson (F, W); Mr. Starr (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.

44. 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)

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.
Mr. Das Gupta (W); Mr. Retzlaff (Sp)

145C–145D. American Role in Southern 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 in Asiatic Westernization, United States-Far Eastern foreign policy, Oriental attitudes towards America. Evaluation of present-day problems.
Mr. Scalapino (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. Starr (F)

146A–146B. Government and Politics in Africa. (5–5)
Two 1½-hour lectures and one 1-hour conference per week.
146A. Introduction to African Politics. Social, economic, and political change in pre-independence Africa. Focus on aspects of pre-independence period which influences 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 polity, 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 conference 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.
Mr. Price (Sp)

147A–147B. Government and Politics in Western and Northern Europe. (5–5)
147A. Two 1½-hour lectures and one 1-hour conference per week. An analysis of political behavior and institutions in continental western Europe, focused on selected countries, areas, issues, or analytical problems.
147B. 4½-hours per week. Constitutionalism and
parliamentarism in the Scandinavian states—Denmark, Finland, Iceland, Norway, and Sweden. Constitutional history and present governmental history and present governmental systems. Inter-Scandinavian cooperation. Mr. Bellquist (Sp)

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.
Mr. Ayres (F, W)

150. 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.
Mr. Rumble (Sp)

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 (W, Sp)

160. Social Groups and Political Power. (5)
Two 1½-hour lectures and one 1-hour conference per week. Analytical, 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 affiliation, leadership, participation, personality factors, public opinion, and group influence processes.
Mr. Citrin (F, W)

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 instrumentalties of opinion formation. Our overseas information programs. Stress upon political implications.
Mr. Bellquist (F, W)

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–164C. Comparative Political Behavior. (5–5–5)
Two 1½-hour lectures and one 1-hour conference per week. Comparison of styles of political behavior within advanced and developing nations. Attention will be given to similarities and differences between types of Western and non-Western polities.

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.

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. Ilichman (W); Mrs. Marshall, Mr. LaPorte (Sp)

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.

185. 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.
Mrs. Marshall, Mr. LaPorte (W)

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 (Sp)

H190A–H190B–H190C. Honors Program. (5–5–5)
Three hours to be arranged (seminar, tutorial, or both). Prerequisite: seniors with honors standing. Offerings in 1971–72 will be announced from departmental undertaker office. Last quarter may be devoted to writing senior thesis. Credit and grade awarded upon completion of full sequence.

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 at least 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 79. 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

200A–200B. Theories for Comparative Analysis. (4–4)

One 2-hour session and one 1-hour conference per week. Prerequisite: enrollment in full two-quarter sequence. Credit and grade will be awarded upon completion of the full sequence. 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 clientele of parties; the relation of party systems to constitutional focus; the comparative study of interest groups.

Mr. Lipson (W, Sp)

202A–202B. Comparative Analysis of Developing 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 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. Julloh (W); Mr. Retzlaff (Sp)

203A–203B. Comparative Analysis of Communist Political Systems. (4–4)

One 2-hour session and one 1-hour conference per week. An analysis of the interrelations between Communist systems with particular reference to institutional and ideological differences, presented at an advanced level for graduate students. Discussion and papers required.

Mr. Starr (W, Sp)

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.

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.

Mr. Jacobson (Sp)

218A–218B–218C. Colloquium in Political Theory. (4–4–4)

One 2-hour session and one 1-hour conference per week. Required of all theory majors. 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.

219A. Perspectives in Political Theory. (4)

One 2-hour session and one 1-hour conference per week. Politics and political theory as science.

Mr. Jacobson (F)

SEMINARS

214A–214B–214C. Themes in Western Political Theory. (4–4–4)

One 2-hour session and one 1-hour conference per week. Theme to be specified each year.

Mrs. Pitkin (F, W)

215. Marxist Theory. (4)

One 2-hour session and one 1-hour conference per week.

219B. Perspectives in Political Theory. (4)

One 2-hour session and one 1-hour conference per week. Politics and political theory as art.

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 and one 1-hour conference per week. Strategic-military, political, economic, and cultural aspects of American foreign policy.
Mr. Seabury (W)

222. Nationalism and Imperialism. (4)
Two 1 1/2-hour sessions and one 1-hour conference per week. Themes in the theory of nation-building, illustrated with Western and non-Western case studies.
Mr. Haas (Sp)

One 2-hour session and one 1-hour conference per week. Survey of methods applicable to systematic research in international relations, with emphasis on quantitative techniques. Relationship between research techniques, research concepts and theory-building in international politics.
Mr. Bonham (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.
Mr. Haas (F)

*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 (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.
Mr. Seabury (Sp)

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.

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.
240C: Mr. Bellquist (Sp)

241A-241B-241C. Soviet and East European Government. (4-4-4)
One 2-hour session and one 1-hour conference per week.

241A. Theoretical perspectives relevant to the study of established Communist regimes in the Soviet Union and East Europe. Concepts of power and political change, problems of studying elites, bureaucracies, interest groups and the fundamental principles of political organization.
Mr. Jowitt (F)

241B. Prerequisite: 241A. Selected topics of Soviet government and politics focusing on the critical analysis of the political process, the character of the elite, and the relationship between political system and society.
Mr. Breslauer (W)

241C. Prerequisite: 241A. Communist government in East Europe (defined as the area between the Soviet Union and West Germany) with emphasis on growing ideological and institutional diversity. The relationship between nationalism, economic development, and political change.
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.

242A. Prerequisite: Statistics 130A or its equivalent. Introductory course in the analysis of political data.

242B. Prerequisite: 242A. Advanced course in the analysis of political data.

*242C. Political Thought in the Middle East. (4)
One 2-hour session and one 1-hour conference per week. Historical survey and analysis of Turkish, Arab,
243A–243B. Contemporary Problems of the Far East. (4-4)

One 2-hour session and one 1-hour conference per week.
Mr. Schr (F); Mr. Scalapino (Sp)

243C–243D. Political Problems of Southeast Asia. (4-4)

One 2-hour session and one 1-hour conference per week.

244A–244B. China. (4-4)

One 2-hour session and one 1-hour conference per week.
Mr. Johnson (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. Rose (W); Mr. Das Gupta (Sp)

246A–246B. African Politics. (4-4)

One 2-hour session and one 1-hour conference per week.
Mr. Rosberg (F, W)


One 2-hour session and one 1-hour conference per week.
247A–B, Mr. Rognin (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. Indian Political Thought. (4)

A study of significant concepts and trends in Indian political thought, with reference to traditional and European influences, and to the contributions of Indian leaders. Attention will be given to nationalism, Hindu polity, Marxist theory, indigenous "socialism," liberal and humanist elements.

249B. Social and Political Change in South Asia. (4)

An exploration of theories of social change as they relate to political developments in India, Pakistan, and the Himalayan Border States, with emphasis upon India.

Public Law and Jurisprudence

SEMINARS

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.

257C. Constitutional and Administrative Law. (4)

One 2-hour session and one 1-hour conference per week. Fundamental principles of constitutional law; leading cases; judicial decisions affecting the liabilities, rights, duties, and procedures of governmental officers and agencies.

Political Behavior (American and Comparative)

COURSES

261A–261B–261C. Political Behavior. (4-4-4)

One 2-hour session and one 1-hour conference per week. Prerequisite: previous work in 261A–261B–261C, or equivalent courses. 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 full sequence.

262A. Problems of political analysis in the American political system. 262B. Selected topics on the relation of groups to politics.

262D. Parties, Public Opinion, and Interest Groups. (4-4)

One 2-hour session and one 1-hour conference per week. 262A. Problems of political analysis in the American political system. 262B. Selected topics on the relation of groups to politics.

Mr. Wolfinger (W, Sp)

SEMINARS

263A–263B–263C. Research Seminar in Political Behavior. (4–4–4)

One 2-hour session and one 1-hour conference per week. Prerequisite: 261A–261B–261C or 261A–261B–261C. Research seminar on selected topics in political behavior, and the preparation of a research report.

265A–265B. Special Topics in Political Behavior. (4–4)

One 2-hour session and one hour of conference per week. Review of research on special topics in political behavior. 1971-72 topic: Conflict Theory (2-quarter sequence). Credit and grade will be awarded upon completion of the full sequence. Judicial Theory (1-quarter). May be repeated for credit with different instructor. Mr. Sperlich (W, Sp)

267A–267B. The Legislative Process. (4–4)

One 2-hour session and one 1-hour conference per week. Research on legislative process and behavior, with attention to legislation and constituency relations. Mr. Folsby (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. Muir (F)
280A. 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. La Porte (F)

280B. Administrative Behavior in Public Organizations. (4)
(Formerly 272)
One 2-hour session and one 1-hour conference per week. Theories of administrative and organizational behavior including decision-making, communications, leadership and functional analysis of public organization. Relation of public organization to its political and technological environment. Mr. Lepawsky (Sp)

280C. 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 (Sp)

SEMINARS

281. Comparative National Bureaucracy. (4)
(Formerly 273)
One 2-hour session and one 1-hour conference per week. Analytical comparison of administrative systems of various countries in different stages of national development. Mr. Ilichman (W)

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. Mr. Jones (W)

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)
(Formerly 276A–276B)
One 2-hour session and one 1-hour conference per week. The social, political, economic, and legal background in which municipal administration is set. The facilities and processes—organization, budgeting, accounting, personnel, and management methods of the municipal administrator.

285A. Budgets as Political Instruments. (4)
(Formerly 278A)
One 2-hour session and one 1-hour conference 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. Mr. Wildavsky (F, W)

285B. The Politics of Taxation. (4)
(Formerly 284)
One 2-hour session and one 1-hour conference per week. Taxation as policy and a unit of political analysis. Public organization tactics for getting taxes and revenue. Public tax preferences.

286. Regional Planning and Resources Management. (4)
(Formerly 285)
One 2-hour session and one 1-hour conference per week. Public policies and the planning process as related to regionalism and to the resource-based activities of society; ecological and environmental aspects of public administration; historical and comparative aspects of natural resources administration. Mr. Lepawsky (W)

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. Ilichman (F)

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.

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 member, with emphasis on the teaching of undergraduate courses in political science. Must be taken on a pass/not pass basis. The Staff (F, W, Sp)

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. Mr. Jones (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

(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.
Edwin E. Ghiselli, Ph.D.
Stephen E. Glickman, Ph.D.
Harrison G. Gough, Ph.D. (Chairman)
Sheldon J. Korchin, Ph.D.
Geoffrey Keppel, Ph.D.
Richard S. Lazarus, Ph.D.
William M. Meredith, Ph.D.
Paul H. Mus sen, 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.
Read D. Tuddenham, Ph.D.
Olga L. Bridgman, M.D., Ph.D., Sc.D. (Emeritus)
David Krech, Ph.D. (Emeritus)
Catherine Landreth, Ph.D. (Emeritus)
Jean Walker Macfarlane, Ph.D. (Emeritus)
Donald W. MacKinnon, Ph.D. (Emeritus)

Assistant Professors:
Jonas Langer, Ph.D.
Gerald A. Mendelsohn, Ph.D.
Dan I. Slobin, Ph.D.
John S. Watson, Ph.D.
Irving Zucker, Ph.D.

Assistant Professors:
Milton R. Blood, Ph.D.
Thomas J. Crawford, Ph.D.
Carl H. Frederiksen, Ph.D.
William K. Graham, Ph.D.
Ervin R. Hafter, Ph.D.
Eleanor R. Heider, Ph.D.
Arnold L. Leiman, Ph.D.
Christina Maslach, Ph.D.
Donald H. McLaughlin, Ph.D.
Robert M. Olton, Ph.D.
Sheldon Zedeck, Ph.D.

Lecturers:
Nathan Adler, Ph.D.
Lynette Beall, Ph.D.
Hilde S. Burton, Ph.D.
Luther Distler, Ph.D.
Clementina K. Hollenberq, Ph.D.
Marjorie P. Honzik, Ph.D.
William Saufley, Ph.D.
Margaret T. Singer, Ph.D.
R. James Yendell, M.D., Ph.D.

The Major

Lower Division Completion of course 1, course 2 or 3, and either of the following courses: Psychology 5, Statistics 2. Completion of one lower division course of at least 4 units chosen from Group A and one such from Group B.

OTE: For key to footnote symbols, see page 78.
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 so as to fulfill the following specific requirements:

1. Course 103 or 104; (2) two courses from among 110, 115, 120, 121; (3) two courses from among 130, 140, 150, 160, 170, and 180; (4) two courses having as prerequisites courses listed under (1), (2), or (3) above, drawn from two different categories below: (a) 105, 106, 107, 108, (b) 111A–B, 112, (c) 116, (d) 122, (e) 123, 124, (f) 141, 142, 143, 173, (g) 151, 152, 153, (h) 161, 162, 163, 164, (i) 171, 171L, 172, 172L, (j) 182, 183A–B; (5) other upper division courses to bring the total in the major to 36 units.

Up to 10 of the 36 upper division units may, upon approval of the adviser, be drawn from upper division courses in anthropology, education, genetics, mathematics, philosophy, rhetoric, sociology, statistics or other related departments; German 190 may be included in this category. In requesting approval for such substitutions, the student must clearly establish the relationship of the substituted courses to his major program.

Subject to the provisions of the passed/not passed privilege, 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/not passed basis except with 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. Admission to the honors seminars is at the discretion of the instructor. Students in the honors program must complete one of the following two-quarter seminars: H192A–B, H193A–B, or H194A–B. He must also complete at least one quarter of H195, culminating in a Senior Honors Thesis.

Students in the honors program are strongly advised to complete requirements (1), (2), and (3) above prior to the senior year; they are excused from requirement (4). Psychology 100 is recommended for students in the honors program.

**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. Rosenzweig (F); Mr. Lazarus (W)
   Mr. Covington (W); Mr. Lazarus, Mr. Ritchie (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.
   Mr. Keppel (F); Mr. Sautley (W)

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 and individual psychology.
   Mr. Keppel (F); Mr. Sautley (W)

5. **Introduction to Psychological Measurements.** (5)
   Three 1-hour lectures and two 1-hour section meetings 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.
   Mr. McLaughlin (F); Mr. Jarrett (W); Mr. Hafter (Sp)

30. **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.

Mr. Mendelsohn, Mr. Riley (F, W)

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. Glickman (Sp)

103. Advanced Statistical Methods in Psychology. (5)
Three 1-hour lectures and one 3-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-sample sampling theory; frequently employed in psychological research; analysis of variance and linear regression problems in experimental psychology.
Mr. Jarrett (F, Sp); Mr. Meredith (W)

104. Theory of Psychological Measurement. (5)
Two 1½-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. Ghiselli (F, W); Mr. Zedeck (Sp)

105. Theory of Multivariate Psychological Experimentation. (5)
Three 1½-hour lectures per week. Prerequisite: course 103 or 104. General uses of multiple measurements in psychological research. Multiple prediction methods, configural scoring, stochastic models for psychological tests, theoretical basis of psychometric methods, factor analysis, multidimensional scaling, personnel classification and assignment problems.
Mr. Frederiksen (F)

106. Mathematical Theory of Behavior. (5)
Three 1½-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. McLaughlin (W)

107. General Traits and Types of Individuals. (5)
Two 1½-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. Meréóith (Sp)

108. Psychological Scaling. (5)
Three 1½-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.

110. Introduction to Biological Psychology. (4)
Two 2-hour lectures per week. Prerequisite: Psychology 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. DeValois (F), Mr. Leiman (W); Mr. Rosenzweig (Sp)

111A. Advanced Biological Psychology. (5)
Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: Psychology 110 and consent of instructor. Current experimental studies of sensory mechanisms and perceptual processes.
Mr. DeValois (W)

111B. Advanced Biological Psychology. (5)
Two 1½-hour lectures and one 3-hour laboratory per week. Prerequisite: Psychology 110 and consent of instructor. Current experimental studies of neural development and behavior, neural bases of learning and memory, and of motivation.
Mr. Leiman (Sp)

*112. Advanced Laboratory Studies in Biological Psychology. (5)
One 1½-hour lecture and six hours of laboratory per week. Prerequisite: Psychology 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 1½-hour lectures and six hours of laboratory per week. Prerequisite: consent of instructor. Individual and group research in animal psychology.
Mr. Ritchie (F)

*114A–114B. Behavioral Genetics. (3–3)
One 1½-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 1½-hour lectures and one hour of section per week. Prerequisite: Psychology 5 or equivalent. Studies of animal behavior in evolutionary perspective, including analysis of behavior development, reproduction, aggression, territoriality.
Mr. Glickman (F); Mr. Beach (W)

116. Advanced Comparative Psychology. (4)
Two 1½-hour lectures and one hour of section per week. Prerequisite: Psychology 115 and consent of instructor. Current experimental studies in comparative psychology.

120. Learning and Memory. (4)
Two 1½-hour lectures and one 1-hour section
meeting per week. Prerequisite: course 5 or an equivalent course. Theoretical and experimental analysis of conditioning, verbal learning, motor learning, and retention.

Mr. Saufl ey (F); Mr. Keppel (Sp)

121. Concept Learning and Problem Solving. (4)
Two 1½-hour lectures and one 1-hour section meeting per week. Prerequisite: course 5 or an equivalent course. Theoretical and experimental analysis of mediational processes, concept learning, problem solving, and thinking. Mr. Saufl ey (W, Sp)

122. Laboratory in Learning and Problem Solving. (4)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: either course 120 or 121 and consent of instructor. Mr. Riley (Sp)

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. Hafer (W); Mr. Jarrett (Sp)

124. Laboratory in Sensory and Perceptual Processes. (3)
Two 3-hour laboratories per week. Prerequisite: course 123 and consent of instructor. Laboratory research on selected topics in the psychophysics of perception. Mr. Leiman (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. Mrs. Heider (F); Mr. Olton (W)

131. Introductory Psychology of Language. (4)
Three 1-hour lectures per week. Prerequisite: course 5 or an equivalent course or a background in linguistics. 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. Cowan (Sp)

131. Laboratory in the Psychology of Language. (1)
One 3-hour laboratory per week. Prerequisite: course 131 and consent of instructor. (May also be taken concurrently with 131.) Mr. Slobin (W)

*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. Mr. Covington (Sp)

140. Developmental Psychology. (5)
Three 1½-hour lectures per week. Prerequisite: course 5 or an equivalent course. Survey of theory and research in developmental psychology; growth and development of sensory, motor, cognitive, learning, intellectual functions; personality and social behavior from birth to adulthood. Mr. Watson (W)

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. Mr. Watson (W)

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. Langer (F); Mr. Cowan (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. Craik (F)

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. Craik (F)

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. Cameron (W); Mr. Mendelsohn (Sp)

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 (Sp)
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.
Mr. Crawford (F); Miss Maslach (W)

161. Psychology of Social Problems. (5)
Three 11/2-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.

162. Attitudes, Belief, and Influence Processes. (5)
Three 11/2-hour lectures and one 3-hour laboratory 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 (Sp) ; Miss Maslach (W)

163. Small Group Structure and Processes. (5)
Two 11/2-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.
Mr. Coffey (F, W, Sp)

164. Social Structure, Culture, and Personality. (5)
Three 11/2-hour lectures per week. Prerequisite: course 150 or 160. Relationships among social structure, culture, and personality.
Mrs. Heider (W)

170. Differential Psychology. (5)
Two 11/2-hour lectures and one 11/2-hour section per week. Prerequisite: course 5 or 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 11/2-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 (F)

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.)
Mr. Tuddenham (W)

*172. Appraisal of Personality Differences. (5)
Three 11/2-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 11/2-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 11/2-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 personality and social aspects of the field.
Mr. Zedec (F); Mr. Blood (Sp)

*181. Psychological Problems in Industry. (5)
Three 11/2-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 11/2-hour lectures and one 2-hour laboratory per week. Prerequisite: course 180. Emphasis on psychological contributions in the development of techniques and practices in personnel management.

183A–183B. Social Psychology. (5–5)
Three 11/2-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. Graham 183A (W)

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. Mussen (W)

H195. Special Study for Honors Students. (2)
Prerequisite: current or prior enrollment in courses H192A–B, H193A–B, or H194A–B, and consent of instructor.
The Staff (F, W, Sp)

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 79. Must be taken on a passed or 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. Frederiksen, Mr. McLaughlin, Mr. Meredith (F, 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. DeValois, Mr. Glickman (F); Mr. Keppel, Mr. Zucker (W); Mr. Postman, Mr. Ritchie (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, sensation, perception, and the relation between biological processes and behavior.

Mr. DeValois, Mr. Glickman (F); Mr. Keppel, Mr. Zucker (W); Mr. Postman, Mr. Ritchie (Sp)

220A–220B. Proseminar in Learning. (4–4)

Two 2-hour lectures per week. Current theories and research in conditioning, discrimination learning, transfer of training, verbal learning, memory and problem-solving.

220A: Mr. Riley (Sp)
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.


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.


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 (F, W, 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. Zedeck (W); — (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. Ghiselli (F)

**290. Seminars. (3)**

(a) Measurement, (b) Biological, (c) Comparative, (d) Learning, (e) Perception, (f) Thinking, (g) Language and Communication, (h) Development, (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.

**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)


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)

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**PUBLIC POLICY**

(Department Office, 2607 Hearst Avenue)

Profsessors:
C. Bartlett McGuire, M.A.
Allan P. Sincler, Ph.D.
Percy H. Tannenbaum, Ph.D.
Martin A. Trow, Ph.D.
Aaron Wildavsky, Ph.D.

Associate Professors:
Arnold Meltzer, Ph.D.

Graduate Courses

The following four courses are open only to students enrolled in the Graduate School of Public Policy.

**200A. Introduction to Policy Analysis. (4)**

Two hours of lecture and one hour of laboratory

NOTE: For key to footnote symbols, see page 78.
210A–210B. Economics of Public Policy Analysis. (4)
This course covers the main principles of micro-economic theory applicable to public policy analysis. The theories of preference, of decision under uncertainty, and of production are examined with an emphasis on application in the public area.
Mr. McGuire (F, W)

230A–230B–230C. Political and Organizational Analysis. (4)
A guide to the structure and dynamics of public policy-making systems in the United States. Taught with a view to giving the student a practitioner's competency in: developing new policy, choosing among alternative policies, gaining acceptance for policies among relevant elites and publics, ensuring acceptable implementation by public bureaucracies, and coping with the unanticipated consequences of new policies once implemented. Staff (F, W, Sp)

240A–240B–240C. Decision Approaches to Public Policy.
This course provides students with the necessary background in the use of various decision models so that they may appreciate the role of such models in analyzing public policy issues, identify public policy issues amenable to quantitative analysis, apply appropriate models and methods of analysis and interpret the analysis of those issues and critically review existing studies using such models and techniques, and develop the ability to offer suggestions which improve the quality of those studies.
Mr. Trinkl (F, W, Sp)

The following courses are open to qualified graduate students from other schools or departments.

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.
Warren J. Kaufman, Sc.D.
Andie L. Knutson, Ph.D.
Stewart H. Madin, D.V.M., Ph.D.
William J. Oswald, Ph.D.
William C. Reeves, Ph.D., M.P.H. (Chairman)
William W. Stiles, † M.D., M.P.H.
S. Leonard Syme, Ph.D.
Irving R. Tabershaw, M.D.
Keith O. Taylor, ‡ Ph.B., M.B.A.
Bernard D. Tebbens, Sc.D.
Helen M. Wallace, M.D., M.P.H.
Warren Winkelstein, Jr., M.D., M.P.H.
Jacob Yerushalmy, Ph.D.
Margaret Beattie, M.A., Gr.P.H. (Emeritus)
Jessie M. Bierman, M.D., M.S.P.H. (Emeritus)

NOTE: For key to footnote symbols, see page 78.

220A–220B. The Strategic Environment of Policy Analysis. (4–4)
This course is concerned with three political components: (1) the political context of analysis, (2) political variables and concepts in analysis, and (3) the analyst as a political actor. The environment of analysis sets a constraint on likely outcomes and also provides opportunities which the analyst can define. 220A is a prerequisite for 220B.
Mr. Meltsner

251A. 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 suggest ways to improve the process.
Mr. Bardach

261A. Policy in Higher Education. (4)
This course will explore current problems and issues in American 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 contest, finance, function and governance.
Mr. Kerr, Mr. Trow

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 MAPA degree. Credit and grade awarded upon completion of the Essay.

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. McAuley, M.S. (Emeritus)
Walter S. Mangold, B.S. (Emeritus)
Dorothy Bird Nyswander (Dorothy Nyswander Palmer), Ph.D. (Emeritus)
John H. Northrup, Ph.D., Sc.D., LL.D. (Emeritus)
Edward S. Rogers, M.D., M.P.H. (Emeritus)

Associate Professors:
Richard M. Bailey, D.B.A. (In Residence)
Robert C. Cooper, Ph.D.
James L. Hardy, Ph.D.
Cyril B. Roseman, 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.
Constantine H. Tempelis, Ph.D.
Neylan A. Vedros, Ph.D.
Robert Dennis, M.P.H., M.D.
Richard W. Emmons, M.D., M.P.H., Ph.D.
Cecil Enteman, Ph.D.
Constance Fraser, M.A., M.P.H.
Fern E. French, M.A., Dr.P.H.
Victor Garlin, Ph.D.
Michael L. Gay, M.D., M.P.H.
Stuart C. Goldstein, M.D., M.P.H.
Joanna F. Gorman, M.S.
Harold C. Gustafson, Dr.P.H.
Mary C. Hampton, M.S.
Robert J. Heckly, Ph.D.
Arthur J. Jenning, M.D., M.P.H.
Rose Horn, R.N., C.N.M., M.S., M.P.H.
Portia Bell Hume, M.D.
George M. Keranen, M.D., M.S., M.P.H.
Elizabeth Jolly, M.D., M.P.H.
Adeline Larson, A.B.
Edwin H. Lennette, M.D., Ph.D.
Carl N. Lester, M.P.H.
George A. McKray, LL.M., M.P.H.
James C. Malcolm, M.D., M.P.H.
Sheldon Margen, M.D.
Leon L. Miller, M.P.H.
Eileen Peck, Dr.P.H.
Maxwell S. Redfearn, D.M.V., Ph.D.
Helen S. Ross, M.P.H.
Constance E. Roth, M.P.H.
Leona R. Shapiro, M.S.
Esther G. Spencer, M.S.S.
Ruth H. Stimson, M.H.A.
Robert Taines, M.D.
Faith Chandler Thesingh, B.Sc., D.H.A.
Howard J. Weddle, M.S., M.P.H.
Dorothy Whissell-Buechey, M.D., Ph.D.

Associates:
Constance F. Carter, M.P.H.
Douglas P. Fowler, M.S.
Lawrence Y. C. Leong, M.S.
Dora Roth-Arkadir, M.D., M.P.H.
Luk G. Van Parijs, M.D., M.P.H.

Assistant Field Program Supervisor in Public Health Social Work:
Laura Bertino, M.A.

Upper Division Courses

102. Organizational Management and Administration of the Health Agency. (2)

One 1-hour lecture and one 2-hour lecture-discussion per week. Introduction, through lectures and exercises, to management practices in the health agency. Discussion of the underlying administrative theory.
Mr. Roseman (F, Sp)

106. Introduction to Human Ecology and Health. (4)

Two 2-hour lecture discussions per week. Current
107. Introduction to Medical Care Administration. (3)

Two 1-hour lectures, one 2-hour group discussion per week. Consumer behavior; need and supply; manpower and facilities; organization; financing, planning and evaluation.

Mr. Childs, Mr. Garlin, Mr. Lester (F)

108. Medical Care Problems and Programs. (2)

One 2-hour lecture-discussion per week. Review of basic literature of medical care administration and discussion of selected topics in social and economic theory and administrative principles.

Mr. Garlin (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. Mrs. Stimson (F)

111. Legal Aspects of Hospital Organization and Administration. (2)

One 2-hour lecture per week. Prerequisite: for students in hospital administration or consent of instructor. Statutes, cases, and readings in law related to hospitals.

Mr. McKay (Sp)

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. Dooley (Sp)

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. Health and social problems of mothers and children.

Mr. Gabrielson (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, Mr. Foord (Sp)

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, Mr. Griffiths, Mr. Carlaw (F, W); 130B, Mr. Griffiths, Mr. Carlaw (W, 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.

Mr. Carlaw (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 (Sp)

133. Introduction to Group Process. (2)

One 1-hour lecture, one 2-hour laboratory per week. Dynamics of interpersonal relationships.

Mr. Griffiths, Mrs. Ross, Mrs. Adler (W)

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.

Mr. Carlaw (W)

139A. Research Methods in the Behavioral Sciences. (3)

One 2-hour lecture and group discussion, one 2-hour seminar 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)

140A–140B. Introduction to Public Health Nutrition. (4–4)

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. Individual field project.

Miss Murai, Miss Peck (W, Sp)

144. Nutrition in Public Health. (3)

Two 1½-hour lecture-discussions per week. Designed for nonnutrition majors. Basic nutrition concepts and their implications for community health.

Miss Murai (Sp)

145. Radiological Aspects of Public Health. (3)

Two 1-hour lectures, one 3-hour laboratory per week. Prerequisite: consent of instructor. Fundamental aspects of radiation biology and ecological cycling of radioisotopes. Radiation detection, moni-
146. Environmental Radiation Protection. (3)
Two 1-hour lectures, one 3-hour laboratory per week. Prerequisite: consent of instructor. Radiation detection, shielding design, monitoring procedures; low-level assaying of food and water; waste disposal, water decontamination, regulation of radiation sources.
Mr. Kaufman (Sp)

149A. Occupational Health and Industrial Hygiene: Introduction. (4)
Four 1-hour lectures per week. Occupational hazards and their control; industrial safety; industrial health administration and organization.
Mr. Tebbens, Mr. Tabershaw (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)

156A–156B. Microbiology of Water and Waste Water. (3-3)
One 1-hour lecture, two 3-hour laboratories per week. Prerequisite: consent of instructor. Principles of microbiology applicable to the aquatic environment and to waste water.
156A, Mr. R. Cooper (F); 156B, Mr. R. Cooper (W)

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. Tarter (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 and one quarter of calculus, or consent of instructor. Bivariate distributions, regression, correlation, analysis of variance.
Mr. Tarter (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 and two quarters of calculus or consent of instructor. Continuous probability distributions, multivariate normal distributions, biometrical applications.
Mr. Tarter (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. Brand (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. Brand (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. Brand (Sp)

162A. Introduction to Public Health Statistics. (3)
Three 1-hour lectures per week. Collection and analysis of vital data, measurements of risk, rate adjustment, introduction to life tables, descriptive statistics, statistical inference.
Mr. Brand (F)

162B. 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)

162C. Introduction to Public Health Statistics. (3)
Three 1-hour lectures per week. Prerequisite: course 162B. Life table methods, follow-up studies, and health surveys.
Mr. Brand (Sp)

Three 1-hour lectures per week. Prerequisite: course 162A or consent of instructor. Evaluation designs, indices and measures, sample designs, analysis.
Mr. Yerushalmi (Sp)

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.
The Staff, Mr. Winkelstein in charge (W)

180A–180B. Medical Microbiology. (5–5)
Two 1½-hour lectures, two 3-hour laboratories per week. Prerequisite: Chemistry 8A–B or 12A–B; Biology 1A, 1B, 1C; Bacteriology 102–102L, or equivalent, or consent of instructor. 180A is a prerequisite for 180B. Evidence of immunization against tetanus, diphtheria, and typhoid fever is required at registration. Basic principles of immunology; pathogenesis and immunity in bacterial and other microbial infections of man and animals.
Mr. Vedros, Mr. Lawson, Miss Larson, Mrs. Carter (W, Sp)

*181. Public Health Microbiology. (5)
Two 1-hour lectures, one 1-hour discussion, two
3-hour laboratories per week. **Prerequisite:** course 180A–180B or equivalent. Bio-assay and identification of specific agents in the diagnosis, control and treatment of disease with emphasis on serology and virology. ——— (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 182L (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. Hematology. (3)**
One 1-hour lecture, one 3-hour laboratory, one 1-hour discussion per week. **Prerequisite:** Biology 1; Biochemistry 102; course 180A–180B. Fundamentals of hemopoiesis, hemoglobin formation and estimation, blood fluidity and immunohematology. ——— (W)

**191B. Survey of General Pathology. (3)**
Two 1½-hour lectures per week. **Prerequisite:** designed for students who have no background in the biological sciences. General principles of disease response of higher mammals to infectious and non-infectious agents. **Mr. Madin (Sp)**

**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. **Mr. Stiles (Sp)**

**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 79. Must be taken on a passed or not passed basis. **The Staff (Mr. Reeves in Charge) (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 ecological systems approach. **Miss Parker (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. **Miss Parker (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. **Mr. Wycoff (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. **Mr. Roseman (W)**

**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. (3)**
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. **Mr. Roseman (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. **Mr. Goldstein (Sp)**

**204C. Principles of Community Health Practice. (3)**
One 2-hour lecture, one 3-hour laboratory per week. **Prerequisite:** course 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. **Mr. Goldstein (Sp)**

**205. Consultation in Public Health Practice. (2)**
One 1-hour lecture, one 2-hour discussion per week. Examination of the techniques, goals, and uses of the consultative process in public health practice through the study of theoretical and practical models. The focus is upon methodological issues and distinctions between consultation and other types of problem-solving in program management. **Mrs. Spencer (W)**

**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. **Miss Jolly (W, Sp)**
207A. Advanced Medical Care Administration. (4)
Two 2-hour lecture-discussions per week. Prerequisite: course 107 or consent of instructor. Selected topics in medical care administration, study of specific programs, and individual projects.  Mr. Childs (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.  Mr. Childs (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)

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)

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 (W)

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. Mr. Taylor, Mrs. Stimson, Mr. Starkweather, Mr. Holloway (F, W, Sp)

212A. Hospital Organization and Administration. (2)
One 2-hour lecture, one 2-hour discussion per week. Limited to graduate students in hospital administration. The organization of hospitals with emphasis on administrative functions, governing boards, and departmental organization and relationships.  Mrs. Stimson, Mr. Starkweather (F)

212B. Hospital Organization and Administration. (2)
One 2-hour lecture, one 2-hour discussion per week. Prerequisite: course 212A. Limited to graduate students in hospital administration. Detailed study of medical staffs, professional organizations, and the educational and research roles of the hospital.  Mrs. Stimson, Mr. Starkweather (W)

212C. Hospital Organization and Administration. (2)
One 2-hour lecture, one 2-hour discussion per week. Prerequisite: course 212B. Limited to graduate students in hospital administration. The application of management practices in the hospital.  Mr. Starkweather (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 relationships to other community agencies and health services.  Mr. Starkweather (W)

213B. The Patient and Hospital Care. (2)
Two 1½-hour lecture-discussions, one 1-hour discussion 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 1½-hour lecture-discussions, one 1-hour discussion 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 (W)

214A. Theory and Research in Hospital Administration. (2)
Two 1-hour lectures, one 1-hour discussion per week. Limited to graduate students in hospital administration or consent of instructor. An introduction to administrative theory and research for hospitals and related health organizations, systematic analysis of theory, research methods and techniques.  Mr. Starkweather (F)

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.  The Staff (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. Miss Leedam, Miss J. French (F)

215B. Organization and administration of public health nursing services; structure, staffing, control procedures. Miss Leedam, Miss J. French (W)

215C. Evaluation of public health nursing services, current trends and issues in public health nursing administration.  Miss Leedam, Miss J. French (Sp)

One 2-hour lecture-discussion per week. For M.P.H. students not specializing in Public Health
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, Mrs. Gorman.

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. Whisell-Buechly (W).

227. International Maternal and Child Health. (2)
One 2-hour lecture per week. Prerequisite: 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. Carlaw (W).

232. Concepts Basic to Change Process. (3)
One 2-hour lecture, one 1-hour discussion per week; scheduled conferences. Prerequisite: consent of instructor. An examination of social-psychological concepts and theories basic to the practice of public health education. Mr. Griffiths, Mr. Carlaw (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).

234A–234B. Community Organization as an Educational Approach. (3–3)
One 2-hour lecture, one 1-hour discussion per week; scheduled conferences. Prerequisite: consent of instructor. Analysis of community organization process, theory and research, and relationship to the practice of public health education.

234A. One-half day of field work required. Mr. Griffiths, Mrs. Anderson, Mr. Carlaw (W).

234B. One day of field work required. Mr. Griffiths in charge (Sp).

238. Advanced Study in Behavioral Sciences in Public Health. (3)
One 2-hour seminar per week and tutorial. Prerequisite: major in behavioral sciences in public health, or consent of instructor. Advanced study of theory, logic, design, methods and techniques of behavioral science research, with special reference to public health. Mr. Knutson (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. Romano-V, Mr. Seiden, 239A (W); 239B (Sp).

241. Current Developments in Public Health Nutrition. (3)
Two 1½-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. Miss Huenemann, Mr. Entenman (Sp).

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, Mr. Margen, Mr. Entenman (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, 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.

*245. Ecological Aspects of Radiation Control. (3)
Two 1-hour lectures, one 3-hour laboratory per week. Prerequisite: course 146; Medical Physics 101 recommended; courses in plant or animal ecology also desirable. Origin and transport of radionuclides in water, air and earth. Cycling in food chains. Waste management systems. Miss Huenemann, Mr. Dooley, Mr. Margen (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. Mr. Tebbens, Mr. Tabershaw (W).

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. Mr. Tabershaw, Mr. W. Cooper (Sp).

249C. Industrial Hygiene Practices. (3)
Two 3-hour lecture-discussions per week. Prerequisite: course 249A. Advanced techniques in occupational 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. Oswald (W)

251A. Environmental Health Standards. (3)
Four hours of lecture per week. Prerequisite: some understanding of physics, chemistry, biology. Background and development of health standards applied to air, water, and land environments. Mr. Tebbens (F)

251B. Environmental Toxicology. (4)
Three 1-hour lectures, one 3-hour laboratory or demonstration per week. Prerequisite: course 251A. Standards, special problems in air, water, food toxicology; measurement and control of chemical hazards, natural and man-made.
Mr. Tabershaw, Mr. W. Cooper (W)

251C. Environmental Health Measurements. (4)
Three 1-hour lectures, one 3-hour laboratory and demonstration per week. Prerequisite: course 251A. Measures of environmental factors; measure of effect on man.
Mr. R. Cooper (Sp)

*253. Environmental Health Administration. (2)
One 1-hour lecture and one 2-hour discussion per week. Prerequisite: consent of instructor. A synthesis of social science and scientific management theory applied to health and safety programs of public and private institutions. (W)

*254. Management and Environmental Health and Safety. (2)
One 2-hour lecture-discussion per week. Prerequisite: course 253 of consent of instructor. Policy, organization, and fiscal decisions by management of institutional and industrial programs in environmental health and safety. (Sp)

*255A–255B–255C. Environmental Health and Safety. (2–2–2)
One 2-hour lecture-discussion per week. Prerequisite: course 255A prerequisite to 255B; 255B prerequisite to 255C. Principles and theory of the prevention of disease by the control of environmental hazards. (F). Sequence beginning (F)

*256. Water and Waste Water Biology. (2)
One 3-hour lecture-discussion per week. Prerequisite: course 156A–156B. Group study in the biology of water and waste water.
Mr. R. Cooper (Sp)

257. Biological Control Systems. (3)
One 3-hour lecture and demonstration per week. Prerequisite: consent of instructor. Systems of biological organisms for environmental control. Fundamental aspects of energy conversion, food production, water reclamation, and waste disposal in microbiological systems and their relationship to environmental control problems in a modern urban society.
Mr. Oswald (Sp)

258. Sanitary Microbiology. (4)
Two 1-hour lectures, two 3-hour laboratories per week. Prerequisite: Bacteriology 2. Sanitary microbiology of food, water, air, and wastes.
Mr. R. Cooper (Sp)

Three 1-hour lectures per week. Prerequisite:

260A: Mathematics 2C, 111, Statistics 100C, or consent of instructor. 260B: course 260A or consent of instructor. 260C: course 260B or consent of instructor.
260A. Stochastic processes applied to biological and health sciences.
260B. Competing risks, illness processes, migration processes.
260C. Stochastic models of epidemics, accident proneness. Sequence beginning (F), Mr. Chiang

261A–261B–261C. Advanced Biostatistical Methods in Epidemiological and Medical Studies. (3–3–3)
Three 1-hour lectures per week. Prerequisite: course 261A and 260C or equivalent. 261B: course 261A. 261C: course 261B.
261A. Design, conduct, and analysis of clinical trials, sequential analysis.
261B. Prospective studies, prognostic studies: advanced life table methods.
261C. Retrospective studies; medical diagnosis, evaluation of diagnostic tests. Sequence beginning (F), Mr. Tarter

265A–265B–265C. Advanced Graduate Study in Biostatistics. (3–3–3)
Three 1-hour lectures per week. Prerequisite: course 260 or 261. Limited to advanced graduate students in biostatistics. Recent developments in biostatistical research.
Mr. Yerushalmi, 265A (F); 265B (W), 265C (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. Winkelman, Mr. Reeves, Mr. Syms, 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, Mrs. F. 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. Syms (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: course 275 and either course 160A–160B or 162A–162B or equivalent course in biostatistics, or consent of instructor. 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 inapparent, inflammatory, chronic, granulomatous, or neoplastic infections.

Mr. Madin, 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. Tempelis (Sp)

*283. Aerobiology. (3)

Two 1-hour lectures, one 1-hour discussion per week. Prerequisite: course 180A–180B, 182, 182L, or consent of instructor. Characteristics of microbial aerosols and factors which affect their survival in relation to the spread of respiratory infections of man and animals.

(–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 immunoelectrophoresis.

Mr. Tempelis, Mr. Heckly (W)

291H. Neighborhood Health Center Organization and Administration. (2)

One 1-hour lecture and one 2-hour discussion per week. Prerequisite: consent of instructor. An exploration of the background, model, problems, issues, and administration of the neighborhood health center.

Mr. Parker (W)

291I. Seminar in Health Economics. (3–4)

Two 2-hour lecture-discussions per week. Prerequisite: course 291J or some background in economics. Focus upon three particular areas of health economics: (1) analysis of the production process in the health services delivery system; (2) capital budgeting for health facilities; and (3) welfare economic concepts applied to the allocation of health resources.

Mr. Bailey (Sp)

291J. Economics of the Health Services Industry. (3–4)

Two 2-hour lecture-discussions per week. A broad introduction into the application of economic concepts and theories in the health field. Each student will be expected to analyze a particular area of the health services industry in depth through a term paper. For students with little or no background in economics.

Mr. Bailey (W)

291L. Interdisciplinary Course of Current Health Problems. (1–8)

Two hours of lecture per week plus conference period and individual and group study outside class (minimum: 3 hours per unit of credit). Prerequisite: enrollment is limited to forty graduate students in public health and related fields. Two quarters required. Application of basic principles and processes of problem-solving to current health problems selected by small, interdisciplinary student groups, which may arrange for additional units.

Mr. Blum, Mr. Griffiths, Miss J. French, Mr. Dooley, Miss Huefmann (F, W, Sp)

291N. Public Health Perspectives and Concerns. (1–2)

One 1-hour lecture per week (1 unit); or one 1-hour lecture and one 2-hour discussion per week (2 units). An opportunity for students and faculty to increase their understanding of historical perspectives, philosophy, and major concerns of public health. This provides background for consideration of relevant current health issues. Provocative readings and case studies will afford guidance to these small discussion groups. The Staff, Mr. Winkelstein, Mr. Gabrielson, Miss Parker in charge (F)

291O. Epidemiology of Mental Health. (4)

Two 2-hour lectures per week. Prerequisite: prior background in epidemiology and/or the behavioral sciences is desirable. A continuing approach to the description and analysis of factors that are associated with mental health, suicide, alcoholism, and drug abuse. Emphasis will be placed upon current research and preventive programs.

Mr. Seiden, Mr. Paffenberger, Mr. Syme (Sp)

291P. Introduction to Dynamic Models. (3)

Three 1-hour lectures per week. Prerequisite: Mathematics 16A and 16B. Development and analysis of a class of mathematical models useful in the study of dynamic systems. Examples from toxicology, microbiology, ecology, engineering, and industrial hygiene.

Mr. Spear (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, process of and approaches to behavioral change.

Mr. Knutson, Mr. Carlaw (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 (W, 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 Peck, Miss Leedam, 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. Griffiths, Miss Leedam (F)
Biological aspects of family planning and physiology of conception.
Mr. Gold (W)
Community approach and analysis of educational aspects of family planning programs.
Mr. Carlaw, Mr. Gold, Miss Leedam (Sp)

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.
Mrs. 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 advisor. 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 them 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
C. Hospital Administration
D. Public Health Nursing Administration
E. Public Health Social Work
F. Maternal and Child Health
G. Public Health Education
H. Behavioral Sciences
J. Public Health Nutrition
K. Environmental Health Sciences
L. Biostatistics
M. Comprehensive Health Planning
N. Epidemiology
P. Biomedical Laboratory Sciences

IDS 175. A Nontechnical Introduction to Operations Research. (4)
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.

RELIGIOUS STUDIES
Head adviser: Mr. John T. Noonan, Jr.; Area I, Buddhist Studies: Mr. J. F. Staal; Area II, Christian Studies: Mr. Paul J. Alexander, Mr. John T. Noonan, Jr., Mr. William B. Slottman, Mr. David H. Wright; Area III, Islamic Studies: Mr. Hamid Algar; Area IV, Jewish Studies: Mr. Mordechai Friedman; Area V, Anthropological and Sociological Studies: Mr. Robert N. Bellah.

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.

Honors Program
The honors program encourages further penetration in one of the specific areas listed below. An honors candidate is expected to write a thesis of distinction under the super-
vision 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.

**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 131, 170, 171; and four of the following courses, one of which must have a value of 5 units: Religious Studies 135; Oriental Languages 110A, 110B, 110C (Chinese prerequisite), 142; History 184A, 184B, 185A, 187A; History of Art 136A, 137; Near Eastern Languages 121A.

**Area II Christian Studies** Religious studies 120A, 120B, 121, and one of the following courses: Comparative Literature 145A; History 104, 117. Three courses from Group A or three courses from Group B. **Group A:** History 104, 114A, 117; Comparative Literature 145A; Art History 150A, 150B, 150C, 152, 153, 154, 157A, 157B, 157C; English 155B; Italian 109A, 109B, 109C, 130. **Group B:** History ——, 121; English 154; Art History 160A, 160B, 166, 170A, 170B.

**Area III Islamic Studies** Near Eastern Languages 180A, 180B; History 182A, 182B; and three of the following courses: History 183A; Environmental Design 176; Near Eastern Languages 102A, 102B, 102C (Arabic prerequisite), 182A, 182B.


**Area V Anthropological and Sociological Studies** Four of the following courses: Anthropology 159, 160, 175; Classics 175A, 176, 178; Near Eastern Languages 170A, 170B, 171A, 171B, 171C, 173A, 173B, 173C; Scandinavian 160; Sociology 165. Three courses in any single area of Area I through IV.

*Recommended for the Major* History 4B, 4C, 19; English 116; Classics 28; Philosophy 25B; Italian 39A; German 39A; Oriental Languages 38A, 38B, 38C; Scandinavian 175; History 191A, 191B, 191C.

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.

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

**Religious Studies 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.

Mr. W. D. Davies (W, Sp)

**Religious Studies 131. Indian Buddhism. (5)**

Three one-hour meetings and one hour of consultation per week. The origins of Buddhism and its development in India.

Mr. Jaini (W)

**Religious Studies 135. Buddhism and Jainism. (5)**

Seminar. Interaction between Buddhism and Jainism.

Mr. Jaini (Sp)
RHETORIC

(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 E. Nathan, Ph.D. (Chairman)
Garff B. Wilson, Ph.D.
Richard Hagopian, M.F.A. (Emeritus)
Gerald E. Marsh, M.A. (Emeritus)

Assistant Professors:
Thomas Conley, Ph.D.
Thomas R. Kerr, LL.B.
Arthur J. Quinn, Ph.D.
Kenneth Salter, J.D.

Associate Professors:
William J. Brandt, Ph.D.
Janette L. Richardson, Ph.D.
William F. Shepard, Ph.D.
Todd G. Willy, Ph.D.

Lecturers:
Mark Oring, M.A.
Fred S. Stripp, Th.D.
Ward E. Tabler, A.B., L.H.D. (Hon.)

Departmental Major Advisers: Mr. Kerr, Mr. Quinn, Mr. Schwalm.
Graduate Advisers: Mr. Sloan, Mr. Brandt.

The Department of Rhetoric offers the student a program of study that concentrates on developing his sensitivity to a wide variety of communication. Rhetoric 1A–1B provides the student with tools for close analysis and for writing argument. Rhetoric 2A–2B, 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 rhetoric and special topics appropriate for advanced study.

Major Program The following lower division courses are required of all major students: Rhetoric 1A and 1B (or Rhetoric 10), and a ten-unit sophomore sequence (consult the major adviser). Eight upper division courses are required in the major, two of which must be Rhetoric 111 and 117. The remaining six courses are selected by the student and his major adviser from courses numbered 112 through 175. 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/Not Passed No course taken passed/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 all quarters, though it is best to apply for fall quarter admissions. The first three

NOTE: For key to footnote symbols, see page 78.
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 and based on an established reading list. Courses 202A, 202B, 202C, and 210 are required of all first-year graduate students. For the M.A. a total of 36 units of course work are required, including work in all areas of study in the department. 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 a 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)
Pre-requisite: 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 lecture 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 Oral Interpretation. (5)
Four and a half hours of lecture per week. Pre-requisite: Rhetoric 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 lecture per week. Pre-requisites: Majors: Rhetoric 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, W, Sp)

6. Readers in Contemporary Poetry. (5)
Four and a half hours of lecture per week. Discussion and readings of poets such as Stafford, Creeley, Wright, and Dickey. No examinations, one paper.

Mr. Nathan (F, W, Sp)

10. The Logic of Argument. (5)
Principles of argument, with emphasis on problems of meaning, inference, and evidence, as developed in terms of current social issues. 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. Rhetoric Legal Staff (F, W, Sp)

12. Psychology of Belief. (5)
Pre-requisite: sophomore standing. Introduction to the psychology of racial prejudice, political ideological commitment, and religious belief, largely based on psychoanalytical theory, and applied to the argumentative and rhetorical analysis of discourse.

Mr. Barnhart (W)

20. Fundamentals of Language and Discourse. (5)
Four and a half hours of lecture per week. An introduction to the elements of language analysis, particularly of syntax, in its relation to the analysis of discourse.

The Staff

45. Public Speaking. (5)
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)

Upper Division Courses

105. Debate. (3)
Designed for those who wish to participate in intercollegiate 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)
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 major literary forms. Principles of effective oral reading practice in platform performance.

Oral Interpretation Staff (F, W, Sp)

109. Analysis of Communication Content. (5)
Research techniques in communication, with special emphasis on content analysis and audience response; supervised individual and group research.

Mr. Barnhart (F)

110. Advanced Writing: Argument and Discourse. (5)
Three 1½-hour meetings per week. Pre-requisites: 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 lecture 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, W)

112. Modern Rhetorical Theory. (5)
Four and a half hours of lecture 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 (Sp)

113. The Philosophy of Rhetoric. (5)
Four and a half hours of lecture 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

114. Rhetoric and Semantics. (5)
Prerequisite: Rhetoric 20 or consent of instructor. Theories of meaning, with special attention to spoken communication; communication and information theory; verbal and nonverbal components of the communication situation; misunderstanding as a special problem in communication. The Staff

115. Rhetoric and Aesthetics. (5)
Four and a half hours of lecture per week. Analysis of mimetic, pragmatic, expressive, and objective theories of the nature and function of literary discourse. The Staff (F)

116. Theory of Discourse Analysis. (5)
Four and a half hours of lecture per week. A linguistic study of discourse, with particular attention to how language distributes itself into various units, such as individual or cultural style, or genre. Mr. Chatman

117. Rhetorical Theory and Practice. (5)
Four and a half hours of lecture 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 lecture 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. Mr. Miller (F)

Four and a half hours of lecture 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 (W)
C. Theatre of the Absurd. Miss Bader (W)

124. Rhetoric of Poetry. (5)
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 lecture 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 lecture per week. 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. Beloof (Sp)

127. Rhetoric and Stylistics. (5)
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

128A–128B. Linguistic Structure in Literary Discourse. (5–5)
Four and a half hours of lecture per week. Prerequisite: Rhetoric 20 or consent of instructor. The nature of literary meanings and how they emerge from texts by techniques of paraphrase, explication, elucidation, and interpretation.

A. Lyric; Mr. Chatman
B. Narrative; Mr. Chatman

129. Rhetorical Stance in Lyric Poetry. (5)
Four and a half hours of lecture per week. Analytic and constructionist implication for interpretation of short poems considered as the utterances of dramatic speakers. Mr. Geiger (W)

Rhetoric and Politics

141. Stasis 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. Mr. Kerr (F)

142A–142B. Freedom of Speech. (5–5)
Four and a half hours of lecture per week. Prerequisite: 142A or consent of instructor is a pre-
143A. Rhetoric of Political Discourse: Seventeenth-Century English. (5)
Four and a half hours of lecture per week. An examination of the construction of meaning in speeches and essays by the manipulation of figures and logical devices. Mr. Brandt (Sp)

143B. Rhetoric of Political Discourse: Eighteenth-Century English. (5)
Four and a half hours of lecture 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 (Sp)

143C. Rhetoric of Political Discourse: Eighteenth- and Nineteenth-Century American. (5)
Four and a half hours of lecture 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 lecture 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. Mr. Salter (Sp)

144. Legal Language. (5)
Four and a half hours of lecture per week. 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 both Federal and State Supreme courts in civil and criminal cases. Prerequisite: Rhetoric 1A-1B, and a course in rhetorical theory, or consent of instructor. Mr. Kerr (Sp)

Culture and Rhetoric

Four and a half hours of lecture 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 (W)
C. Nineteenth century. Mr. Smith (Sp)
D. Twentieth century. Miss Bader (F)

152. Language and Society. (5)
Four and a half hours of lecture per week. Prerequisite: 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

153. Cultural Patterns of Discourse. (5)
Four and a half hours of lecture per week. Prerequisite: Rhetoric 20 or consent of instructor. Cultural factors of communication. Case studies from contemporary societies, literate and nonliterate. The Staff

154. Rhetoric of Medieval Genres. (5)
Four and a half hours of lecture 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. Mrs. Richardson (F)

155. Language Across Cultures. (5)
Four and a half hours of lecture per week. Prerequisite: 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

156. Language Development. (5)
Four and a half hours of lecture per week. Prerequisite: 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

157. The Rhetoric of Crisis. (5)
Four and a half hours of lecture 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. Brandt, Mr. Willy

158. Legal Trial and Its Cultural Context. (5)
Four and a half hours of lecture per week. Prerequisite: Rhetoric 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. Mr. Salter (W)

159. Law and Social Institutions. (5)
Four and a half hours of lecture per week. Prerequisite: Rhetoric 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. Rhetoric Legal Staff

160. Rhetoric and Translation. (5)
Four and a half hours of lecture per week. Prerequisite: 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,
Rhetoric and Performing Voice

171. The Lyric Mode. (5)
Four and a half hours of lecture per week. Prerequisite: Rhetoric 1A–1B; 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 lecture per week. Prerequisite: Rhetoric 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 lecture per week. Prerequisite: Rhetoric 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 lecture per week. Prerequisite: 173. Achievement of literary meaning through group interpretation of literary texts.
Mr. Beloof

181. The Practice of Poetry. (3)
Prerequisite: Rhetoric 2A or 106, and Rhetoric 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. Nathan and Staff

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 advisor. 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 honors 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 79. 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.
Graduate Courses

A. A prerequisite for all graduate courses is graduate status and approval of the graduate adviser.

201. Research Problems in Speech. (5)
Offerings vary from year to year. May be repeated for credit. Several sections on different topics may be offered in any one quarter and may be taken simultaneously.
A. Topics in Rhetoric. Mr. Willy, Mr. Brandt
B. Topics in Speech Science. Mr. Chatman, Mrs. Ervin-Tripp
C. Topics in Oral Interpretation. Mr. Beloof
D. Topics involving a combination of rhetoric and/or speech science and/or oral interpretation.
The Staff

Problems in the scope, applications, and divergencies of western theory and practice 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. Miss Richardson (W)
C. 1700 to the present. Mr. Willy (Sp)

203. Principles of Speech Science. (5)
An introduction to research in articulatory and acoustic phonetics, phonology, morphology, syntax, semantics, and related fields. Should be taken by all graduate students before other speech science graduate courses.
Mr. Chatman (F)
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<th>Course Code</th>
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<td>History of Oral Literature and Oral Interpretation to 1900 A.D. (5)</td>
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<td>213A-213B</td>
<td>Methodology of Oral Interpretation: Individual Authors. (5–1)</td>
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<td>Prosody and Oral Communication. (5)</td>
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<td>Rhetoric and Rhetorical Criticism: Ancient Rome. (5)</td>
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<td>234A–234B</td>
<td>Rhetoric and Poetics in the Middle Ages and Renaissance. (5–1)</td>
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<td>Studies in Legal Rhetoric. (5)</td>
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<td>Advanced Stylistics. (5)</td>
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<td>Advanced Contrastive Language Analysis: English as a Second Language. (5)</td>
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<td>Discourse Analysis. (5)</td>
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<td>Studies in Speech Behavior. (5)</td>
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<td>266</td>
<td>Values and World View: Cultural Bases of Communication. (5)</td>
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<td>268</td>
<td>Advanced Studies in the Rhetoric of the Novel. (5)</td>
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<td>295</td>
<td>Special Study. (1–5)</td>
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**Faculty:**

- Mr. Geiger
- Mr. Sloan (Sp)
- Miss Richardson
- Mr. Beloof (F)
- Mr. Chatman
- Mrs. Ervin-Tripp
- The Staff (F)
- The Staff (Sp)
299. Directed Research. (1-6)

One to six class hours per week. Prerequisite: Graduation 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. Accepted in partial satisfaction of the unit requirement in education for the general secondary credential.

The Staff (F, W, Sp)

ROMANCE PHILOLOGY

Professors:
Francis J. Carmody, Ph.D.,
Yakov Malkiel, Ph.D.
Manfred M. G. Sandmann, Ph.D.
Ronald N. Walpole, Ph.D. (Emeritus)

Graduate Advisers: Mr. Malkiel (Su); Mr. Stefanini (F, W, Sp).

Associate Professor:
Ruggero Stefanini, Dottore in Lettere

Assistant Professor:
Jerry R. Craddock, Ph.D.

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 substrata 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 colloquial Latin and Late Latin, down to the Carolingian period, on the basis of original sources.

Mr. Sandmann (Sp)

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 Provençal. (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. Sandmann (Sp)

*204. Humanistic Literature in Latin. (2)

Prerequisite: a working knowledge of Latin and consent of instructor. A study of the growth of Humanism through the reading and interpretation of selected Latin texts from Alcuin to Erasmus.

Mr. Malkiel (Sp)

*205. Romance Dialect Geography. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. Methods of interpreting linguistic 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.

Mr. Carmody (W)

*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 Mediterranean cultures through the analysis of linguistic substrata, with special attention to Romance-speaking areas.

Mr. Stefanini (Sp)

*210. Romance Derivation and Composition. (4)

Three hours of lecture per week. Prerequisite: consent of instructor. Methods and assumptions in the study of Romance word formations, with special attention to derivational suffixes and to compositional patterns.

Mr. Malkiel (W)

*212. Seminar in Albanian Language, Literature, and Folklore. (2)

Two 1-hour lectures. General survey and individual research projects in the field of Albanian, with special reference to Albania’s links with Latin and Romance culture.

Mr. Stefanini (Sp)

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

NOTE: For key to footnote symbols, see page 78.
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. Stefani in charge) (F, W, Sp)

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 Phonemics (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).

[1] SCANDINAVIAN

(Department Office, 1305 Dwinelle Hall)

Professors:
Haakon Hamre, C.Philol.
Assar Götrik Janzén, Ph.D.
Eric O. Johannesson,† Ph.D. (Chairman)

Associate Professors:
Lars C. Lönroth,† Ph.D.
Børge Gedso Madsen, Ph.D.
Gregory P. Nybo, Ph.D.

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; 15A–15B.

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.

NOTE: For key to footnote symbols, see page 78.
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.

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), Mr. Janzén

103A–103B. Advanced Norwegian. (4–4)
Three classroom hours per week. Prerequisite: course 13A–13B or the equivalent. Grammar review, reading, conversation, composition.
Mr. Nybo, 103A (W); Mr. Nybo, 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), Mr. Madsen

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. Mr. Larson (F) 141B. From Strindberg to the present.

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. Mr. Madsen
143B. From Hanssen to the present. Mr. Madsen

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. Mr. Madsen
144B. From Brandes to the present. 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.

*151. Advanced Swedish Composition. (4)
Three classroom hours per week. Prerequisite: 20 units of lower division courses in Swedish or the equivalent. Composition in conjunction with the reading of selected Swedish texts.
153. Advanced Norwegian Composition. (4)
Three classroom hours per week. Prerequisite: 20 units of lower division courses in Norwegian or the equivalent. Composition in conjunction with the reading of selected Norwegian texts. Mr. Nybo (Sp)

154. Advanced Danish Composition. (4)
Three classroom hours per week. Prerequisite: 20 units of lower division courses in Danish or the equivalent. Composition in conjunction with the reading of selected Danish texts. Mr. Madsen (Sp)

H195. Special Study for Honors Candidates. (2-5)
The Staff (Mr. Jønneson in charge) (F, W, Sp)

198. Directed Group Study for Advanced Undergraduates. (2-5)
Prerequisite: at least two years of one of the Scandinavian languages. Advanced reading and interpretation of modern Scandinavian texts.
The Staff (Mr. Johannessen in charge) (F, W, Sp)

199. Supervised Independent Study and Research. (1-5)
Enrollment is restricted by regulations listed on page 79. Must be taken on a passed or not passed basis.
The Staff (Mr. Jønneson in charge) (F, W, Sp)

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. (5)
Two 2-hour lectures per week. Reading and discussion of Ibsen’s most important plays.
Mr. Jønnesen (F)

108. Strindberg and His Writings. (5)
Two 2-hour lectures per week. Reading and discussion of Strindberg’s works in connection with his biography.
Mr. Jønneson (Sp)

109. Scandinavian Drama of the Twentieth Century. (4)
Three 1-hour lectures per week. Reading of modern Scandinavian dramas in translation; discussions.
Mr. Madsen (W)

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. Nybo, 120A (W); Mr. Nybo, 120B (Sp)

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.

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. Hamre (W)

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 (Sp)

Graduate Courses

Language 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. Jønneson (W)

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. Jønneson (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. Jønneson (F)

*204. History of the Danish Language. (4)
Three 1-hour lectures per week. Prerequisite: an A.B. degree with an undergraduate major in Scandinavian. Phonology, historical grammar, texts.
Mr. Hamre (W)

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.).
Mr. Jønneson (Sp)

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. Hamre (W)

208. The Poems of the Poetic Edda. (4)
Three 1-hour lectures per week. Reading of some more important poems with emphasis on the mythological songs.
Mr. Hamre (Sp)

*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.
Mr. Hamre (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.
    Mr. Hamre (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. Offers 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. Janzen
    Swedish Language. Mr. Janzen
    Norwegian Language. Mr. Hamre
    Danish Language. Mr. Hamre (F, W, Sp)
    Icelandic. Mr. Hamre (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.

*225. The Scandinavian Ballad. (4)
    Three 1-hour lectures per week. A comparative and historical study of the mediaeval ballad in Scandinavia, its later derivatives, 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. Lomnroth (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)

244. Modern Danish Literature. (4)
    Three 1-hour lectures per week. Reading and analysis of representative works.
    Mr. Nybo (W)

251. Seminar in Scandinavian Literature. (4)
    One 2-hour lecture per week. The Staff (F, W, Sp)

298. Special Study. (2–6)
    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.
    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 AND MATHEMATICS EDUCATION

(Group Office, 347 Birge Hall)

Professors:
Max Alver, Ph.D. (Zoology)
Walter J. Freeman, Ph.D. (Physiology)
Paul A. Heist, Ph.D. (Education)
Leon A. Henkin, Ph.D. (Mathematics)
Robert Karplus, Ph.D. (Physics)
John L. Kelley, Ph.D. (Mathematics)
Watson B. Laetsch, Ph.D. (Botany)
Michel Loewe, Docteur ès Sciences (Mathematics and Statistics)
Roderic B. Park, Ph.D. (Botany)
Alan M. Portis, Ph.D. (Physics)

Graduate Adviser: F. Reif.

NOTE: For key to footnote symbols, see page 78.
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.

290. Seminar. (2)
   Staff (Mr. Reif in charge) (Su, F, W, Sp)

295. Research. (1–12)  Staff (Su, F, W, Sp)

299. Independent Reading and Study. (1–5)
   Individual reading and study under the supervision of a faculty member.  Staff (Su, F, W, Sp)

602. Individual Study for Doctoral Students. (1–8)
   Individual study, in consultation with the major field adviser, designed to prepare the student for examinations required of Ph.D. candidates. This course may be taken only on a satisfactory/unsatisfactory basis; it does not satisfy unit or residence requirements for the doctoral degree.  Staff (Su, F, W, Sp)

SLAVIC LANGUAGES AND LITERATURES

(Department Office, 5416 Dwinelle Hall)

Professors:
Simon Karlinsky, Ph.D.
Oleg A. Maslenikov, Ph.D.
Hugh McLean, Ph.D. (Chairman)
Francis J. Whitfield, Ph.D.
Gleb Struve, A.B. (Emeritus)

Assistant Professors:
Mary P. Coote, Ph.D.
Joan Delaney,† Ph.D.
Olga Hughes,† Ph.D.
Robert P. Hughes, Ph.D.

Professor:
Benjamin Hrushovski, Ph.D. (Visiting)

Assistant Professor:
Bill J. Darden, M.A. (Acting)

Lecturers:
Lóránt G. Czigány, Ph.D.
Serge Kassatkin, M.A.
Ema Leskovar, A.B.
Ludmila A. Patrick, M.A.
Michael K. Pawlikowski, LL.M.
Olga Sorokin, Ph.D.

Acting Instructor:
Phyllis A. Reed, M.A.

Associates:
Douglas M. Herron, M.A.
Oscar E. Swan, M.A.

Departmental Major Advisers: Mr. Whitfield, Mr. Karlinsky.

Departmental Graduate Advisers: Mr. Darden, Mr. Hughes.

NOTE: For key to footnote symbols, see page 78.
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 in a second modern Slavic language (except for those who do not plan to go beyond the M.A. level); and a final comprehensive examination, partly written and partly oral.

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.
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, W, Sp)

4. Intermediate Russian. (4)
   Five 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 3.
   The Staff (Mrs. Reed in charge) (F, W, Sp)

5. Intermediate Russian. (4)
   Four 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 4.
   (Mr. Herron in charge) (W)

6. Intermediate Russian. (4)
   Four 1-hour meetings and one 1-hour laboratory per week. Prerequisite: course 5.
   (Mr. Herron in charge) (Sp)

*12A–12B–12C. Elementary Bulgarian. (4–4–4)
   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. Mr. Swan (F)

24A–24B. Intermediate Polish. (4–4)
   Four 1-hour meetings per week. Prerequisite: course 23.
   Sequence beginning (W), Mr. Swan

   Ten 1-hour meetings per week. Mrs. Leskovar (F)

26A–26B. Intermediate Serbo-Croatian. (4–4)
   Four 1-hour meetings per week. Prerequisite: course 25.
   Sequence beginning (W), Mrs. Leskovar

   Ten 1-hour meetings per week.

30A–30B. Intermediate Czech. (4–4)
   Four 1-hour meetings per week. Prerequisite: course 29.
   Sequence beginning (W)

39. Great Writers of Russian Literature. (4)
   Four 1-hour meetings per week. No knowledge of Russian is required.
   Mr. Maslenikov (F)

40. Specialized Russian Reading. (4)
   Three 1-hour meetings per week. Prerequisite: course 4 or consent of instructor.
   Miss Delaney (F, Sp)

45A–45B–45C. Survey of Russian Literature and Intellectual Trends. (4–4–4)
   (Formerly course 130A–130B–130C)
   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 1845.
   Mr. McLean
45B. From 1845 through the nineteenth century.
   Mr. Maslenikov
45C. The twentieth century.
   Mr. Hughes

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. Maslenikov, Mrs. Sorokin

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), Mr. Karlinsky, Mrs. Hughes, 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. Cooter

116A–116B. Czech Reading, Grammar, and Composition. (5–5)
   Four 1-hour meetings per week. Prerequisite: course 30B.
   Sequence beginning (F)

125A–125B. Introduction to Descriptive Russian Grammar. (5–5)
   Two 1½-hour meetings 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.
   Sequence beginning (W), Mr. Darden

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
Lecture Courses on Slavic Literatures

Except where otherwise indicated, these courses are given in English and require no knowledge of any other language.

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.

133A–133B–133C. The Russian Novel and its Relations to West European Literatures. (5–5–5)
Two 1-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.
133A. to 1845
133B. 1845 to 1865
133C. 1865 to 1885
134A. Dostoevsky. (5)
Three 1-hour meetings per week. The Staff (Sp)

134B. Tolstoy. (5)
Three 1-hour meetings per week. Mr. McLean (Sp)

134C. Chekhov. (5)
Three 1-hour meetings per week. Mr. Karlinsky (F)

134D. Turgenev. (5)
Three 1-hour meetings per week. Miss Delaney (W)

134F. Pushkin. (5)
Three 1-hour meetings per week. Prerequisite: reading knowledge of Russian required.
Mr. McLean (Sp)

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 (F)

135. Russian Drama from the Seventeenth-Century to the Twentieth. (5)
Three 1-hour meetings per week. Mr. Karlinsky (W)

138. Nineteenth-Century Russian Literary Criticism. (5)
Two 1½-hour meetings per week. Prerequisite: course 103B or equivalent. Mr. Hrushovski (Sp)

139. Twentieth-Century Russian Literary Criticism. (5)
Three 1-hour meetings per week. Mr. Hrushovski

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 (W)

160A–160B. Survey of Czech and Slovak Literatures. (5–5)
Three 1-hour meetings per week. Sequence beginning (W),

170A–170B. Survey of Serbian and Croatian Literatures. (5–5)
Three 1-hour meetings per week. Sequence beginning (W), Mrs. Coote

187A–187B. Russian Poetry. (5–5)
Three hours of class 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), Mr. Karlinsky, 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.

H195. Honors Proseminar. (5)
One 2-hour meeting for discussion each week, or individual meetings with the instructor. Advanced literary study for senior honor students. Emphasis on the writing of one or more papers and discussion of them. The Staff (F, W, Sp)

199. Supervised Independent Study and Research. (1–5)
Enrollment is restricted by regulations listed on page 79. Additional limitation: overall grade-point average of at least 3.00. Must be taken on a passed or not passed basis. The Staff (F, W, Sp)

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. Mr. Darden (F)

226. Historical Russian Grammar. (4)
Three 1-hour meetings per week. Prerequisite: courses 210A–210B. Mr. Darden (W)
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. Mr. McLean (F)

230. Old Russian Literature. (4)
Three hours of lecture per week. The content varies; the Kiev and Muscovite 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 1 1/2-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)

16G–26G. Russian for Graduate Students. (No credit)
Three 1-hour meetings per week. Preparation for graduate reading examinations. Sequence beginning (F)

11G–12G. Spoken Russian for Graduate Students. (No credit)
Three 1-hour meetings per week. Prerequisite: course 163A–163B 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. Sequence beginning (W), Mr. Kassatkin

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. Intensive Course. (8)
Ten 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. Mr. Darden (Sp)
Field Major in Social Sciences

The Social Science Field Major is open only to students who can complete the program and graduate by June 1972.

Major Advisers: Consult Field Major Office, 750 Barrows Hall.

The field major in social sciences may serve the needs of four groups of students: (1) those generally interested in social science but who have not chosen a field of specialization; (2) those who intend to do graduate work in a specific discipline but who want a broad undergraduate education; (3) those intending to enter professional schools, such as the School of Law or the School of Social Welfare, that do not require training in a special discipline but recommend broad training in the social sciences; and (4) those preparing to teach in elementary schools, high schools, or junior colleges.

Lower Division Courses  The student must take an introductory course in two of the following disciplines: anthropology, demography, economics, geography, political science, psychology, sociology, social science. He must also take an introductory course in statistics (Psychology 5 or Statistics 2 or equivalent) and a two-quarter sequence in history, either a lower or upper division course.

Upper Division Courses  Social Science 100A or a suitable substitute course as suggested by one of the major advisers is to be completed as prerequisite to 100B–100C. Social Science 100B–100C is to be completed by each student during the senior year. The student must also complete nine other upper division courses from among the following: anthropology, demography, economics, geography, political science, psychology, sociology, and approved social science courses in ethnic studies. Specifically, the student must take two upper division courses in each of two separate departments and five upper division courses in a third department. Only one 198 or 199 course is acceptable in the major, and it must be taken in the student’s field of emphasis.

Honors Program  Special honors sections, Social Science H100B–H100C, will be offered and a senior honors thesis will be required. See the instructor in Social Science 100B for arrangements.

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

Upper Division Courses

100A. The Individual in Organized Society. (5)
  One and one-half lecture hours plus two 1½-hour section meetings per week. Fundamental perspectives on social theory and their application in modern social research. (F)

100B–100C. The Individual in Organized Society:
  Senior Seminar. (5 or 10; 5 or 10)
  Limited to students in the Field Major in Social Sciences. One and one-half lecture hours; three hours of seminar discussions, group and individual tutorials per week. Prerequisite: Social Science 100A or equivalent. Seminars will be organized around major contemporary issues. Students will select one of these issues and prepare a senior thesis on a topic related to it. Credit and grade will be awarded upon completion of the sequence. (W, Sp)

H100B–H100C. Senior Honors Seminar and Thesis.
  (5 or 10; 5 or 10)
  Limited to students in the Field Major in Social Sciences. One and one-half hours of lecture; three hours of seminar discussions, group and individual tutorials per week. Prerequisite: Social Science 100A or equivalent. Open only to seniors in the Field Major in Social Sciences who are seeking an A.B. degree with honors. Seminars will be organized around major contemporary issues. Students will select one of these issues and prepare a senior thesis on a topic related to it. Credit and grade will be awarded upon completion of the sequence. (W, Sp)
The group major in social welfare, leading to the degree of Bachelor of Arts, 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, Psychology 3, Sociology 1, and Psychology 5 or Statistics 2.

**Upper Division**

**NOTE:** For key to footnote symbols, see page 78.
and five courses chosen from a list of courses offered in the departments of Psychology, Sociology, Economics, Anthropology, and Political Science, with at least three of the courses taken in one department.

**Honors Program** Eligible social welfare majors, upon recommendation of their advisers, 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.

**Graduate Programs**

For information about graduate study in the School of Social Welfare, see page 71 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.

Mr. O’Shea, ——— (F, W, Sp)

**110A–110B–110C. The Social Services. (5-5-5)**
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 (F)

110B. Social Welfare Policies and Programs. Analysis of social welfare policies and programs including public assistance, social insurance, 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. Gilbert (Sp)

(Formerly numbered H197A–H197B–H197C)
Weekly hours to be arranged. Problems in social 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 79. 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 (F) ——— in charge (F, W)

*202. Development of the Handicapped Child. (2)*
One 1½-hour session per week. **Prerequisite:** course 200A–200B or consent of instructor. Emotional, cognitive and social development of the handicapped child, with special emphasis on the mentally retarded and implications for welfare services.

Mr. Lucco (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 (F) and (W)
The Staff (F, W, Sp)

211. Seminars in Human Development and Pathology. (2)
One 1½-hour session per week. Prerequisite: course 201A–201B 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. — (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. — (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)

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. — (W)

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. — (Sp)

233. Seminar in Social Security. (2)
One 1½-hour session per week.

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. Wollins (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.

240A–240B–240C. Social Work Methods with Individuals and Groups. (2–2–2)
One 1½-hour session per week. Basic principles of social work practice with individuals, families, and small groups. — The Staff (F, W, Sp)

One 1½-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 1½-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, Sp)

243. Community Development. (2)
One 1½-hour session per week. Principles and practice in urban and rural community development. — (Sp)

244. Methods of Social Action. (2)
One 1½-hour session per week. Principles and methods in developing social action programs in social welfare. — (Sp)

Two seminar hours per week. Prerequisite: admission to the predoctoral program or consent of in-
50. Advanced Social Casework. (2)
One 1½-hour session per week. Prerequisite: use 240A–240B–240C or consent of instructor. Generic and specific components of social casework different fields of practice, including corrections, family and child welfare, medical, psychiatric, public welfare, and school social work. The Staff (F, W, Sp)

51. Specialized Methods of Social Work Practice. (2)
One 1½-hour session per week. Prerequisite: consent of instructor. A study of various methods of social work practice with individuals, groups, organizations, and certain ethical bases of social work practice with generic and specific components of social casework. The Staff (F, W, Sp)

52A–52B. Advanced Social Group Work. (2–2)
One 1½-hour session per week. Prerequisite: use 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)

53A–253B–253C. Advanced Community Organization and Social Planning. (2–2–2)
One 1½-hour session per week. Prerequisite: use 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)

4A–254B. Social Welfare Administration. (2–2)
One 1½-hour session per week. Prerequisite: use 242A–242B or consent of instructor. Administrative process and problems in social welfare organizations. Sequence beginning (F).
Mr. McEntire (W, S)

Two 1½-hour sessions per week. Sequence beginning (F). ——— (F, W, Sp)

8. Methods of Supervision in Social Work. (2)
One 1½-hour session per week. Prerequisite: second-year standing in the M.S.W. program or consent of instructor.
Sequence beginning (W)
259A, analysis of selected theories of social work practice; 259B, analysis of selected social problems; 259C, theories of change and their implications for social work practice.
——— (W, Sp)

One 2-hour session per week. Prerequisite: for third-year community mental health students; others with consent of instructor. 260A prerequisite to 260B; 260B prerequisite to 260C.
The multifactorial nature of mental illness is examined from a social, psychological, ecological, and epidemiological perspective. Approaches to problem solving are explored from the public health, social policy and planning perspective as applied to special population groups at risk. Credit and grade will be assigned upon completion of the full sequence.
Mr. Apte (F, W, Sp)

261A–261B–261C. Seminar in Methods of Community Mental Health. (2–2–2)
One 2-hour session per week. Prerequisite: for third-year community mental health students; others with consent of instructor. 261A prerequisite to 261B; 261B prerequisite to 261C.
This seminar focuses on the methods used in community mental health practice applied to special problem groups. The students’ field projects will be analyzed for the application of principles of consultation, community organization, program planning, administration, and research. Credit and grade will be assigned upon completion of the full sequence.
Mr. Apte, Mrs. Fuller, Mr. Pilsuk (F, W, Sp)

262. Methods of Consultation in Community Mental Health. (2–3–2)
One 1½-hour session per week. Prerequisite: for third-year community mental health students; others with consent of instructor.
Practice theory in mental health consultation is presented with delineation of various theoretical approaches and their application in health, education, and welfare agencies. Emphasis will be on both case and administrative consultation and on individual or group consultation methods. ——— (F)

265A–265B–265C. Behavioral Sciences for Community Mental Health. (2–2–2)
One 2-hour session per week. Prerequisite: for third-year community mental health students; others with consent of instructor. 265A prerequisite to 265B; 265B prerequisite to 265C.
Topics from the behavioral sciences with implications for community mental health are examined. Emphasis is upon the analyses of social systems and the conditions of conflict and stress within them. Credit and grade will be assigned upon completion of the full sequence.
Mr. Pilsuk (F, W, Sp)

Two seminar hours and one consultation hour per week. Primarily for doctoral students.
Sequence beginning (W)
Mr. Fuller (F, W, Sp)

279A, 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 1½-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 1½-hour session per week consisting of lecture and 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)

At least one 1½-hour session per week in lecture and/or laboratory. A three-quarter research sequence designed to introduce students to the logic, methods, and techniques of research in social welfare and give them some experience in their application to research problems. 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, Sp)

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.
The Staff (F, W, Sp)

287A–287B–287C. Directed Group Study. (2–2–2)
One 1½-hour session per week. Prerequisite: course 280. Group research on a selected problem in social welfare. Three quarters are devoted to the conduct of a single investigation from problem formulation to report writing. 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, Sp)

288. Advanced Graduate Study in Social Welfare. (2)
One 1½-hour session per week. Prerequisite: course 280. Methodological critique of investigations in selected substantive areas in social welfare.
The Staff (F, W, Sp)

Two seminar hours and one consultation hour per week. Primarily for doctoral students.
Sequence beginning (F), 289A, advanced study of the logic and method of social research, with special reference to social welfare and social work; 289B, advanced study of the methods and techniques of social research, with special reference to social welfare and social work; 289C, seminar on research design.
The Staff (F, W, Sp)

290A–290B. Advanced Research Methods and Techniques in Social Welfare. (3–3)
Two lecture hours and one laboratory hour per week. Prerequisite: course 289A or consent of instructor. Primarily for advanced graduate students. Rationale and procedure of research design, hypothesis testing, measurement, and data analysis in the study of social welfare problems, with emphasis on quantitative research.
The Staff (Sp)

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. Chemin in charge) (F, W, Sp)

298. Group Study for Graduate Students. (1–9)
(Mr. Chemin 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. Chemin in charge) (Su, F, W, Sp)

Professional Courses

401. Field Work. (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. Credit and grade for the first two quarters in each year of field work will be assigned upon completion of the second quarter.
The Staff (F, W, Sp)

402. Laboratory in Community Organization and Social Planning. (2)
One day per week. Introduces the student to the range of professional roles and services in community organization and social planning through a series of visits, interviews, observations, and participation in community meetings. Offered in conjunction with courses 242A and 242B.
The Staff (F)

Four to five days per week during an eleven-month period. Supervised practice in public health departments.
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 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. Chemin in charge) (Su, F, W, Sp)

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

1. A theory course: either 157, History of Sociological Theories, or 158, Contemporary Sociological Theories.


3. At least one course in the core area of organizations and institutions: choice from 118, 119, 120, 124, 129, 130, 132, 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.

NOTE: For key to footnote symbols, see page 78.
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 December 15. 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 substantive 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 course Sociology 299 or in 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 in quantitative methods, and (2) two more seminars.

Before the qualifying examination, the student must have completed all required courses and must pass an examination in an approved foreign language. 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)
Two lecture hours, two discussion section hours, and two consultation hours 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, Mr. Werthman (F); Mrs. Horowitz, (W); Mr. Geiser, Mr. Paige (Sp)

2. Population and Society. (4)
Two lecture hours, two discussion section hours, and two consultation hours per week. Introduction to sociological analysis using demographic data and concepts.
Mr. Davis (Sp)

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.

101. Historical Sociology. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Social and cultural processes of change and persistence in Marx, Teggart, Kroeber, Spengler, Teggart, Sorokin, Weber, and others.

102. Major Social Issues. (5)
Three lecture hours and two consultation hours per week. Prerequisite: does not give credit toward 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 major in sociology. An introduction to the study of political power, social class, and social movement.

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 towards 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.
Mr. Glock (Sp)

(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. Nasatir (F, W)

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. Geiser (W, Sp)

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.
Mr. Edwards (F)

110B. Peoples of Color: Continuities, Conflicts, and Consequences. (5)
Three lecture hours and two consultation hours per week. Prerequisite: Sociology 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.
Mrs. Morgan (Sp)

110C. Selected Topics in Ethnic and Racial Relations. (5)
Three lecture hours and two consultation hours per week. Prerequisite: Sociology 110A or Sociology 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.
Mr. Edwards (Sp)

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 these 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. Ojiaku (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.
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.
Mr. Ofshe

*115. Major Social Problems. (5)
Three lecture hours and two consultation hours per week. The diagnosis and treatment of problems related to race relations, crime, old age, industrial conflict, political disorder.

117. American Society: A Comparative Analysis. (5)
Three lecture hours and two consultation hours per week. Prerequisite: restricted to majors in sociology and to seniors 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 (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, and religious groups, and the influence of cultural values.
Mr. Geiser (F); 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. Sudnow (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.
Mr. Geiser (W)

*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.
Mr. Ojiaku (W); Mrs. Hochschild (Sp)

*125. Sociology of Intellectual Life. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. The status of the intellectual, knowledge and action in social thought, as analyzed by major social theorists.

129. 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. Wilensky (W)

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.
Mr. Edwards (W)

131A. The Black Family: Its Historical Development in America. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. The role of 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 western African roots.
Mrs. Morgan (F)

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.
Mr. Stinchcombe (W)

133. Methods and Documents in Population Analysis. (5)
Three lecture hours and two consultation hours per week. Prerequisite: course 20 or consent of instructor. Review of sources of demographic and similar data, their uses and limitations, and how the data are statistically analyzed. Fertility, mortality, population composition and distribution, are included.

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.

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.
Mr. Ojiaku (Sp)

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. Smelser (Sp)

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.
Mr. Schurmann (Sp)

142. Comparative Institutions. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. Comparison of selected social institutions; their relation to ideas and social change.
Mr. Eberhard (F)

143. Sociology of Religion. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. 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 with other spheres of social life.
Mr. Bellah (W)

144. 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 (F)

145. 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.
Mr. Blumer (W)

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 feminin movement, past and present, with special emphasis on struggles over conflicting definitions of woman’s “nature” and potential.
Mrs. Horowitz (F, Sp)

57. History of Sociological Theory. (5)
Three lecture hours and two consultation 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. Mr. Nonet (F); Mrs. Horowitz (W, Sp)

58. Contemporary Sociological Theories. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the instructor. Major theoretical perspectives and schools in sociology.
Mr. Selzuck (Sp)

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; metropolitan areas; location and types of cities; social and demographic characteristics of urban populations.
Mr. Werthman (W)

161A-161B. Urban Problems. (5-5)
Two lecture hours, two seminar hours, and one consultation hour per week. Prerequisite: one lower division sociology course or consent of instructor. A research practicum.

165. Japanese Society. (5)
Three lecture hours 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.

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. Contacts of nomads with settled groups. Processes of modernization in both groups.
Mr. Eberhard (W)

174. Sociology of Literature. (5)
Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course or consent of instructor. The relation of literature to the social order and to systems of social control. Analysis of the social role of the writer.
Mr. Lowenthal (Sp)

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.
Mr. Ofshe (Sp)

177. Experimental Research in Sociology. (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. Swanson (W)
179. Personality and Social Structure. (5)

Three lecture hours 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 (W)

180. The Group Studying Itself. (5)

Three lecture hours and two consultation hours per week. Prerequisite: one lower division sociology course, or consent of the 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.

Mr. Zablocki, (Sp)

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 the 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 (F)

191F. Folklore and Society. (5)

Three lecture hours and two consultation hours, and fieldwork to be arranged with instructor. Prerequisite: one lower division sociology course, or consent of the instructor. Knowledge of one Far Eastern language is desirable but not required. The connection between folklore and social structure, using data from Far Eastern societies, mainly from China. Basically a lecture course; however, students will be asked a undertake small-scale field research, results of which to be discussed in class.

Mr. Eberhard (Sp)


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 79. Must be taken on a pass or not pass basis.

Graduate Courses

201A–201 B. Methods of Sociological Research. (4–4)

Two lecture hours and two consultation hours per week. Prerequisite: course 105 or equivalent. A two-quarter section 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: courses 201A–201B or equivalent.

Mr. Paige (F); Mr. Matza (W); Mrs. Selznik, Mr. Stinchcombe (Sp)

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)

209. Advanced Interpersonal Behavior. (4)

One 2-hour meeting and two consultation hours per week. Prerequisite: course 209 when followed by one quarter of course 290 with the same instructor may be considered a sequence course; registration for both quarters is recommended. 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.

Mr. Ofshe (W)

210. Racial and Ethnic Minorities. (4)

Two lecture hours and two consultation hours per week. 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.

Mr. Werthman (F)

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. Werthman (W)

214. Advanced Quantitative Methods. (4)

Two lecture hours and two consultation hours per week. Prerequisite: Statistics 130A or equivalent. Analysis of variance and its application to sociological problems; multiple and partial correlation and
217. History of Social Thought. (4) Two lecture hours and two consultation hours per week. Mr. Lowenthal (W)

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. Mr. Nonet (W)

220. 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. Mr. Blumer (Sp)

224. Social Change. (4) Two lecture hours and two consultation hours per week. Stresses the rise and spread of industrialism to underdeveloped countries.

227. Basic Issues in Sociological Theory. (4) Two lecture hours and two consultation hours per week.

228. Seminars in Sociological Theory. (4) Two seminar hours and two consultation hours per week. Prerequisite: course 227 or equivalent. Mrs. Selznick, Mr. Bock (F); Mr. Selznick, Mr. Smelser (W); Mr. Blumer (Sp)

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 230 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, college group, and complex organization; worker participation in management; social aspects of industrial conflict, labor, industry, and society. Mr. Wilensky (W)

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.

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. Mr. Davis (W)

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.

241. Organizations and Institutions. (4) Two lecture hours and two consultation hours per week. Mr. Eberhard (W)

242. Comparative Social Structure. (4) Two lecture hours and two consultation hours per week.

246. Sociology of Religion. (4) Two lecture hours and two consultation hours per week. Prerequisite: course 146, or consent of instructor. Mr. Glock (Sp)

248. Collective Behavior. (4) Two lecture hours and two consultation hours per week. Studies in mass behavior, social movements, and political action. Mr. Zablocki (Sp)

253. Sociology of Culture. (4) Two lecture hours and two consultation hours per week. Theories of elite and popular cultures, particularly in modern mass society; sociology of knowledge, the arts, popular culture, and education.

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. Mr. Clausen (Sp)

260. Political Sociology. (4) Two lecture hours and two consultation hours per week. Contributions of sociology to theory and research in politics. Analysis of structure and ideology of organized groups. Mr. Kornhauser (Sp)

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 conflict, patterns of city growth, problems of measurement.

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. Swanson, Mr. Ofshe, Mr. Selznick (F); Mr. Schurmann, Mrs. Hochschild, Mr. Sudnow (W); Mr. Bellah, Mr. Bock, Mr. Wilensky (Sp)

299. Individual Study and Research. (1-9) Primarily for students engaged in writing a Ph.D. dissertation. May not be substituted for available graduate lecture courses or course 290. The Staff (F, W, Sp)

601. Individual Study for Master's Students. (1-8) Individual study for the comprehensive requirements in consultation with the 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 Graduate Adviser (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 Graduate Adviser (F, W, Sp)
SOILS AND PLANT NUTRITION

(Department Office, 108 Hilgard Hall)

Professors:
Kenneth L. Babcock, Ph.D. (Chairman)
Theodore C. Broyer, B.S.
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)
R. Earl Storie, B.S. (Emeritus)

Professors:
A. Herbert Gold, Ph.D.
Maynard A. Joslyn, Ph.D.
Gordon MacKinney, Ph.D.
Edward C. Stone, Ph.D.
Perry R. Stout, Ph.D. (Davis)

Associate Professor:
Paul J. Zinke, Ph.D.

Assistant Professor:
Oenes C. Huisman, Ph.D. (Acting)

Lecturers:
Rodney J. Arkley, Ph.D.
Issac Barshad, Ph.D.
Eugene L. Begg, B.S. (Davis)
Albert Ulrich, Ph.D.
D. Emerton Williams, Ph.D.

Undergraduate Major Adviser: Mr. Doner.
Graduate Adviser for Soil Science: Mr. Day.
Graduate Adviser for Plant Physiology: Mr. Broyer.

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 60). 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.

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, 21 units as follows: biology (15); 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, 73 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.

NOTE: For key to footnote symbols, see page 78.
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: Chemistry 1A-1B; Physics 6A-6B; Geology 5A or 10, introduction to physical, chemical, and biological properties of soil.

Mr. Day (F)

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, 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 (Extrasection)

101L. 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, 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 (Extrasection)

110. The Soil as a Medium for Plant Growth. (5)

Five 1-hour lectures per week. Prerequisite: Chemistry 1A-1B-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-1C.
Activities of microorganisms related to soil organic matter, soil properties, and the rhizosphere.

Mr. Huisman (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, reactions; chemistry of macronutrients and micronutrients.

Mr. Doner (W)

116. Soil Management. (3)

Two 1¹⁄₂-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)

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 79. Must be taken on a passed or not passed basis.

The Staff (F, W, Sp)

IDS 10A—1OB—10C. Man and His Environment—Crises and Conflicts. (4-4-4)

See Interdepartmental Studies for complete description of this course.

Guest Lectures

203. Soil Resource 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. McLaren (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. Barshad (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. Barshad (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 1¹⁄₂-hour meeting per week. Prerequisite: graduate standing in soil science, plant physiology, or related subjects.

The Staff (W, Sp)

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, 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. Waldron 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. Waldron in charge (F, W, Sp)

Staff Seminar in Soil Science. (No credit)

The Staff (F, W, Sp)

Plant Nutrition

Upper Division Courses

115. The Nutrition of Green Plants. (3)

Three 1-hour lectures per week. Prerequisite: Biology 1A—1B—1C. Evolution of modern concepts of plant nutrition, including functional aspects of inorganic nutrients, photosynthesis, nitrogen metabolism.

Mr. Bromley (F)

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)
SOUTH AND SOUTHEAST ASIAN LANGUAGES AND LITERATURES

Adviser: Mr. J. F. Staal.

The College of Letters and Science offers a Group Major in South and Southeast Asian Languages and Literatures. This program is designed for students interested in the languages, literatures, cultures, and religions of the Indian subcontinent and Southeast Asia, ancient and modern. When fully developed, the program will offer six majors: four with an emphasis on language, and two that are more culturally oriented. Students completing any one of the majors should be qualified to enter a variety of graduate programs in the humanities, the social sciences, and area studies. Equally important, the program offers a liberal education of general interest, enabling the student to step outside the confines of Western culture.

Area I Sanskrit Linguistics 188A–188B, 189; Philosophy 155A. Twelve units from the following courses: Linguistics 189, 193, H195, 199 (189, H195, 199 may be repeated for credit). Fifteen units from the following courses: Anthropology 188A, 188B; Comparative Literature 100, 190UL; History 187A, 187B; Near Eastern Languages: South Asian 121A, 121B, 121C, 122, 123; Near Eastern Languages: Dravidian (any upper division course); Near Eastern Languages: Hindi-Urdu (any upper division course). Other upper division courses to be determined in consultation with the adviser.

Area II Modern Indo-Aryan Elementary courses in Hindi-Urdu, to be taken as early as possible; thirty upper division language units in Hindi-Urdu; fifteen units to be selected from the list under Area I from which students are to select 15 units. Add to that list the following courses: upper division courses in the language not chosen above; courses in Sanskrit; Philosophy 155A; Political Science 145A, 145B.

Area III Indian Civilization Thirteen upper division units in Sanskrit, Modern Indo-Aryan, or Dravidian. Thirty-two units from the following courses: Art 136A, 136B, 137; Near Eastern Languages: South Asian 121A, 121B, 121C; Philosophy 155A; Interdepartmental Studies 101A, 101B, 101C. Other upper division courses to be determined in consultation with the adviser.

NOTE: For key to footnote symbols, see page 78.
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 (b) complete an acceptable honors thesis in his senior year.

SPANISH AND PORTUGUESE  
(Department Office, 4321 Dwinelle Hall)

Professors:
G. Arnold Chapman, Ph.D. (Chairman)
Luis Monguíó, Licenciado en Derecho, LL.D.
Edwin S. Morby, Ph.D.
John H. R. Polt, Ph.D.
Dorothy C. Shadi, Ph.D.
José F. Montesinos, Licenciado en Filosofía y Letras, Docteur ès Lettres (h.c.), LL.D. (Emeritus)
Lesley B. Simpson, Ph.D. (Emeritus)
Robert K. Spaulding, Ph.D. (Emeritus)
Arturo Torres-Rioseco, Ph.D. (Emeritus)

Associate Professors:
Arthur L. Askins, Ph.D.
Louis A. Murillo, Ph.D.
Rafael Pérez de la Dehesa, Licenciado en Derecho, Ph.D., Doctor en Filosofía y Letras
Benjamin M. Woodbridge, Jr., Ph.D.

Assistant Professors:
Demetrios Basdekis, Ph.D.
Jerry R. Craddock, Ph.D.
Charles B. Faulhaber, Ph.D.
Donald R. Larson, Ph.D.
Martin C. Taylor, Ph.D.
John K. Walsh, Ph.D.

Departmental Major Advisers: Mr. Faulhaber, Mr. Murillo, Mr. Taylor, 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 acquaintanceship 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 Latin 1A (to be completed before the senior year). 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, or more than one quarter of 192 not to be included as one of the five. One upper division course in Portuguese literature may be substituted for one of the five specialized courses. Recommended: further study in French, German, Italian, Latin, and Portuguese; and History 147A–147B, 156A–156B.

Honors Program  To be admitted to the honors program in Spanish, students shall

* No major is currently offered in Portuguese.

NOTE: For key to footnote symbols, see page 78.
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 See the Announcement of the School of Education.

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 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 also 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.
   Mr. Faulhaber in charge (F, W, Sp)

2. Elementary Spanish (Continuation of 1). (4)
   Five 1-hour class meetings per week. Prerequisite: course 1 or equivalent.
   Mr. Walsh in charge (F, W, Sp)

3. Elementary Spanish (Continuation of 2). (5)
   Five 1-hour class meetings per week. Prerequisite: course 2 or equivalent.

4. Intermediate Spanish (Continuation of 3). (5)
   Five 1-hour class meetings per week. Prerequisite: course 3 or equivalent.
   Mr. Taylor in charge (F, W, Sp)

5. Intermediate Spanish (Continuation of 4). (5)
   Five 1-hour class meetings per week. Prerequisite: course 4 or equivalent.
   Mr. Askins in charge (F, W, Sp)

8A. Spoken Spanish. (4)
   Five 1-hour class meetings per week. Prerequisite: course 3 or equivalent. May be taken in conjunction with course 4, 5, or 25.
   Mr. Basdeks in charge (F, W, Sp)

8B. Spoken Spanish. (4)
   Five 1-hour class meetings per week. Prerequisite: 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.
   Mr. Basdeks in charge (F, W, Sp)

Spanish 12A. Beginning Spanish. Intensive Course. (8)
   An intensive course in beginning Spanish, equivalent to Spanish 1 and Spanish 2. Ten 1-hour class meetings per week. Two hours per week obligatory laboratory attendance.
   Mr. Taylor in charge (F)

Spanish 12B. Intermediate Spanish. Intensive Course. (10)
   An intensive course in intermediate Spanish, equivalent to Spanish 3 and Spanish 4. Ten 1-hour class meetings per week. Two hours per week obligatory laboratory attendance.
   Mr. Taylor in charge (W)

Spanish 12C. Advanced Spanish. Intensive Course. (10)
   An intensive course in advanced Spanish, equivalent to Spanish 5 and Spanish 25. Ten 1-hour class meetings per week.
   Mr. Taylor in charge (Sp)

25. Advanced Spanish. (5)
   Four 1-hour class meetings per week. Prerequisite: course 5 or equivalent.
   Mr. Larson in charge (F, W, Sp)

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. Mr. Basdeks (F, W, Sp)
   39B. Spain: Neo-Classical Period to Present Day Mr. Basdeks (W, Sp)
   39C. Spanish America: To the End of the Nineteenth Century Mr. Askins (Sp)
   39D. Spanish America: Modernism and the Contemporary Period

Upper Division Courses

Prerequisite to all upper division courses 28 units of lower division Spanish or their equivalent.

100. Introduction to Spanish Linguistics. (4)
   Three class hours per week.
   Mr. Faulhaber, Mr. Walsh (F, W, Sp)

103. Nineteenth-Century Spanish Fiction. (4)
   Three class hours per week.
   Mr. Basdeks (Sp)

104A–104B. Survey of Spanish-American Literature (4–4)
   Three class hours per week. Sequence begins fall学期.
   Mr. Monguio, Mr. Taylor

105. Modern Peninsular Drama: From the Romantic Movement to the Present. (4)
   Three class hours per week.
   Mrs. Shadi (F, W, Sp)

107A–107B–107C. Survey of Spanish Literature. (4–4–4)
   Three class hours per week. Sequence begins fall学期.
   Mr. Faulhaber, Mr. Larson, Mr. Morby, Mr. Muriel

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 (W, Sp)

110. The Generation of ’98. (4)
   Three class hours per week.
   Mr. Basdeks (F, W, Sp)

*111A–111B. Cervantes. (4–4)
   Three class hours per week.
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Credits</th>
<th>Meeting Schedule</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>112. Studies in Spanish Culture</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Taylor (Sp)</td>
</tr>
<tr>
<td>113. Studies in Latin-American Culture</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber, Mr. Polt (F, W, Sp)</td>
</tr>
<tr>
<td>14. The Contemporary Spanish-American Novel</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber, Mr. Larson, Mr. Morby (F, W, Sp)</td>
</tr>
<tr>
<td>15. A Survey of Spanish Lyric Poetry</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mrs. Shadi W)</td>
</tr>
<tr>
<td>16. Advanced Grammar</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber, Mr. Polt (F, W, Sp)</td>
</tr>
<tr>
<td>17. Advanced Composition</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber (F)</td>
</tr>
<tr>
<td>25. Spanish Phonetics</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Murillo, Mr. Walsh (W, Sp)</td>
</tr>
<tr>
<td>26. Medieval Spanish Literature</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber (F)</td>
</tr>
<tr>
<td>127. Eighteenth-Century Spanish Literature</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber (F)</td>
</tr>
<tr>
<td>128. Contemporary Spanish Literature</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Faulhaber (F)</td>
</tr>
<tr>
<td>129. The Spanish-American Essay</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Murillo (Sp)</td>
</tr>
<tr>
<td>30. Twentieth-Century Spanish-American Poetry</td>
<td>4</td>
<td>Three class hours per week.</td>
<td>Mr. Monguió (F)</td>
</tr>
<tr>
<td>11. Spanish Literature in English Translation</td>
<td>3</td>
<td>Three class hours per week.</td>
<td>Mr. Monguió (F)</td>
</tr>
<tr>
<td>12. Senior Course in Hispanic Literature</td>
<td>3</td>
<td>Three class hours per week.</td>
<td>Mr. Monguió (F)</td>
</tr>
<tr>
<td>98A–H198B. Spanish Honors Course</td>
<td>4–4</td>
<td>Honors thesis. The Staff (F, W)</td>
<td></td>
</tr>
<tr>
<td>9. Supervised Independent Study and Research</td>
<td>2–4</td>
<td></td>
<td>The Staff (F, W)</td>
</tr>
</tbody>
</table>

Enrollment is restricted by regulations listed on page 79. Restricted to senior honor students with adequate preparation for the subject proposed.

SPANISH AND PORTUGUESE

Graduate Courses

*200A–200B. Introduction to Medieval Hispanic Literature. (3–3)
One 2-hour meeting per week. Sequence beginning (F)

201A–201B–201C. History of Hispanic Poetry. (3–3–3)
One 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for 1971–1972: Cancionero poetry. (Fall 1971 and winter 1972 only.) Sequence beginning (F), Mrs. Shadi


One 2-hour meeting per week. Mr. Larson (W)

One 2-hour meeting per week. Sequence beginning (W), Mr. Askins, Mr. Faulhaber

*204A–204B–204C. The Spanish-American Novel. (3–3–3)
One 2-hour meeting per week. Sequence beginning (F)

One 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for 1971–1972: Modernism. Sequence beginning (F), Mr. Monguió

One 2-hour meeting per week. Credit and grade will be awarded on completion of the sequence. Sequence beginning (F), Mr. Polt

*208A–208B–208C. The Ballad. (3–3–3)
One 2-hour meeting per week. Sequence beginning (F)

212A–212B. Old Spanish. (3–3)
One 2-hour meetings per week. Sequence beginning (F), Mr. Walsh

One 2-hour meeting per week. Sequence beginning (F)

One 2-hour meeting per week. Sequence beginning (F)
221. Morals and Satirists of the 16th and 17th Centuries. (3-3-3) One 2-hour meeting per week. Sequence beginning (F)

*216. Spanish Versification. (3) One 2-hour meeting per week.

217. History of the Spanish Language Since the Middle Ages. (3) One 2-hour meeting per week. Prerequisite: course 212A-212B. Mr. Walsh (Sp)

221. Medieval Seminar. (3) One 2-hour meeting per week. Prerequisite: Spanish 200A-200B or consent of instructor. Detailed study of a single genre or author. Course may be repeated for credit when topic changes. Mrs. Shadi (Sp)

226A-226B-226C. Critical and Stylistic Studies of a Single Author or Genre. (3-3-3) One 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for Fall 1971: Problems of Generation of '98 and Modernism. Topic for Winter 1972: Unamuno. Sequence beginning (F), Mr. Pérez de la Dehesa, Mr. Basdekis (W)

228A-228B-228C. The Literature of a Single Spanish-American Country. (3-3-3) One 2-hour meeting per week. Course may be repeated for credit when topic changes. Topic for Fall 1971: Portuguese Literature. I 212A-212B. Mr. Walsh (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.

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)

16-26. 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.

2. Elementary Portuguese (Continuation of 1). (4) Five 1-hour class meetings per week. Prerequisite: course 1 or equivalent.

3. Intermediate Portuguese (Continuation of 2). (5) Five 1-hour class meetings per week. Prerequisite: Intermediate Portuguese 3 or equivalent. Reading, translation, and oral interpretation of modern texts. Mr. Woodbridge (F)

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), Mr. Woodbridge (W)

**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 (Sp)

*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 of Portuguese or another Romance language. Studies in the literature of Portugal. Course may be repeated for credit when topic changes. Winter 1972: The Middle Ages and the 16th century. Mr. Askins (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.
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 79. 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 79.)

STATISTICS  
(Department Office, 367 Evans Hall)

Professors:  
Edward W. Barankin, Ph.D.  
Peter J. Bickel, Ph.D.  
David Blackwell, Ph.D., D.Sc.(hon.)  
David R. Brillinger, Ph.D.  
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.  
Michel Loève, Docteur ès Sciences  
Roy Radner, Ph.D.  
Henry Scheffé, Ph.D.  
Elizabeth L. Scott, Ph.D. (Chairman)  
Aram J. Thomason, Ph.D.  
Jerzy Neyman, Ph.D., D.Sc.(hon.), LL.D. (hon), Ph.D.(hon) (Emeritus)

Associate Professor:  
Richard E. Barlow, Ph.D.

Assistant Professors:  
Charles E. Antoniak, Ph.D.  
Rudolph J. Beran, Ph.D.  
Rabindra N. Bhattacharya, Ph.D.  
Kjell A. Doksum, Ph.D.  
Gus W. Haggstrom, Ph.D.  
Norman L. Doksum, Ph.D. (Acting)  
Pressley W. Millar, Ph.D.  
Roger A. Purves, Ph.D.  
Miron L. Straf, Ph.D.

Professors:  
F. N. David, Sc.D. (Visiting)  
Yu V. Linnik, Ph.D. (Visiting)

Assistant Professors:  
William H. DuMouchel, M.S., M.Ph. (Acting)

Instructor:  
Friedrich W. Scholz (Acting)

Departmental Major Adviser: Mr. Hodges.

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–B, 147 (the first two quarters are devoted to probability, the re-

NOTE: For key to footnote symbols, see page 78.
maind e r to statistics) or 134A–B and 141 or 142 (stochastic processes). Another cycle emphasizing interpretations and concepts, which requires one year of calculus, consists of 133 followed by 135A–B (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–B–C; the probability material is developed as needed for the statistics. A cycle intended mainly 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**  Mathematics 1A–1B–1C and 51A–51B–51C (or preferably the corresponding honors courses), or equivalent such as Mathematics 11A–11B–11C–12A–12B, with emphasis on the conceptual side of the material offered. **Recommended:** The students may take Statistics 1A–1B or 2. Statistics 20 is an excellent preparation for the upper division program in statistics.

**Upper Division Courses**  Statistics 100A–B–C; Mathematics 112 or 113C. At least four courses from Statistics 141, 142, 160, 161, 162, 165, 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.

**Individual 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.

**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. LeCam (see section on Program of Study in Engineering Science, page 191).

**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.

**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 either 205A–B or 203A–B and 210A–B–C; the program for the applied type of M.A. will usually include 230A–B, 236A–B, 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. In addition, there is a test of his reading knowledge in two languages out of French, German, Russian.

For further details on the requirements for the M.A., consult the graduate adviser, Mr. Scheffé, and for the Ph.D. with emphasis on probability, Mr. Loève, with emphasis on statistics, Mr. Lehmann.

**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**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite</th>
<th>Credits</th>
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<tbody>
<tr>
<td>1A</td>
<td>Introduction to Probability</td>
<td>course 1A</td>
<td>3</td>
</tr>
<tr>
<td>1B</td>
<td>Introduction to Statistical Inference</td>
<td>course 1A</td>
<td>3</td>
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**Upper Division Courses**

<table>
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<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>100A</td>
<td>Introduction to the Theory of Probability and Statistics</td>
<td>course 1A</td>
<td>4</td>
</tr>
</tbody>
</table>


Mr. Hodges (F); Mr. Purves (W); Mr. Mertens (Sp)
probability and statistics relevant to social science applications. Mr. Kuznets (F); Mr. Brillinger (W)

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 132. Course 131L is not prerequisite to 132L.
Mr. Kuznets in charge (F); Mr. Brillinger in charge (W)

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. Haggstrom (F); Mr. Scheffé (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.
134A. 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. Barankin, Mr. Thomasian, Mr. Freedman, ______ (F); Mr. Barankin, Mr. Straf (W); Mr. Dubins, Mr. Haggstrom, Mr. Barankin (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. Mertens (F); Mr. Thomasian, Mr. Mertens (W); Mr. Barankin, Mr. Straf (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.
135A. 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 \( t \), and \( F \) distributions. Analysis of discrete data (Poisson, binomial, multinomial distributions). Fitting lines. Mr. Beran (F); Mr. Fielding (F); Mr. Straf (W)
Mr. Beran (W); Mr. Straf (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. Kaplan (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. Purves (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. Antoniak (F)

160. Elements of Nonparametric Inference. (5)
One 3-hour lecture 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 (F)

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. Haggstrom (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. Haggstrom (Sp)

165. Introduction to Continuous Probability. (4)

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. Brillinger (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. Brillinger in charge (Sp)
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. Blackwell (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. Radner (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. The Staff (F)

**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. Antoniak (F)

**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 79. Must be taken on a passed or not passed basis.

**Graduate Courses**

Courses 210A–B–C constitute the bases of the graduate instruction for students whose primary interest is in mathematical statistics; course 205 or 203, 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. Bickel, Mr. Dorksum, Mr. DuMouchel (F); Mr. Barlow (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, χ². Point estimation, properties and methods. Testing hypotheses, simpler applications. Mr. Bickel, Mr. Doksum (W)


— (F) Mr. Bickel, Mr. Doksum (Sp)

**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. Mr. Scholz (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. Mr. Doksum (W, M); Mr. Scholz (W);

200N, — (F); — (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. Tchebychev theorem. Mr. Kaplan (F)


Three 1-hour lectures per week. **Prerequisite:** Mathematics 105 and one of course 100A, 134, 200A or consent of instructor. Topics such as random walks, Brownian motion, Markov chains, gambling. General theory will be developed as needed.

Sequence beginning (F)


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)

Mr. Freedman (F, W, Sp)


Three 1-hour lectures per week. **Prerequisite:** a year of upper division probability and statistics. Mathematics 111 (or 113B), Course 203A or 205A
is prerequisite to 210B. A survey of mathematical statistics including the theorems 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. Beran (W); Mr. Beran (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. Lehmann (F); 216B, Mr. Lehmann (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 $\chi^2$ test, likelihood ratio tests and asymptotically similar tests. Sequence beginning (F), 217A, Mr. Straf (F); 217B, — (W); 217C, — (Sp)

218. Theory of Statistical Decision Functions. (4)
Three 1-hour lectures. Prerequisite: consent of instructor. Minimax theorems. Completeness of the class of Bayes procedures. Invariance, Criteria for admissibility. Mr. Beran (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-way layouts. Multiple comparisons. 230B, incomplete blocks, latin squares, nested designs. Variance components and mixed models. Effects of departures from underlying assumptions. Sequence beginning (F). 230A, Mr. Scheffe (F); 230B, Mr. Scheffe (W)

232. Experimental Design. (5)
Three 1-hour lectures and one 2-hour laboratory per week. Prerequisite: course 230B. Randomization models. Blocking, confounding, and fractional replication in 2$^n$ experiments. Response surface exploration. Mr. Daniel (W)

236A–236B. Analysis of Discrete Observations. (4–4)
Two 1-hour lectures and one 2-hour laboratory per week. Prerequisite: one of course 100C, 130C, 132, 135A, 200C. Review of standard discrete distributions and generating functions. Discrete stochastic models. Elementary birth and death processes. Contingency tables. Generalized chi-square tests. Quantal response. Regression and analysis of variance with discrete variables. Sequence beginning (F). 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. Mr. Doksum (F)

240. Nonparametric Analysis. (5)
Two 1-hour lectures and two 2-hour laboratories per week. Prerequisite: one of course 100C, 130B, 132, 135A, 200C. Standard nonparametric tests. Emphasis on interpretation rather than proofs. Includes weighted rank tests, normal score tests. Permutation tests. Comparison of tests. Nonparametric estimation. Mr. Hodges (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. DuMouchel (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)

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 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. Loève (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. Blackwell (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. Loève (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.

(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.

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.

Mr. Daniel (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

(Committee in Charge)

William J. Brandt, Ph.D., (Rhetoric)
John Coolidge, Ph.D. (English and Comparative Literature; Chairman)
Jesse O. Sawyer, Ph.D. (Language Laboratory)

Lecturer:
Sabina T. Johnson, M.A. (Supervisor)

### ZOOLOGY

(Committee in Charge)

Paul Licht,† Ph.D.
C. H. Fraser Rowell, Ph.D.
Richard C. Strohman, Ph.D.
David B. Wake, Ph.D.
Seth B. Benson, Ph.D. (Emeritus)

Assistant Professors:
David R. Bentley, Ph.D.
Roy L. Caldwell, Ph.D.
Robert K. Colwell, Ph.D.
Michael T. Ghiselin,† Ph.D.
James L. Patton, Ph.D.
John E. Simmons, Ph.D.
Richard A. Steinhardt, Ph.D.

Professors:
Max Alpert, Ph.D.
William Balamuth, Ph.D.
George W. Barlow, Ph.D.
William E. Berg,† Ph.D.
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. Fitelka,† Ph.D.
Wilbur B. Quay,† Ph.D.
Ralph I. Smith, Ph.D.
Robert C. Stebbins, Ph.D.
Fred H. Wilt, Ph.D.
Jonas E. Gullberg, A.B. (Emeritus)
Oliver P. Pearson, Ph.D. (Emeritus)
Curt Stern, Ph.D., D.Sc. (h.c.), (Emeritus)

### The Department of Zoology

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, and 1C; Chemistry 1A, 1B, 8A, and 8B; Mathematics 16A and 16B or equivalent; Physics 6A, 6B, and 6C. Recommended: German, French, addi--

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**NOTE:** For key to footnote symbols, see page 78.
tional 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–B; (b) Cell Biology: Zoology 104 or 110A–110B or Physiology 101; (c) Organismal Animal Biology: Zoology 105 or 106–106L or 120 or 124A–124B or 131–131L or 135–135L or 135–136 or Physiology 123–123L; (d) Natural History, Systematics, Ecology: Zoology 107A–107B; or 108 with another course in invertebrate zoology (including entomology) of at least 3 units; or 155; or 157; or Biology 150 plus Zoology 140; or Forestry and conservation 173. The total upper division program must include at least one course with laboratory, one course with field work, and a third course 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 proseminar (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 proseminar (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. Twenty quarter units or equivalent preparation are required in one of the following languages: German, French, or Russian. Under special circumstances another language of scientific importance may be substituted. Language deficiencies at entrance must be rectified by additional course work.

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.

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

Lower Division Courses

10A–10B–10C, Animal Biology. (4-4-4)

Three 1-hour lectures per week, plus demonstrations to be arranged. Open without prerequisite to all students, but designed for those not specializing in zoology.

10A—Analysis of selected contemporary human problems, with emphasis on human physiology and genetics.  Mr. Strohman (F)

10B—An outline of the main facts and principles of biology, with emphasis on human biology.  Mr. Caldwell (W)

10C—Natural history of man in the tropics, with emphasis on ecological relations between man and other species.  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)

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
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. Mr. Quay (W)

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 I or Biology 11.
An introductory survey of the biology of inverte-
brates, stressing natural history, comparative anat-
omy, and evolution. Mr. Chiselin, Mr. Simmons (W)

109. Animal Evolution. (4)
Two 1½-hour lectures per week, plus written re-
ports and special readings. Prerequisite: Biology 1,
Genetics 100. A course in evolutionary theory, with
emphasis on basic processes, adaptive strategies,
specialization, and major patterns. Mr. Wake (F)

110A–110B. Cytology. (3–3)
Two 1-hour lectures per week. Prerequisite: a
basic biology course and general chemistry. Se-
quence beginning (F). Both quarters must be com-
pleted for credit. The structure and function of the
cell and its organelles from a 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 prepara-
tory methods.
Mr. Alfert (F, W)

*111. Experimental Embryology. (4)
Three 1-hour lectures per week. Prerequisite:
course 105. A survey of experimental and biochemi-
ical 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)

112. Movement. (4)
Three 1-hour lectures per week. Prerequisite:
Zoology 104 or equivalent or consent of instructor.
Cellular and molecular aspects of muscle function,
growth, and development. Mr. Strohman (Sp)

113. Normal and Abnormal Growth. (4)
Two 1½-hour lectures per week, plus written re-
ports. Prerequisite: Biology I. Biosynthesis at mo-
lecular, cellular, and organismal levels; regulatory
aspects of growth as seen in cell cultures and in
the development of tumors. Mr. Harris (Sp)

120. Biology of Chemical Mediation. (5)
Three 1½-hour lectures per week. Prerequisite:
Biology I. Recommended: organic chemistry, and
course 105 or 106. Hormonal and parahormonal
mechanisms, with emphasis on the comparative end-
crino logic of vertebrates and invertebrates.
Mr. Bern (F)

*121. Advanced Comparative Endocrinology. (5)
Two 3-hour laboratories, two 1-hour lecture-dis-
cussion periods per week. Prerequisite: course 120,
or Physiology 141. Recommended: course 180, or
Anatomy 201A–B–C. Mr. Nandi, Mr. Bern (W)

124A–124B. Invertebrate Physiology. (3–3)
Two 1-hour lectures and one discussion period
per week. Prerequisite: course Zoology 108 or 157
or an upper division course in physiology or ento-
mol ogy.
124A—Comparative physiology of nutrition, res-
spiration, excretion, osmoregulation and related
processes in invertebrates. Mr. Smith (W)
124B—Comparative physiology of nervous and
hormonal coordination, activity, sensory physiol-
ogy, and behavior of invertebrates. Mr. Smith (Sp)

124L–124M. Invertebrate Physiology
Laboratory. (5–5)
Two formal 3-hour laboratory periods per week
plus about 6 hours of individual work, oral and writ-
en reports, and discussion. Zoology 124A–124B,
normally taken concurrently. Laboratory work on
topics covered in lectures of Zoology 124A–124B.
Emphasis is on individual laboratory projects. Limi-
ted to ten students.
Mr. Smith (W, Sp)

131. Physiological Ecology. (4)
Two 1½-hour lectures per week. Prerequisite:
Biology 1ABC, or equivalent. Comparative physiol-
y of the vertebrates with emphasis on adaptation
to the various aspects of the physical environment,
such as temperature, water, ions, and gases.
Mr. Licht (W)

*131L. Laboratory in Physiological Ecology. (5)
Two formal 3-hour laboratories per week. Stu-
dent projects may also require six or more hours
of additional laboratory work per week, detailed la-
boratory 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)
(Formerly numbered 136)
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. Bentley, Mr. Steinhardt (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. Barlow (W)

140. Animal Ecology. (4)
Two 1½-hour lectures per week. Prerequisite: three quarters of upper division work in biology, or graduate status in a related field. Recommended: Biology 150 and a course in statistics. Quantitative ecology of animal populations and natural communities; emphasis on terrestrial environment.
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 man-altered biological communities; analytical and mathematical approaches.
Mr. Cobwell (Sp)

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)

55L. Laboratory in General Animal Parasitology. (3)
Prerequisite: course 156, or consent of instructor. Two 4½-hour laboratories per week. Zoology of protozoan, helminth, and other invertebrate parasites with selected experiments.
Mr. Simmons (Sp)

57. 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. Hand, Mr. Smith (Su)

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, Mr. Lidicker (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.
Mr. Johnson (W)

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)

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.
Mr. Quay (Sp)

180L. Laboratory in Comparative Histology. (4)
Two 3-hour 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.
Mr. Quay (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. DeOme, Mr. Harris, Mr. Nandi, Mrs. Blair, Mr. Winkelsstein (F)

181L. Laboratory in Biology of Neoplasia. (5)
Two 1-hour lectures and two 3-hour laboratories per week. Prerequisite: course 181 and consent of instructor. Lectures and laboratory exercises emphasizing recognition of neoplasms and the laboratory methods appropriate to research in cancer biology.
Mr. DeOme, Mr. Harris, Mr. Nandi, Mrs. Blair, Mr. Winkelsstein (W)
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. Simmons in charge (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.

Mr. Rowell (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 79. Must be taken on a passed or not passed basis.

The Staff, Mr. Pitelka in charge (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 (Sp)

*214. Advanced Laboratory in Cell Biology. (5)
One 6-hour laboratory and one discussion hour per week. Prerequisite: course 212 or equivalent. Application of physicochemical techniques to analysis of developmental and in vitro culture systems.

*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 (F)

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)

220. Special Topics in Biology of Chemical Mediation. (2)
One 2-hour lecture and discussion period per week. Prerequisite: consent of instructor. Topic for 1972: neurosecretion and comparative neuroendocrinology. Intended primarily for graduate students in neurobiology.

Mr. Bern (W)

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)

225. Comparative Neurophysiology. (4)
Four 1-hour lectures per week. Prerequisite: consent of instructor. Comparative structure and function of nervous systems. Emphasis on current research in the analysis of membrane phenomena, sensory information processing, central integration, and the development of neuronal circuitry.

Mr. Bentley, Mr. Rowell, Mr. Steinhardt (F)

225L. Advanced Laboratory in Neurophysiology. (5)
Two 6-hour laboratories per week. Prerequisite: course 225 (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. Enrollment limited.

Mr. Bentley, Mr. Rowell, Mr. Steinhardt (F)

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. Licht (F)

236. Seminar in Comparative Neurophysiology. (2)
One 2-hour meeting per week. Prerequisite: consent of instructor. Critical discussion of current problems.

Mr. Bentley, Mr. Rowell, Mr. Steinhardt (W)

237. Seminar in Animal Behavior. (2)
One 2-hour meeting per week. Prerequisite: course 135 or equivalent and consent of the instructor.

Mr. Barlow, Mr. Caldwell (F, Sp)

*240A–240B. Analytical Field Ecology. (4-4)
One 1-hour lecture, two 4-hour field periods per
week. Prerequisite: courses 107A–107B or 108, 140, and a course in statistics. Analytical methods for the investigation of animal populations and tropic relationships; survey of major communities in California. Sequence beginning (W) Mr. Pitelka, ————, (W, 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 (W)

244. Seminar in Animal Ecology. (2)
One 2-hour meeting per week. Prerequisite: course 140 or equivalent, and consent of instructor. Mr. Colwell, Mr. Pitelka, (W)

245. Ecological Research Reviews. (1)

One 1½-hour meeting per week. Prerequisite: graduate standing, basic courses in ecology and consent of instructor; enrollment limited. Reports and discussions of original research. Mr. Lièpvre, Mr. Licht, Mr. Lidicker, Mr. Colwell, Mr. Pitelka, Mr. Wake (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)

255. Experimental Protozoology. (5)

Two 1-hour lectures and two 3-hour laboratories per week, plus individual conferences to be arranged. Prerequisite: course 155, or a course in microbiology or cellular physiology. Aspects of physiology and morphogenesis applied to study of protozoa. Laboratory concerned with problems of growth, cyclical differentiation, regeneration, and sexuality. Enrollment limited. ———— (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. Hand, Mr. Smith

*258. Advanced Invertebrate Zoology. (5)

Two 1-hour lectures, two 3-hour laboratories per week. Prerequisite: course 108 or consent of instructor. Biology of major invertebrate groups, topics to vary from year to year. May be repeated. Mr. Ghiselin, Mr. Hand, Mr. Smith (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. Johnson, 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. Wake (F)

*275. Seminar in Wildlife Ecology and Population Dynamics. (2)

One 2-hour meeting per week. Prerequisite: course 170 or equivalent. Mr. White, Mr. Leopold (Sp)

280. Chordate Neurology. (2)

One 2-hour lecture and discussion period per week. Prerequisite: course 180 or consent of instructor. Organization, composition and regulatory mechanisms of chordate nervous systems. Subject matter will vary from year to year. Mr. Quay (Sp)

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)

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. Deome, Mrs. Blair, Mr. Harris, Mr. Nandi (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. Mr. Quay (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. Smith (in charge) (F); Mr. Wilt (in charge) (W)

295. Group Research in Summer.

295A. Special Problems in Biology of Neoplasia. (4)

Nine hours of laboratory work per week, plus individual conferences. Prerequisite: consent of instructor. Special problems in biology of neoplasia.
Open to graduate students not preparing M.A. or Ph.D. theses in this area.
Mr. DeOme, Mr. Bern, Mr. Nandi, Mrs. Blair

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)

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. Johnson (F); Mr. Smith (W); Mr. Bern (Sp)

IDS 100. Problems in Marine Biology. (15)
See Biology for a complete description of this course.

IDS 170. Wildlife Biology and Management. (4)
See Biology for a 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 these courses.
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Address: Office of Admissions, 127 Sproul Hall, University of California, Berkeley, California 94720. (No charge.)

ADMISSION TO GRADUATE STUDY, BERKELEY A brief description of the graduate program, including procedures and dates for filing applications, degrees offered, fields of study available, fees and expenses, financial aids, living accommodations, and sources of additional information. Course descriptions are not included.

Address: Dean of the Graduate Division, 110 California Hall, University of California, Berkeley, California 94720. (No charge.)

COLLEGE AND SCHOOL ANNOUNCEMENTS Information about requirements and regulations in the respective colleges and professional schools, with lists of courses. Issued by:

Colleges of AGRICULTURAL SCIENCES • CHEMISTRY • ENGINEERING ENVIRONMENTAL DESIGN • LETTERS AND SCIENCE

Schools of BUSINESS ADMINISTRATION • GRADUATE SCHOOL OF BUSINESS ADMINISTRATION • CRIMINOLOGY • EDUCATION • FORESTRY AND CONSERVATION • LAW • LIBRARIANSHIP • OPTOMETRY • PUBLIC HEALTH • SOCIAL WELFARE

Address: The Dean of the School or College. (No charge.)

SCHEDULE AND DIRECTORY Lists time and place of meeting for specific classes, names of instructors, and units of credit awarded. Also contains a directory of departmental offices and officers of instruction.

Address: The Registrar, University of California, Berkeley, California 94720. (Price: 25¢; 50¢ by mail.)

SUMMER SESSION BULLETIN Complete information about summer sessions instruction.

Address: Office of the Summer Sessions, 22 Wheeler Hall, University of California, Berkeley, California 94720. (No charge.)

* Descriptive material about instruction in dentistry, medicine and nursing may be obtained from the schools at Los Angeles and San Francisco; for pharmacy and physical therapy, from San Francisco; and for veterinary medicine, from Davis. (No charge.)